1946

Report of the

DEPARTMENT OF MINES

WESTERN AUSTRALIA

PRESENTED TO BOTH HOUSES OF PARLIAMENT BY HIS EXCELLENCY'S COMMAND

1948.

—

WESTERN AUSTRALIA.

REPORT

of the

Department of Mines

FOR THE YEAR

1946

PERTH:
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ANNUAL REPORT OF THE DEPARTMENT OF MINES, WESTERN AUSTRALIA, 1946.

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STATE OF WESTERN AUSTRALIA.

Report of the Department of Mines for the State of Western Australia for the Year 1946.

To the Hon. Minister for Mines.

Sir,—I have the honour to submit the Annual Report of the Department for the year 1946, together with reports from the officers controlling Sub-Departments, and comparative tables furnishing statistics relative to the Mining Industry.

Department of Mines,
Perth, 30th May, 1947.

I have, etc.,
A. H. TELFER,
Under Secretary for Mines.

Division I.

The Hon. Minister for Mines,—

I have the honour to submit, for your information, a report on the Mining Industry for the year 1946.

The estimated value of the mineral output of the State for the year was £3,674,575 (calculating gold at £4 4s. 11.45d. per fine ounce) an increase in value of £784,321 compared with the amended figure for the preceding twelve months. The estimated value of the premium paid to gold producers amounted to £A4,019,376, bringing the gross value of all minerals up to £A7,693,951, an increase of £A1,783,432 compared with the 1945 production.

There were increases in quantities and values of alunite, antimony, barytes, bentonite, coal, felspar, glauconite, gypsum, kyanite, pyrites, lead ore, magnesite, red ochre, tantalite, talc, tin and vermiculite. Decreases in quantities and values were shown in arsenic, asbestos, beryl ore, dolomite and tungsten ores, while there was no production of phosphatic guano or bismuth.

The estimated value of gold received at the Perth Branch of the Royal Mint and exported in gold-bearing material was £A6,640,069 (and equalled 86.30 per cent. of all minerals). (See footnote to Table 1 (a), Part II.)

Other minerals realised:—Coal, £730,104; Pyrites, £107,250; Alunite, £41,658; Arsenic, £33,935; Antimony, £23,458; Gypsum, £21,154; Asbestos, £13,525; Red Ochre, £9,531; Glauconite, £9,162; Felspar, £6,282; Tin, £5,838; Tungsten Ores, £1,552; Talc, £1,499; Clays, £1,341; Vermiculite, £1,218; Lead Ore, £1,068; Beryl Ore, £581; Kyanite, £568; Dolomite, £491; Tantalite, £281; Glass Sand, £227; Bentonite, £186; Copper Ore, £105; Barytes, £50; and Magnesite, £26.

Dividends paid by mining companies amounted to £713,926, an increase of £255,447, when compared with the previous year. (See Table 6, Part II.)

To the end of 1946, the total amount distributed by gold mining companies in dividends was £42,457,069. To the same date, the value of the mineral production amounted to £237,497,301, of which gold accounted for £215,932,503 based on normal values; but premiums on sale of gold during years 1920-1924, and payments under the Gold Bounty Act, 1930, increase the total value of gold and mineral productions by £67,165,689.

GOLD.

The quantity of gold reported as being received at the Perth Branch of the Royal Mint (610,873.51 fine ounces), together with that contained in bullion, concentrates and other gold bearing materials exported for treatment (6,090.14 fine ounces) totalled 616,963.65 fine ounces, and exceeded that of 1945 by 148,412.93 fine ounces (vide Table 1 (a) of Part II.).

On the other hand, the total gold yield for the year reported directly to the Department by the producers was 618,607.31 fine ounces, which was an increase of 148,700.83 fine ounces in comparison with the previous year's figures. (Vide Table 3 of Part II.)

The non-collation of the two totals mentioned above is principally due to the fact that the gold reported as being received at the Mint and exported for treatment is not all necessarily produced during the calendar year under review, a certain quantity being in the transitory stage or near transitory stage from the producer at the end of the year. Then again, unfortunately, a small percentage of the production is not reported to the Department, despite a strict surveillance. For these and other reasons, the former total is accepted as the official production of the State, whilst the latter is utilised mainly in tracing the gold back to its source, etc. The calculated average value per ton of ore treated in the State as a whole increased from 23 shillings per ton in 1945, to 23.948 shillings per ton in 1946, calculating gold at the rate of £4 4s. 11.45d. per fine ounce, but the premium rate which remained unchanged throughout the year (153.37 per cent.) would more than double this estimate. For East Coolgardie Goldfield (which produced approximately 65.98 per cent. of the State's yield of gold), the calculated average value of the ore treated decreased from 24.597 shillings to 23.992 shillings per ton. The estimates for East Murchison (Wiluna Gold Mines and Emu Gold Mines, Limited), Murchison (Big Bell Mines Limited and Hill 50 Gold Mine N.L.), Mt. Margaret (Sons of Gwalia) and Dundas (Norseman Gold Mines and Central Norseman Gold Corporation), were 17.244s. ((11.152s.), 17.902s. (48.271s.), 30.610s. (32.076s.) and 24.850s. (23.403s.) respectively; 1945 figures are shown in parentheses.

The tonnage of ore reported to have been treated in 1946, viz., 2,194,477 tons was 457,885 tons more than the previous year and formed 51 per cent. of the State record tonnage established in 1940. East Murchison with a decrease of 200,955 tons was the only Goldfield in decline. The various Goldfields

with their increased tonnages are as follows:—East Coolgardie, 396,886; Murchison, 172,588; Dundas, 35,713; Mt. Margaret, 25,242; Yilgarn, 9,432; Pilbara, 6,705; Broad Arrow, 4,234; Coolgardie, 3,176; Peak Hill, 2,130; North Coolgardie, 1,785; North-East Coolgardie, 803; Phillips River, 112; and Yalgoo, 36.

While the output of gold has shown a steady annual increase since the war, the industry has been, and is being faced with many difficulties. Contrary to expectations, labour, despite the return to civil life of the men from the services, has been scarce. This applies not only to the more isolated centres, but to the larger towns, including Kalgoorlie.

No industry is such a regular purchaser of machinery as mining, and machinery of the type required has been extremely difficult to obtain. Orders are accepted by Australian, English, and American firms but delivery cannot be guaranteed, and it is not unusual to have to wait two years before it comes to hand.

Stores fortunately have not been quite so difficult, although anxious periods are experienced from time to time, this has been particularly the case with explosives, although the position has now improved, and cotton piece goods, such as filtercloth, calico and corduroy cloth.

Mining costs generally have increased, and gold mining producers, unlike many others, have to absorb these increases themselves, as they cannot add them on to the price of the product.

A great deal of activity is taking place in most goldfields in regard to the search for new mines. Particular attention is being given by companies of standing to the Yilgarn, Coolgardie, Meekatharra and Dundas fields. This is a very pleasing angle from the Department's viewpoint.

Assistance to prospectors was continued during the year and 218 men were helped by the supply of rations and explosives and loan of tools. On the 31st December, 1946, 120 men were being assisted.

The returns reported by them while on the scheme during the year amounted to 249 ozs. from 432 tons crushed.

GOLD TAX.

The total gold tax collections from Western Australia since the Act came into force in 1939 until 31/12/1946 amounts to £4,072,110 10s. 11d. made up as follows:—

	£	s.	d.
Total to 31/12/1940	926,907	15	1
Year ended 31/12/1941 ..	869,990	17	10
Year ended 31/12/1942 ..	616,879	4	9
Year ended 31/12/1943 ..	394,335	9	2
Year ended 31/12/1944 ..	347,401	19	6
Year ended 31/12/1945 ..	394,634	15	8
Year ended 31/12/1946 ..	521,960	8	11
	£4,072,110	10	11

The amounts refunded to prospectors and low grade producers over the same period totals £941,131 1s. 7d. It is apparent that the industry continues to be a notable taxpayer.

MINERALS.

World starvation extends to certain mineral supplies as well as food and other products.

As a result, buyers are in the market for many of our minerals, and activity in regard to tin, lead, kyanite, antimony and asbestos particularly is noticeable.

Here again manpower, machinery and shipping difficulties have been encountered.

I would offer a word of advice to producers of minerals. Unlike gold, of which only a very small proportion is utilised for manufacturing purposes, minerals are purchased for commercial and industrial uses.

Nothing is worse for a State than that any of its mineral producers should enter into contracts which they cannot fulfil.

Buyers desire that the products shall conform to samples and that the quantities ordered shall be forthcoming at regular intervals.

Should the terms of contract be not honoured, buyers turn their attention to other States or countries, with the result that the local deposits are discarded and deserted.

Steady progress has been maintained by Australian Iron and Steel Limited, at Cockatoo Island in the erection of plant and development of the iron deposit, while another major mineral undertaking, that of Australian Blue Asbestos, Limited, in the Hamersley Ranges, has also been actively pressed on with during the year.

COAL.

The output for 1946 exceeded that for 1945 by over 98,924 tons.

The year's tonnage, 642,287, constituted an all time record for the Collie field, which supplied the whole of same.

With an ever-increasing number of industrial projects in the State, a much greater output still will be necessary, and from the market angle the future of Collie seems assured.

During the year the Department, with the assistance of the Commonwealth Geophysical Section, undertook a geological and geophysical survey of Collie.

It is expected that this will be completed in 1947, and the resultant reports should provide a most valuable picture of the field.

GENERAL.

During the year considerable expansion took place in a number of the Department's activities.

The Chemical, Analytical and Mineralogical Laboratories were re-organised. Fuller comment on the activities of the laboratories appear under Part VIII. of this Division.

The staff of the Geological Survey has also been increased, and a very valuable programme of work is now being followed. The major long term investigations proceeding are the geological examinations of the Collie Coalfield, the Coolgardie Goldfield, and the Yalgoo Goldfield. In addition, of course, many short-term examinations are made. The Department's policy is to keep abreast of mining activities and operations, and tender geological advice in the early stages when it is most required.

The School of Mines, Kalgoorlie, was also reorganised, and in addition to its usual students is catering for a large number of ex-servicemen full-time students operating under the Commonwealth Rehabilitation Training Scheme.

The Department during 1946 gave a great deal of consideration to the question of installation in the industry of aluminium therapy. Dr. George, who is a recognised Eastern States authority on silicosis visited Canada and the United States of America to investigate and examine the results of the work of the McIntyre Institute, which had patented the treatment. He subsequently furnished a full report on his visit, and as a result of same, the State Government invited him to visit our Goldfields to examine our conditions and further discuss the question with its expert officials.

This visit duly took place in January of this year.

The Department has since approached the McIntyre Institute in regard to the supply of the necessary plant and materials and is awaiting advice in this regard.

MINING DEVELOPMENT ACT.

The expenditure incurred in rendering assistance to mine owners and the industry generally under the provisions of this Act totalled £12,488 13s. 11d., and in the preceding year £7,790 8s. 4d.

PART II.—MINERALS.

TABLE 1.—*Quantity and Value of Minerals, other than Gold and Silver, produced and/or exported during Years* 1945 *and* 1946.

Description of Minerals.	1945.		1946.		Increase or Decrease for Year compared with 1945.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.	£A.	Tons.	£A.	Tons.	£A.
Alunite (Crude Potash)	1,358·80	23,902	1,735·80	41,658	+ 377·00	+ 17,756
Antimony	Nil.	Nil.	462·01	23,458	+ 462·01	+ 23,458
Arsenic	1,989·00	41,771	1,624·50	33,935	— 364·50	— 7,836
Asbestos (Anthophyllite)	81·00	870	8·50	121	— 72·50	— 749
Asbestos (Chrysotile)	19·64	918	Nil.	Nil.	— 19·64	— 918
Asbestos (Crocidolite)	991·30	42,873	365·56	13,404	— 625·74	— 29,469
Bentonite	50·00	120	62·00	186	+ 12·00	+ 66
Beryl Ore	33·61	953	15·49	581	— 18·12	— 372
Barytes	Nil.	Nil.	10·00	50	+ 10·00	+ 50
	lbs.		lbs.		lbs.	
Bismuth	506·00	152	Nil.	Nil.	— 506·00	— 152
	Tons.		Tons.		Tons.	
Clays	2,363·00	1,424	2,682·00	1,341	+ 319·00	— 83
Coal	543,362·55	572,896	642,286·70	730,104	+ 98,924·15	+ 157,208
Copper Ore	39·57	364	74·00	105	+ 34·43	— 259
Dolomite	105·35	502	98·09	491	— 7·26	— 11
Felspar	1,234·50	4,321	1,793·00	6,282	+ 558·50	+ 1,961
Glass Sand	175·00	227	180·50	227	+ 5·50	...
Glauconite	180·00	4,500	366·50	9,162	+ 186·50	+ 4,662
Gypsum	7,232·50	9,136	15,350·00	21,154	+ 8,117·50	+ 12,018
Kyanite	19·95	100	139·74	568	+ 119·79	+ 468
Lead Ore etc	Nil	Nil	36·21	†1,068	+ 36·21	+ 1,068
Magnesite	Nil	Nil	10·50	26	+ 10·50	+ 26
Phosphatic Guano	8,483·00	46,656	Nil	Nil	— 8,483·00	— 46,656
Pyrites	66,504·00	102,053	77,784·00	107,250	+ 11,280·00	+ 5,197
Red Ochre	650·00	*8,998	859·90	9,531	+ 209·90	+ 533
Tantalite	Nil	Nil	·36	281	+ ·36	+ 281
Talc	Nil	Nil	389·41	1,499	+ 389·41	+ 1,499
Tin	21·76	4,370	28·52	5,838	+ 6·76	+ 1,468
Tin-Tantalum	6·17	915	Nil	Nil	— 6·17	— 915
	units		units		units	
Tungsten Ores (Scheelite)	1,638·00	8,946	285·00	1,552	— 1,353·00	— 7,394
	tons		tons		tons	
Vermiculite	59·00	254	203·50	1,218	+ 144·50	+ 964
	...	*877,221	...	1,011,090	...	+ 133,869

TABLE 1 (a).—*Quantity and Value of Gold and Silver exported and minted during Years* 1945 *and* 1946

	Fine ozs.	£A	Fine ozs.	£A	Fine ozs.	£A
Gold (exported and minted)	468,550·72	‡5,010,541	616,963·65	‡6,640,069	+148,412·93	+ 1,629,528
Silver (exported and minted)... ...	146,024·96	22,757	171,452·22	42,792	+ 25,427·26	+ 20,085
Total	...	5,033,298	...	6,682,861	...	+ 1,649,613

* Adjusted figures. † Estimated ‡ Included in the value of Gold shown are the following estimated premiums:—1945, £A3,020,265; 1946, £A4,019,376.

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.
	£	£	
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
1924	13,808,910	1,424,319	13·24
1925	13,642,852	173,126	1·27
1926	14,668,184	1,597,698	10·89
1927	15,805,120	472,041	2·99
1928	16,911,932	996,099	5·88
1929	16,660,742	1,802,709	10·82
1930	19,016,639	6,370,396	33·49
1931	14,266,650	4,333,421	30·37
1932	16,771,465	5,657,870	33·74
1933	18,098,214	5,328,869	29·44
1934	16,784,705	5,759,324	34·31
1935	17,611,547	5,698,721	32·36
1936	19,564,716	7,130,381	36·45
1937	21,594,942	9,026,313	41·80
1938	24,220,864	10,417,458	43·01
1939	23,244,509	11,969,562	51·49
1940	25,800,562	12,480,721	48·37
1941	24,536,777	12,411,316	50·58
1942	20,681,284	8,476,622	40·99
1943	18,014,340	6,539,295	36·30
1944	19,453,001	*1,282,867	6·59
1945	20,170,624	§205,587	...
1946	26,342,125	§211,890	...
Total since 1902 ...	657,720,439	240,342,924	36·54

Exclusive of Arsenic prior to 1935. † Including Ship's Stores. * Approx. 25 per cent. only of gold bullion production exported. § No gold bullion exported.

COMPARATIVE STATISTICAL DIAGRAMS
SHOWING
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 1946

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

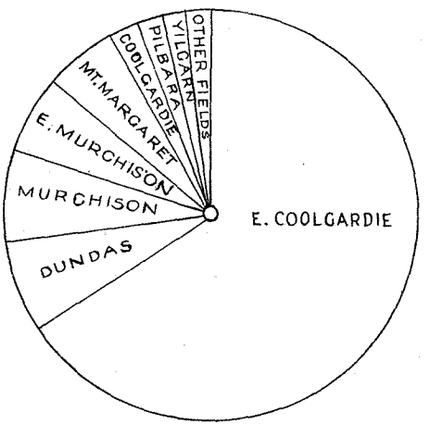


FIG.2 Gold produced from various Goldfields as given by the Export and Mint Returns.

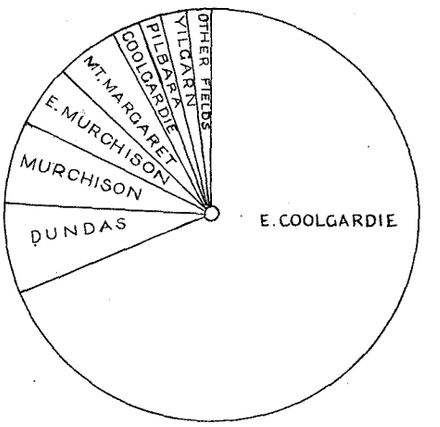


FIG.3 Value of Gold and other Minerals.

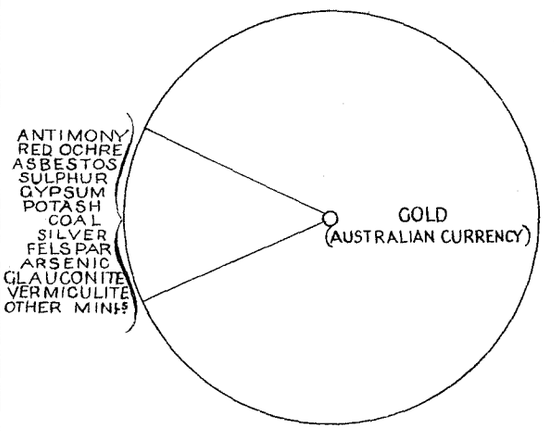


FIG.4 Value of Minerals other than Gold.

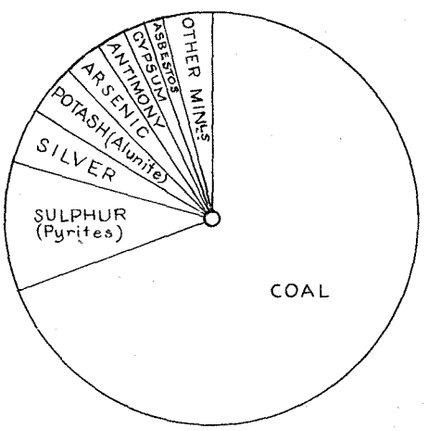


FIG.5 Areas of land leased for Goldmining on various Goldfields.

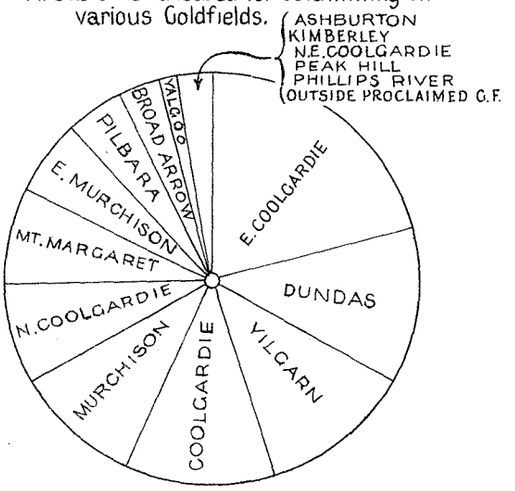


FIG.6 Output of Gold in the States of Australia and the Dominion of New Zealand.

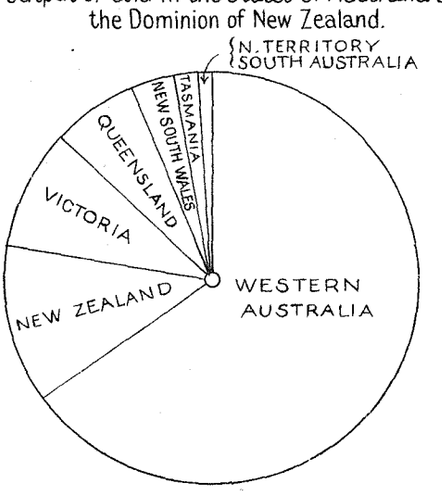


DIAGRAM OF GOLD OUTPUT

Showing Tonnage Treated (as reported to Mines Dept.); the Total Output of Gold Bullion, Concentrates etc., entered for export and received at the Perth Mint, and the Estimated Value thereof, in Australian Currency.

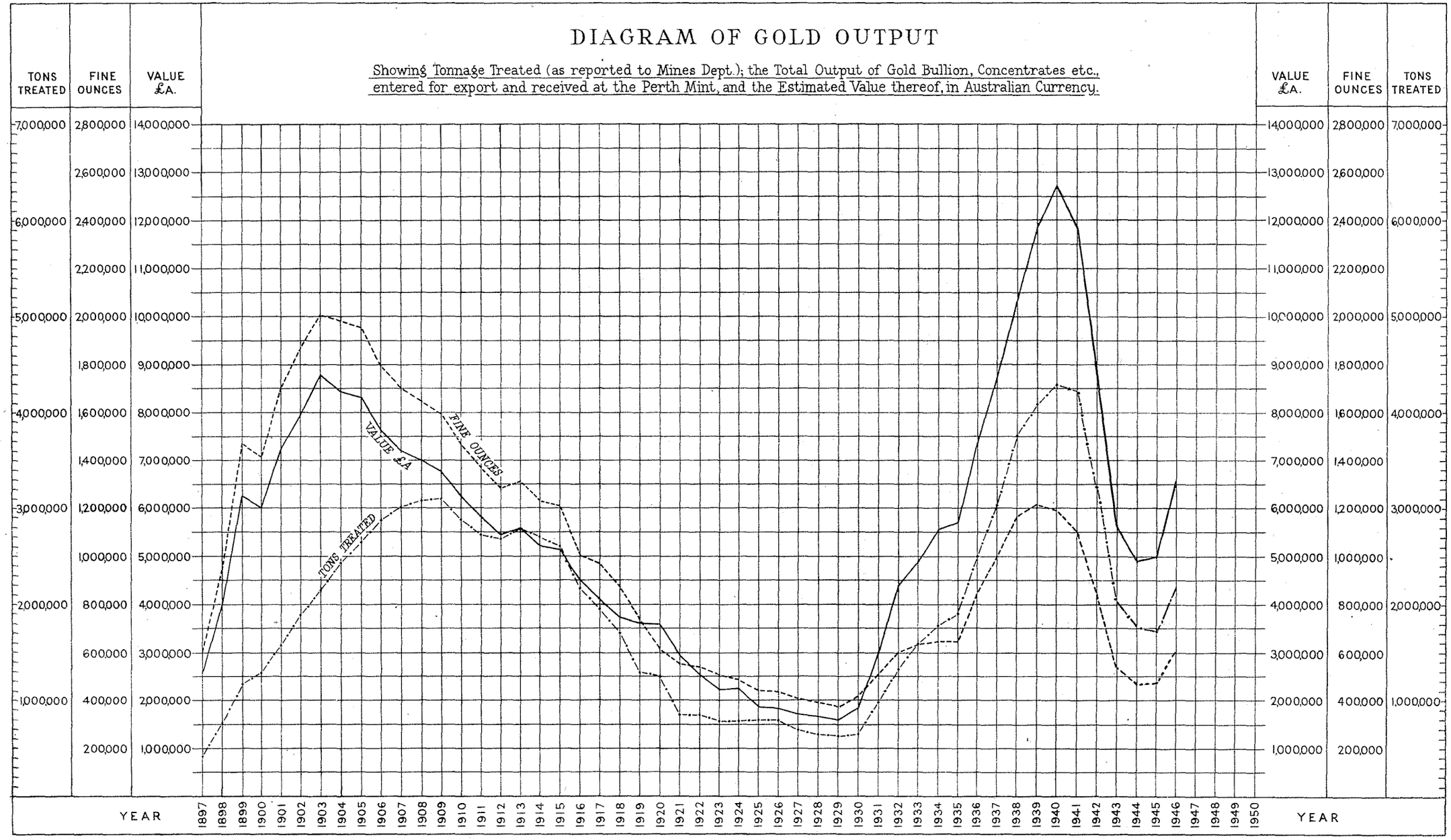


TABLE 3.

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

Goldfield.	Reported Yield.		Percentage for each Goldfield.		Average Value per ton of Ore Treated. (Gold at £4 4s. 11·45d. per fine oz.)	
	1945.	**1946.**	1945.	**1946.**	1945.	**1946.**
	Fine ozs.	Fine ozs.	%	%	shillings	shillings
1. Kimberley	107	233*	·023	·038	...	...
2. Pilbara	9,066	12,491	1·929	2·019	43·428	43·402
3. Ashburton	39	53*	·008	·009	...	...
4. Gascoyne	...	16*	...	·003	...	...
5. Peak Hill	541	1,160	·115	·188	92·154	37·506
6. East Murchison	50,380	37,148	10·721	6·005	11·152	17·244
7. Murchison	21,378	44,304	4·549	7·162	48·271	17·902
8. Yalgoo	877	653	·187	·106	50·849	36·872
9. Mt. Margaret	26,747	34,634	5·692	5·599	32·076	30·610
10. North Coolgardie	4,836	5,906	1·029	·955	71·281	66·436
11. Broad Arrow	1,587	4,084	·338	·660	81·606	58·934
12. North-East Coolgardie	197	610	·042	·099	91·452	52·560
13. East Coolgardie	303,373	408,170	64·560	65·980	24·597	23·992
14. Coolgardie	12,886	13,986	2·742	2·261	29·136	29·144
15. Yilgarn	5,938	10,709	1·264	1·731	33·563	37·178
16. Dundas	31,891	44,327	6·787	7·166	23·403	24·850
17. Phillips River	8	34	·002	·005	...	25·334
18. Outside Proclaimed Goldfield ...	55	89	·012	·014	...	...
Totals and Averages	469,906	618,607	100·000	100·000	23·000	23·948

*Alluvial and/or Dollied.

The total yield of the State is as shown in Table 1, being the amount of the gold received at the Royal Mint, the gold exported in bullion and concentrates, and alluvial and other gold not reported to the Mines 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.

Average Quantities of Gold Ore raised and treated, and Gold produced therefrom, per man employed on the several Goldfields of the State, during 1945, *and* 1946.

Goldfield.	1945.				**1946.**			
	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	...	...	107·38	35·79	...	...	77·82	25·94
2. Pilbara	264·83	103·76	135·21	53·02	317·53	116·43	162·23	59·48
3. Ashburton	...	...	...	19·44	...	...	...	26·61
4. Gascoyne	...	...	...	...	...	...	...	...
5. Peak Hill	55·44	20·79	60·15	22·55	202·19	101·10	89·27	44·63
6. East Murchison	1,366·40	680·70	179·28	89·32	978·64	394·41	198·65	80·06
7. Murchison	230·94	117·63	131·15	66·81	546·06	270·57	115·07	57·02
8. Yalgoo	162·88	66·63	97·43	39·85	83·47	42·93	36·27	18·65
9. Mt. Margaret	488·81	191·58	184·46	72·29	410·76	175·40	148·01	63·20
10. North Coolgardie	115·33	42·71	96·72	35·82	82·99	33·71	64·90	25·24
11. Broad Arrow	47·23	22·34	45·33	21·44	84·09	39·77	58·34	26·52
12. North-East Coolgardie ...	15·26	6·78	16·44	7·31	46·95	20·12	29·05	11·09
13. East Coolgardie	844·07	456·39	244·26	132·07	784·60	441·29	221·59	123·80
14. Coolgardie	458·45	193·77	157·15	66·42	463·28	202·83	158·93	69·58
15. Yilgarn	168·97	85·44	66·72	33·73	128·79	66·14	56·36	28·94
16. Dundas	576·24	299·29	158·66	82·41	470·61	267·73	137·66	78·32
17. Phillips River	...	...	8·30	2·77	112·50	28·13	33·55	8·39
18. Outside Proclaimed Goldfields	...	...	27·53	11·01	...	...	29·72	9·91
Total Averages ...	725·39	362·85	196·28	98·18	619·03	317·26	174·50	88·87

TABLE 5.

Output of Gold from the several States of Australia, the Northern Territory, Papua, the Mandated Territory of New Guinea, and the Dominion of New Zealand, during 1946.

State.	Output of Gold.	*Value.	Percentage of Total.	
			Output of Commonwealth.	Output of Australasia.
	Fine ozs.	£		
1. Western Australia	616,964	2,620,693	74·830	65·373
2. Victoria	86,993	369,523	10·551	9·218
3. New South Wales	32,009	135,965	3·882	3·392
4. Queensland	62,733	266,473	7·609	6·647
5. Tasmania	15,362	65,254	1·863	1·628
6. South Australia	628	2,668	·076	·066
7. Papua	Nil	Nil	...	...
8. Northern Territory	9,797	41,615	1·189	1·038
9. Mandated Territory of New Guinea	Nil	Nil	...	...
10. New Zealand	119,271	506,631	...	12·638
	943,757	4,008,822	100·000	100·000

*Exclusive of Premium.

TABLE 6.

Dividends, etc., paid by Western Australian Mining Companies during 1 9 46, *and the Total to date.*

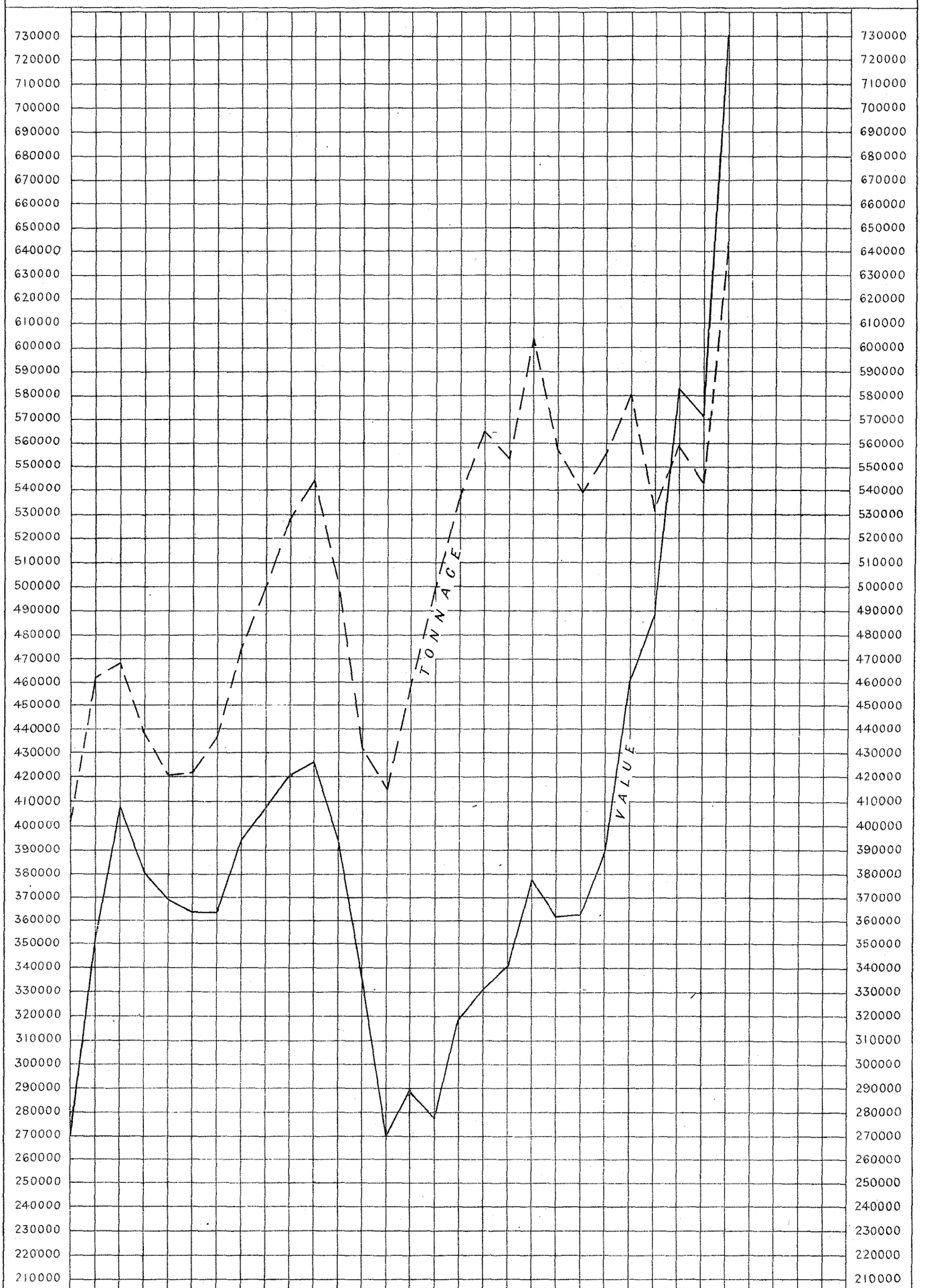
(Mainly compiled from information supplied to the Government Statistician's Office by the Cha mber of Mines, of Western Australia.)

Goldfield.	Name of Company.	Dividends Paid.	
		1946.	Grand Total to end of 1946.
		£	£
Pilbara	Various Companies	...	26,513
Peak Hill	do. do.	...	199,305
East Murchison	do. do.	...	1,914,053
Murchison	Hill 50 Gold Mine, N.L.	9,375	175,001
	Various Companies	...	2,714,945
Mt. Margaret	Sons of Gwalia, Limited	25,391	1,958,254
	Various Companies	...	958,286
North Coolgardie	do. do.	...	712,551
Broad Arrow	do. do.	...	92,500
North-East Coolgardie	do. do.	...	129,493
East Coolgardie	Boulder Perseverance, Ltd.	56,206	(*a*) 2,473,989
	Golden Horseshoe (New) Ltd.	11,459	(*b*) 4,021,459
	Gold Mines of Kalgoorlie, Ltd.	66,719	394,782
	Great Boulder Proprietary Ltd.	78,125	6,926,588
	Kalgoorlie Enterprise Mines, Ltd.	11,000	254,375
	Lake View & Star, Ltd.	280,000	(*c*) 3,759,500
	North Kalgurli (1912), Ltd.	85,937	954,687
	Paringa Mining and Exploration Co., Ltd.	30,183	228,723
	South Kalgurli Consolidated, Ltd.	19,531	(*d*) 1,126,723
	Various Companies	...	10,754,854
Coolgardie	do. do.	...	388,770
Yilgarn	do. do.	...	1,205,556
Dundas	Central Norseman Gold Corporation	40,000	300,000
	Various Companies	...	786,162
	Totals	713,926	42,457,069

(*a*) Also £45,091 in bonuses and profit-sharing notes in years 1935–36. (*b*) Also £42,000 in bonuses and profit-sharing notes in year 1934. (*c*) Also £75,000 in bonuses and profit-sharing notes and £93,750 Capital returned in years 1932–35. (*d*) Also £55,000 Capital returned in year 1932 by Golden Horseshoe (New), Ltd.

DIAGRAM OF COAL OUTPUT

Showing Quantities and Values as reported to Mines Dept. from 1919 onwards



YEAR	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	YEAR
£ VALUE	270355	350346	407117	381555	368949	363255	363203	394400	407967	420145	426706	394758	336178	270630	289806	278704	318013	331565	340444	375083	362811	364500	389278	461495	489721	583075	572896	730104						£ VALUE
TONS	401713	462021	468817	438443	420714	421864	437461	474819	501505	528420	544719	501425	432400	415719	458399	500343	537188	565075	553510	604793	557535	539427	556574	581176	531546	558322	543362	642287						TONS

TABLE 7.

Quantity and Value of Minerals, other than Gold and Silver, reported to the Mines Department during 1946.

Goldfield, District or Mineral Field.	1946.		Increase or Decrease as compared with 1945.	
	Quantity.	Value.	Quantity.	Value.
ALUNITE (Crude Potash)—	tons.	£A.	tons.	£A.
Yilgarn	1,735·80	41,658	+ 377·00	+ 17,756
ANTIMONY—				
East Murchison (Wiluna)	306·07	13,981	+ 306·07	+ 13,981
Pilbara (Nullagine)	155·94	9,477	+ 155·94	+ 9,477
ARSENIC—				
East Murchison (Wiluna)	1,624·50	33,935	— 364·50	— 7,836
ASBESTOS (Anthophyllite)—				
Outside Proclaimed Goldfield	5·00	100	— 76·00	— 770
East Coolgardie (Bulong)	3·50	21	+ 3·50	+ 21
ASBESTOS (Chrysotile)—				
Outside Proclaimed Goldfield	...	...	— 19·64	— 918
ASBESTOS (Crocidolite)—				
Outside Proclaimed Goldfield	365·56	13,404	— 625·74	— 29,469
BARYTES—				
North-East Coolgardie (Kurnalpi)	10·00	50	+ 10·00	+ 50
BENTONITE—				
Outside Proclaimed Goldfield	62·00	186	+ 12·00	+ 66
BERYL ORE—				
Pilbara	15·49	581	+ 4·36	+ 257
Murchison	...	...	— 3·00	— 104
Coolgardie	...	...	— 19·23	— 519
Outside Proclaimed Goldfield	...	...	— ·25	— 6
BISMUTH—	lb.		lb.	
Outside Proclaimed Goldfield	...	...	— 506·00	— 152
CLAYS—	tons.		tons.	
Outside Proclaimed Goldfield	2,682·00	1,341	+ 319·00	— 83
COAL—				
Collie	642,286·70	730,104	+ 98,924·15	+ 157,208
COPPER ORE—				
Phillips River	74·00	105	+ 74·00	+ 105
East Murchison (Lawlers)	...	...	— 9·12	— 159
Yalgoo (Fields Find)	...	...	— 30·45	— 205
DOLOMITE—				
Murchison (Mount Magnet)	98·09	491	— 7·26	— 11
FELSPAR—				
Coolgardie	1,793·00	6,282	+ 558·50	+ 1,961
GLASS SAND—				
Outside Proclaimed Goldfield	180·50	227	— 5·50	...
GLAUCONITE—				
Outside Proclaimed Goldfield	366·50	9,162	+ 186·50	+ 4,662
GYPSUM—				
Outside Proclaimed Goldfield	11,126·16	14,819	+ 3,893·66	+ 5,683
Yilgarn	4,012·00	6,018	+ 4,012·00	+ 6,018
Dundas	212·00	317	+ 212·00	+ 317
KYANITE—				
Outside Proclaimed Goldfield	139·74	568	+ 119·79	+ 468
LEAD ORE—				
Northampton	36·21	1,068	+ 36·21	+ 1,068
MAGNESITE—				
East Coolgardie (Bulong)	10·50	26	+ 10·50	+ 26
PHOSPHATIC GUANO—				
Outside Proclaimed Goldfield	...	...	— 8,483·00	— 46,656
PYRITES—				
Dundas	77,784·00	107,250	+ 11,280·00	+ 5,197

TABLE 7—*continued.*

Quantity and Value of Minerals, other than Gold and Silver, reported to the Mines Department during 1946—*continued.*

Goldfield, District or Mineral Field.	1946.		Increase or Decrease as compared with 1945.	
	Quantity.	Value.	Quantity.	Value.
RED OCHRE—	Tons.	£A.	Tons.	£A.
Murchison (Cue)	505·85	4,398	+ 455·85	+ 4,078
Outside Proclaimed Goldfield	354·05	5,133	— 245·95	— 3,545
TALC—				
East Coolgardie	389·41	1,499	+ 389·41	+ 1,499
TANTALITE—				
Pilbara	·36	281	+ ·36	+ 281
TIN—				
East Murchison	...	...	— ·25	— 50
Greenbushes	14·53	3,088	+ 3·72	+ 837
Pilbara	13·99	2,750	+ 3·18	+ 499
TIN-TANTALUM—				
Greenbushes	...	...	— 6·17	— 915
TUNGSTEN ORES (Scheelite)—	Units.		Units.	
Coolgardie	27·00	150	+ 27·00	+ 150
Yilgarn	258·00	1,402	— 1,380·00	— 7,544
VERMICULITE—	tons.		tons.	
Outside Proclaimed Goldfield	203·50	1,218	+ 144·50	+ 864

TABLE 8.

Quantity of Coal raised during 1945 *and* 1946, *estimated Value thereof, 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	1945	543,363	572,896	224	636	854	632
	1946	**642,287**	**730,104**	**262**	**693**	**927**	**673**

The quantity and value of coal raised during the year 1946 showed an increase amounting to 98,924 tons and £157,208 respectively. The average number of men employed increased by 95, and the number of tons raised per man employed increased by 41 tons when compared with figures for 1945.

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

TABLE 9.

Total Number and Acreage of Leases, Mineral Claims, and Prospecting Areas held for Mining on 31*st December,* 1945 *and* 1946.

Leases and Other Holdings.	1945.		1946.	
	No.	Acreage.	No.	Acreage.
Gold Mining Leases on Crown Land	1,316	21,991	**1,455**	**24,966**
Gold Mining Leases on Private Property	3	72	**9**	**226**
Mineral Leases on Crown Land	176	38,515	**176**	**38,496**
Mineral Claims	154	8,875	**148**	**9,341**
Prospecting Areas	*498	8,430	†913	**19,056**
Totals	2,147	77,883	**2,696**	**92,085**

† Includes 5 Prospecting Areas for Minerals of a total area of 3,088 acres.
* Includes 20 Prospecting Areas for Minerals of a total area of 462 acres.

PART IV.—MEN EMPLOYED.

TABLE 10.

Average number of Men reported as engaged in Mining during 1945 *and* 1946.

Goldfield.	District.	Reef or Lode.		Alluvial.		Total.	
		1945.	1946.	1945.	1946.	1945.	1946.
Kimberley	...	3	9	...	...	3	9
Pilbara	Marble Bar	107	126	...	...	107	126
	Nullagine	64	84	...	...	64	84
Ashburton	...	2	2	...	...	2	2
Gascoyne	...	...	...	...	...	...	...
Peak Hill	...	24	26	...	...	24	26
East Murchison	Lawlers	90	111	...	...	90	111
	Wiluna	458	329	...	...	458	329
	Black Range	16	24	...	...	16	24
Murchison	Cue	116	487	...	...	116	487
	Meekatharra	75	103	...	...	75	103
	Day Dawn	25	39	...	...	25	39
	Mt. Magnet	104	148	...	...	104	148
Yalgoo	...	22	35	...	...	22	35
Mt. Margaret	Mt. Morgans	75	112	...	...	75	112
	Mt. Malcolm	239	332	...	...	239	332
	Mt. Margaret	56	104	...	...	56	104
North Coolgardie	Menzies	75	100	4	5	79	105
	Ularring	27	48	1	2	28	50
	Niagara	12	24	...	...	12	24
	Yerilla	21	52	2	3	23	55
Broad Arrow	...	74	148	3	6	77	154
North-East Coolgardie	Kanowna	18	33	2	4	20	37
	Kurnalpi	9	16	1	2	10	18
East Coolgardie	East Coolgardie	2,297	3,250	17	19	2,314	3,269
	Bulong	12	25	2	3	14	28
Coolgardie	Coolgardie	178	185	...	...	178	185
	Kunanalling	16	16	...	...	16	16
Yilgarn	...	176	370	...	...	176	370
Dundas	...	387	566	...	...	387	566
Phillips River	...	3	4	...	...	3	4
State Generally	...	5	9	...	...	5	9
Total—Gold Mining	...	4,786	6,917	32	44	4,818	6,961
MINERALS OTHER THAN GOLD.							
Alunite	...	120	120	...	...	120	120
Arsenic	...	19	18	...	...	19	18
Asbestos	...	107	436	...	...	107	436
Bentonite	...	1	1	...	...	1	1
Beryl	...	3	1	...	...	3	1
Bismuth	...	1	...	...	...	1	...
Clays	...	5	3	...	...	5	3
Coal	...	860	955	...	...	860	955
Copper Ore	...	2	1	...	...	2	1
Dolomite	...	1	2	...	...	1	2
Felspar	...	8	7	...	...	8	7
Glass Sand	...	1	1	...	...	1	1
Glauconite	...	2	8	...	...	2	8
Gypsum	...	10	25	...	...	10	25
Kyanite	...	...	1	...	...	...	1
Lead Ore	...	...	5	...	...	...	5
Phosphatic Guano	...	27	...	...	...	27	...
Pyrites	...	54	57	...	...	54	57
Red Ochre	...	3	4	...	...	3	4
Talc	...	...	2	...	...	...	2
Tantalite	...	...	2	...	...	...	2
Tin	...	13	10	...	...	13	10
Tin-Tantalum	...	4	...	...	...	4	...
Tungsten Ore (Scheelite)	...	11	3	...	...	11	3
Vermiculite	...	1	1	...	...	1	1
Total—Other Minerals	...	1,253	1,663	...	...	1,253	1,663
GRAND TOTAL	...	6,039	8,580	32	44	6,071	8,624

PART V.—ACCIDENTS.

TABLE 11.

MEN EMPLOYED IN MINES KILLED AND INJURED IN MINING ACCIDENTS DURING 1945 AND 1946.

A.—According to Locality of Accident.

Goldfield.	Killed.		Injured.		Total Killed and Injured.	
	1945.	1946.	1945.	1946.	1945.	1946.
1. Kimberley ...	...	...	...	...	...	...
2. West Kimberley	...	...	...	...	...	...
3. Pilbara ...	1	...	14	14	15	14
4. West Pilbara	...	...	...	...	...	...
5. Ashburton ...	...	...	...	...	...	...
6. Gascoyne ...	...	...	...	...	...	...
7. Peak Hill ...	...	...	...	...	...	...
8. East Murchison	1	1	80	45	81	46
9. Murchison ...	...	3	35	65	35	68
10. Yalgoo ...	...	...	...	...	...	...
11. Mount Margaret	...	1	24	31	24	32
12. North Coolgardie	...	...	2	4	2	4
13. North-East Coolgardie	...	...	...	...	...	...
14. Broad Arrow	1	2	...	2	1	4
15. East Coolgardie	7	3	345	556	352	559
16. Coolgardie ...	...	...	21	25	21	25
17. Yilgarn ...	...	...	4	6	4	6
18. Dundas ...	1	...	65	78	66	78
19. Phillips River	...	...	...	...	...	...
MINING DISTRICTS—						
Northampton	...	...	...	...	...	...
Greenbushes ...	...	...	...	...	...	...
Collie	1	1	275	286	276	287
South-West ...	...	...	4	10	4	10
Totals	12	11	869	1,122	881	1,133

From the above table it will be seen that the number of fatal accidents for the year 1946 was 11, as against 12 in 1945. The number injured showed an increase of 253. In the report of the State Mining Engineer, published as Division II of this report, these accidents are classified according to their causes.

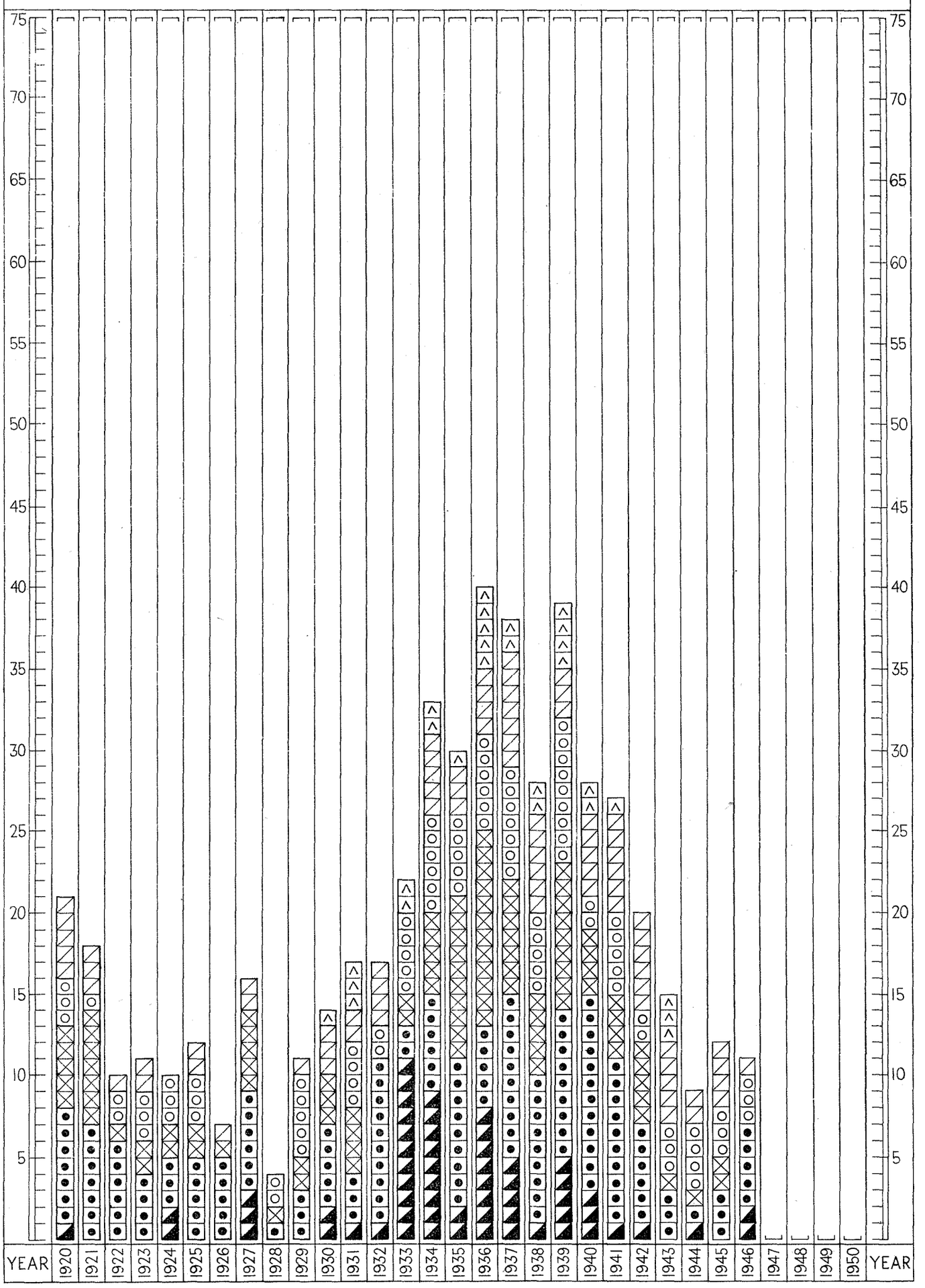
B.—According to Causes of Accidents.

Cause.	1945.		1946.		Comparison with 1945.	
	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.
1. Explosives ...	...	6	2	7	+ 2	+ 1
2. Falls of Ground	3	50§	5	62	+ 2	+ 12
3. In Shafts ...	2	19	...	16	— 2	— 2
4. Miscellaneous Underground	3	608	3	787	...	+179
5. Surface ...	4	184§	1	250‡	— 3	+ 66
6. Fumes ...	...	2	...	...	...	— 2
Totals	12	869	11	1,122	— 1	+253

‡ Includes 10 serious accidents in Quarries. § Includes 2 serious accidents in Quarries.

DIAGRAM OF ACCIDENTS

Showing the number of Deaths, arranged in Six Classes, in the Mines of Western Australia, from 1920 onwards



Explosions · Falls of Ground · In Shafts · Misc. Underground · On Surface · Fumes

PART VI.—STATE AID TO MINING.

(A) *State Batteries.*

(1) The number of State Batteries existing at the end of the year was 22 with three leased. From inception to the end of 1946 gold and tin to the value of £12,858,224.227 including Gold Premium estimated at £3,341,284.071 has been recovered from State plants. 2,696,654.69 tons of auriferous ore have been treated and have produced £10,131,025.061 plus estimated premium by amalgamation; £2,356,698.196 by cyanidation; £265,266.11 by slimes; £10,779.7 from residues and 81,786 tons of tin ore produced tin to the value of £93,883.16 and in addition a sum of £572 was recovered from residues.

(2) During the year 45,476½ tons of ore were crushed for 27,930.13 ounces of bullion estimated to contain 23,671.25 ounces of fine gold equal to 10 dwt. 9.8 grains per ton. The average value of tailing produced was 4 dwt. 10.6 grains per ton, making the average head value 14 dwt. 20.4 grains per ton. 60.5 per cent. of the tailing produced assayed over 2 dwt. 8 grains per ton; 10.1 per cent. was tailing between 2 dwt. 8 grains and 1 dwt. 18 grains and 24.7 per cent. was tailing 1 dwt. 18 grains and under per ton, and 4.7 per cent. contained too much copper to treat.

The estimated value of gold produced was 23,671.25 ounces by amalgamation and 4,807.56 ounces from tailing treatment; a total of 28,478.81 ounces valued at £A281,880.

(3) The working expenditure for all plants for the year was £61,519 2s. 2d. and the revenue £39,154 5s. 8d., which shows a loss of £22,364 16s. 6d. on the year's operations.

(4) The capital expenditure since inception of the scheme has been £547,588 17s. 2d.; £409,933 19s. 6d. from General Loan Fund; £95,246 16s. 3d. from Consolidated Revenue Fund; £28,621 13s. 5d. from Assistance to Gold Mining Industry and £13,786 8s. from Commonwealth Assistance to Metalliferous Mining.

(5) Head Office expenditure including insurance under Workers' Compensation Act, was £5,243 1s. 10d. against £5,101 11s. 1d. for 1945

The working expenditure from inception to the end of the year exceeds the revenue by £138,586 12s. 1d.

(B) *Geological Survey.*

The work of the Geological Survey for the year 1946 is represented by the following reports which are published in Division IV of this report. These comprise:—

- Garnet and Ilmenite Bearing Beach Sands at Witchcliffe.
- Future Prospects Blue Spec Gold-Antimony Mine.
- Water Supply Blue Spec Gold-Antimony Mine.
- Ore Reserve Position at McKinnon's and Comet Gold Mines, Marble Bar.
- Silica Sand Deposit Six Miles South-West of Coorow.
- Future Development of Edna May (W.A.).
- Limestone Deposit at Lake Muir, 45 miles E.S.E. of Manjimup.
- Boring for Coal on M.L. 324 Ewington, Collie.
- Final Report on Port Hedland Water Supply.
- P.A. 3094 (Late P.A. 2968) Jumbulyer, near Mt. Magnet.
- Progress Report on the Geology of portion of the North-West Division.
- Progress Report on the Re-Survey of the Coolgardie District.
- Report on "Second Try" G.M.L. 1530, Norseman.
- Notes on some Mining Groups in the Coolgardie District:—
  - (i) Hampton Group,
  - (ii) Baker's Find,
  - (iii) Burbanks,
  - (iv) Bayleys.
- Progress Report on the Geological Survey of the Collie Coalfield.
- Petrographical Notes on Rocks from portion of the Yalgoo and Murchison Goldfields.

During 1946 the following publications were issued:—

- Annual Progress Report of the Geological Survey of Western Australia for 1944.
- Mineral Resources of Western Australia, Bulletin No. 3—Tantalum and Niobium.

The following publications are still in the press:—

- Annual Progress Report of the Geological Survey of Western Australia for 1945.
- Mineral Resources of Western Australia, Bulletin No. 4—The Dandaragan Phosphate Deposits; by R. S. Matheson, B.Sc., Geological Survey of Western Australia.
- Geological Survey of Western Australia, Bulletin No. 101—The Mining Groups of the Yilgarn Goldfield, North of the Great Eastern Railway; by R. S. Matheson, B.Sc., Geological Survey of Western Australia.
- Geological Survey of Western Australia, Bulletin No. 102—The Greenbushes Mineral Field; by R. A. Hobson, B.Sc., (Hons.) and R. S. Matheson, B.Sc., Geological Survey of Western Australia.

Authority to print is awaited for the following Bulletins:—

- Geological Survey of Western Australia, Bulletin on the Geology of Portion of the Mt. Margaret Goldfield; by R. A. Hobson, B.Sc. (Hons.), Geological Survey of Western Australia.
- Geological Survey of Western Australia, Bulletin on Some Economic Aspects of the Principal Tantalum Bearing Deposits of the Pilbara Goldfield, North-West Division; by H. A. Ellis, B.Sc., A.O.S.M., Geological Survey of Western Australia.
- Mineral Resources of Western Australia, Bulletin—Moulding Sands; by K. R. Miles, D.Sc., F.G.S., Geological Survey of Western Australia and H. A. Stephens, B.Sc., Council for Scientific and Industrial Research.
- Mineral Resources of Western Australia, Bulletin—Silver, Lead and Zinc; by W. Johnson, B.Sc. (Hons.), Geological Survey of Western Australia.
- Mineral Resources of Western Australia, Bulletin—Vermiculite, Talc and Soapstone, Fullers Earth, Bentonite and Diatomite; by W. Johnson, B.Sc. (Hons.), Geological Survey of Western Australia.

Field officers of the Geological Survey continue to provide much practical assistance to prospectors and miners in the course of their field work. An increased number of requests for information concerning the geology and mineral resources of the State, from both local and overseas sources, have been dealt with at Head Office of the Geological Survey during the year.

(C) *Assistance under the Mining Development Act,* 1902.

The following statement shows the sums advanced during the year 1946 under this Act:—

		£	s.	d.
1.	Advanced in aid of mining work and equipment of mines with machinery	9,308	2	5
2.	Subsidies on stone crushed for the public, being amounts paid to owners of plants crushing at fixed rates	292	9	0
3.	Providing means of transport, equipment and sustenance for prospectors	2,547	8	3
4.	Other assistance	340	14	3
		£12,488	13	11

The receipts under this Act, exclusive of interest payments, amounted to:—

	£	s.	d.
1. Refund of Advances	847	11	7
2. Prospecting Refunds	253	10	2
	£1,101	1	9

PART VII—INSPECTION OF MACHINERY.

The Chief Inspector of Machinery reports that the number of useful boilers registered at the end of the year totalled 5,482, against 5,183 total for the preceding year, showing an increase after all adjustments of 299 boilers.

Of the total 5,482 useful boilers, 3,131 were out of use at the end of the year, 2,384 thorough and 165 working inspections were made and 2,351 certificates were issued.

Permanent condemnations totalled 25 and temporary condemnations 10. There was one conversion. Five boilers were transferred beyond the jurisdiction of the Act.

The total number of machinery groups registered was 20,017 against 18,908 for the previous year, showing an increase of 1,109.

Inspections made total 11,750 and 3,155 certificates were granted.

The total miles travelled for the year were 67,029 against 58,549 miles for the previous year, showing increase of 8,480 miles. The average miles travelled per inspection were 4·68 as against 4·33 miles per inspection for the previous year.

Three hundred and sixty seven applications for engine drivers' and boiler attendants' certificates were received and dealt with, and 339 certificates, all classes, were granted, as follows:—

Winding Competency (including certificates issued under Regulation 40 and Section 60)	6
First Class Competency (including certificates issued under Regulations 40 and 45, and Sections 60 and 63)	16
Second Class Competency (including Certificates issued under Regulation 40 and Section 60)	39
Third Class Competency (including certificates issued under Regulations 40 and 45 and Sections 60 and 63 of the Act)	42
Locomotive Competency (including certificates issued under Regulation 40 and Section 60)	10
Traction Competency (including certificates issued under Regulation 40 and Section 60)	3
Internal Combustion Competency (including certificates issued under Regulation 40 and Section 60)	47
Crane and Hoist Competency (including certificates issued under Regulation 40 and Section 60)	32
Boiler Attendants' Competency (including certificates issued under Regulation 40 and Section 60)	130
Interim	—
Copies	13
Transfers	1
	339

The total revenue from all sources during the year was £8,320 8s. 7d., as against £8,207 5s. 5d. for the previous year, showing an increase of £113 3s. 2d.

The total expenditure for the year was £10,564 16s. 3d. as against £8,209 0s. 3d. for the previous year, showing an increase of £2,355 16s.

PART VIII—CHEMICAL, MINERALOGICAL AND ANALYTICAL LABORATORIES.

The activities of the Government Chemical Laboratories continue to expand and with the end of the war they are now concentrating their attention to meeting the new developments brought about by post-war conditions.

During the year the staff was materially augmented and further appointments to the technical staff are now under consideration.

Under the new establishment approved during the year, the following divisions of work were provided, viz., (a) Agriculture, Water Supply and Forestry; (b) Foods, Drugs and Toxicology; (c) Fuel Technology; (d) Industrial Chemistry; (e) Mineralogy, Mineral Technology and Geochemistry; (f) Soil Mineralogy and Sedimentary Petrology.

On the completion of this establishment the laboratories should be in a position to meet any demands made by the Government Departments and the public for chemical and mineralogical advice in regard to the development of this State's natural resources in addition to providing Government Departments and Industry with technical information concerning the properties and processing of materials used in industry.

Work of special interest carried out in the Laboratories during the year include:—

(a) *Agriculture, Water Supply and Forestry.*—Soil investigations in association with a research into breeding problems of sheep (Dystokia) and the growth of the drug plant Pituri (Duboisia Hopwoodii). The comprehensive survey of the waters from rivers and streams in the south-west of this State was continued. Work in connection with the study of the copper status of subterranean clover and the control of Dieback in flax by the use of zinc salts.

(b) *Food, Drugs and Toxicology.*—The small investigation initiated during the past year with the purpose of securing data governing the composition and freezing point of milk produced near Mundijong was concluded. As a result of the information obtained a comprehensive investigation was initiated on the milk produced in the sandy country adjacent to Perth.

An investigation for the purpose of fixing a Western Australian standard for citrus fruits in respect to acidity and juice content was initiated during the year.

Much attention was devoted in this Division to Industrial Hygiene particularly in respect to lead and arsenic hazards and factory hygiene.

(c) *Fuel Technology.*—The newly erected building to house the Fuel Technology Laboratory was made available for occupation during the year and much progress was made in equipping it with the special apparatus required to enable it to function on the arrival of the Fuel Technologist to take over his duties, when immediate attention will be devoted to the study of the properties of Collie coal with a view to its beneficiation and utilisation under modern conditions.

(d) *Industrial Chemistry.*—On the arrival in the State of the recently appointed Chief Industrial Chemist this officer will devote his attention to implementing the Government's policy to assist local industry in elucidating any of the problems that may arise in connection with the establishment of secondary industries in this State. This officer will be responsible for carrying out any fundamental research associated with the development of Governmental projects.

(e) *Mineralogy, Mineral Technology and Geochemistry.*—An increase in the laboratory activities due to the added interest in gold production was responsible for a rapid increase in the number of gold samples received. During the year under review a systematic survey of the quality of the coal from the

various seams worked at Collie was carried out. Beneficiation tests on local molybdenite ores for the purpose of supplying molybdenum oxide for experimental use as a trace element supplement for agricultural purposes gave very encouraging results.

(f) *Soil Mineralogy and Sedimentary Petrology.*—Because of the peculiar geological conditions of the southern portion of this State, soil mineralogy has assumed considerable importance on account of the necessity to supplement information obtained in the field and chemically in order to define the parent materials in the soil which are responsible for supplying the chemical elements required by animals and plants.

The investigations into the Boyup Brook-Muradup soils collected from farms regarded as sound and unsound with respect to sheep infertility problems represented an important activity of this Division during the year. Much work was also done on soils from which sub-clover samples would be collected for test of potency in producing infertility.

PART IX—SCHOOL OF MINES.

(a) Kalgoorlie.—The individual enrolments for 1946, exclusive of Correspondence Course Students, reached a maximum of 587, as compared with 372 in 1945, while Correspondence Course enrolments totalled 38.

Under the Commonwealth Reconstruction Training Scheme, the school enrolled 99 full-time and 144 part-time students.

The teaching staff had to be increased to meet the expansion in numbers of students.

In the Public Assay Branch of the School, 483 gold and metal determinations and 56 mineral determinations were carried out, as against 152 and 45, respectively, during 1945.

A Special Geology School for Prospectors was conducted during the Christmas Vacation and was attended by 54 prospectors, including four women.

The Metallurgical Laboratory undertook 21 special investigations mainly on gold ores. It also dealt with 947 gold assays, 259 chemical tests and 68 screen analyses.

(b) Wiluna.—The maximum individual enrolment was 24, approximately half the number enrolled in 1945.

Owing to the cessation of mining operations by the Wiluna Gold Mines, Limited, and the consequent drop in the population of the town, it was decided to permanently close the school at the end of the year.

(c) Norseman.—Seventy was the maximum number of individual enrolments, and as the Norseman district is an active one, there is no doubt that this school is on a stable basis.

A permanent instructor has been appointed to the school for the year 1947.

PART X—MINERS' PHTHISIS ACT AND MINE WORKERS' RELIEF ACT.

In 1946 all Goldfields were visited with the exception of Ashburton, Gascoyne, Kimberley, Phillips River, Pilbara, West Kimberley and West Pilbara.

The number of examinations conducted were 5,606 compared with 3,334 for 1945.

STAFF.

It is with great regret that I have to record the death of Mr. R. W. Fletcher, B.Sc., Director of the School of Mines, Kalgoorlie, which occurred suddenly shortly before the completion of this report. Mr. Fletcher took over the duties of the position early in 1946, and in the short time in which he held the office, had shown marked ability and had instituted many innovations of benefit to the school and the students.

Throughout a very busy year, the members of the staff, both Head Office and Goldfields, loyally and efficiently carried out their duties and I am very appreciative of their efforts.

In dealing with the various activities I have commented only on the principal items. Divisions II to IX of the publication contain the detailed reports of the responsible officers.

I have, etc.,

A. H. TELFER,
Under Secretary for Mines.

Department of Mines,
Perth, 30th May, 1947.

Division II.

Report of the State Mining Engineer for the Year 1946.

The Under Secretary for Mines.

Sir,—I have the honour to submit for the information of the Hon. the Minister for Mines, my report on this branch of the Mines Department for the year 1946.

STAFF.

Two assistants working on mine ventilation, have been added to the staff at Kalgoorlie in the persons of Mr. J. F. Haddow appointed Assistant Inspector of Mines (Ventilation) on 2nd January and Mr. G. F. Mead appointed Assistant Inspector of Mines (Ventilation) on 9th December.

ACCIDENTS.

Fatal and serious accidents on mines and quarries reported to the Department for the year are shown below. Corresponding figures for 1945 are shown in brackets.

There were 11 (12) fatal and 1,122 (869) serious accidents including 1 (1) fatal and 296 (279 serious on coal mines and quarries.

Of the fatal accidents 10 occurred in gold mines and one in a coal mine.

The total number of serious accidents reported from gold mines was 826 (590). The average number of men employed on such mines was 6,961 (4,786). The average accident rate per 1,000 men employed on gold mines was thus 1.43 (2.09) for fatal and 118.66 (123.28) for serious accidents.

On the coal mines the number of serious accidents was 286 (275) while the average number of men employed was 955 (860). The average accident rate per 1,000 men employed was therefore 299.47 (319.76) for serious and 1.05 (1.16) for fatal accidents.

A classification of the serious accidents showing the nature of the injuries is given in Table A.

TABLE A.

SERIOUS ACCIDENTS—1946.

Goldfield.	Major Injuries—Exclusive of Fatal.																						
	Fractures.											Amputations.						Loss of Eye.	Serious Internal.	Hernia.	Dislocations.	Other Major.	Total Major.
	Head.	Shoulder.	Arm.	Hand.	Spine.	Rib.	Pelvis.	Thigh.	Leg.	Ankle.	Foot.	Arm.	Hand.	Finger.	Leg.	Foot.	Toe.						
East Coolgardie	1	....	2	7	....	11	....	....	4	2	8	....	....	2	....	....	....	....	....	....	....	....	37
Yilgarn	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	1
Coolgardie	....	....	....	....	....	....	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	2
Dundas	....	....	1	....	....	4	....	....	1	1	1	....	....	....	....	....	....	....	....	....	....	....	8
Broad Arrow	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Mt. Margaret	....	....	1	....	....	2	....	....	1	....	....	....	....	....	....	....	....	1	....	....	....	....	5
North Coolgardie	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
East Murchison	1	....	2	....	1	....	....	1	2	....	1	1	....	2	....	....	....	....	....	2	....	1	14
Murchison	....	....	....	1	....	4	....	....	....	1	2	....	....	3	....	....	....	....	....	1	....	....	12
Pilbara	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
South-West Mining Districts	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1
Collie Coalfield	2	....	7	5	1	28	2	....	6	....	2	....	....	1	....	....	....	....	....	1	5	8	68
Total	4	....	13	13	2	49	2	1	15	4	14	1	....	10	....	....	....	1	....	4	5	10	148

Goldfield.	Minor Injuries.												
	Fractures.		Head.	Eyes.	Shoulder.	Arm.	Hand.	Back.	Rib.	Leg.	Foot.	Other Minor.	Total Minor.
	Finger.	Toe.											
East Coolgardie	11	11	6	15	13	37	155	83	4	87	51	46	519
Yilgarn	....	....	....	....	....	....	2	1	....	....	2	....	5
Coolgardie	....	1	....	3	....	1	6	2	....	2	4	4	23
Dundas	....	....	1	5	1	7	20	14	3	7	7	5	70
Broad Arrow	....	....	....	....	....	....	1	1	....	....	....	....	2
Mt. Margaret	2	3	....	1	2	1	6	4	....	2	2	3	26
North Coolgardie	....	....	....	....	....	....	....	1	2	1	....	....	4
East Murchison	3	1	....	3	2	1	7	5	1	3	1	4	31
Murchison	6	6	1	....	....	1	15	7	....	9	6	2	53
Pilbara	....	1	1	....	....	1	3	5	....	1	2	....	14
South-West Mining Districts	....	....	....	2	1	....	1	2	....	1	2	....	9
Collie Coalfield	10	7	14	19	3	4	76	6	4	27	25	23	218
Total	32	30	23	48	22	53	292	131	14	140	102	87	974

Table B shows the number of fatal accidents recorded year by year for the past five years and the death rate per 1,000 men employed:—

TABLE B.

	1942.	1943.	1944.	1945.	1946.
Fatal accidents to men engaged in mining (exclusive of quarries) ...	20	15	8	12	11
Total number of men engaged in mining (average)	9,100	6,227	5,930	6,071	8,624
Accident death rate per 1,000 men engaged in mining	2·23	2·41	1·35	1·97	1·28

FATAL ACCIDENTS.

Following is a brief description of all fatal accidents that were reported on the mines during the year:—

Name and Occupation.	Date.	Mine.	Details and Remarks.
		Explosives (2).	
Marshall, William Burton (Engineer); McKenzie, James Augustus McIntyre (Fitter)	23–1–46	Ora Banda Amalgamated	The two men killed in this accident were lowered to the 600 level and arrived there just as a sand blast close to the shaft exploded. Signals had been arranged with the driver on day shift and when a new driver came on shift, confusion resulted. This unfortunate accident stresses the necessity for adhering rigidly to the signal code.
		Falls of Ground (5).	
Gilbert, Neville Kenneth (Underground Manager); Gobbart, William Gleeson (Surveyor); Alberts, Christopher (Miner)	1–3–46	Hill 50 Gold Mine ...	In this accident three men were killed by the same fall of stone, containing about 30 tons which came away from the hanging wall of a stope. Alberts was a miner working in the stope, and left his working place to go to where Gilbert and Gobbart were standing. They were directly in the path of the fall and were killed instantly. The other miner in the stope escaped with minor injuries.
Watson, Ian Austin (Mechanical Shovel Operator)	11–9–46	Lake View and Star Associated Mine	Watson was operating a mechanical shovel in a leading stope. While he was attempting to scale down the place there was a heavy fall of rock which killed him instantly.
Davey, William Robert (Machine Man)	8–11–46	Sons of Gwalia ...	Davey who was working in a stope had bored a hole in the hanging wall and was proceeding with the boring of the face. He left his machine to relieve a spaller and shortly afterwards about 10 tons of rock fell and killed him. The other man narrowly escaped.
		Miscellaneous Underground (2).	
Ferrier, Isaac	30–3–46	North Kalgurli (1912), Ltd.	Ferrier was caught on a chinaman chute by a run of ore from a shrink stope. There was no witness to the accident but it is thought that he went up under hanging ore to free it. There is a regulation forbidding such action.
Davey, George Alfred ...	2–11–46	Gold Mines of Kalgoorlie (Iron Duke Shaft)	A locomotive which Davey was using to haul a rake of trucks became derailed and overturned. Davey was found pinned against the wall of the crosscut by the locomotive and was apparently dead when found. There were no witnesses to the accident and no evidence to show how the locomotive became derailed or why it overturned.
Brickhill, Joseph Gregson (Labourer)	14–10–46	Wiluna Gold Mines, Ltd.	Brickhill's body was found in an ore bin buried in the ore. There was no evidence to show how he got in the bin but the medical evidence suggested that he had a heart attack and fell in and was possibly dead when he fell.
McVee, Robert	20–8–46	Stockton Mine ...	On 28th August, McVee fell while carrying a stick of timber and did not appear to be seriously hurt. He was unable to work the following day and died on 5th September. The general condition of his health apart from any injury he received when he fell was not good.

Table C shows the total number of fatal and serious accidents that were reported during the year classified according to the gold or mineral field in which they occurred and also according to their causes. Table 11, showing fatal and serious accidents and the districts in which they occurred is forwarded herewith for your Annual Report, together with a diagram showing the fatal accidents year by year according to their causes.

TABLE C.

Fatal and Serious Accidents showing the Causes and Districts in which they occurred.

	Explosives.		Falls of Ground.		In Shafts.		Fumes.		Miscellaneous Underground.		Surface.		Total.	
	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.
1. East Coolgardie ...	...	5	1	14	...	8	...	...	2	411	...	118	3	556
2. Mt. Margaret ...	...	...	1	1	...	1	...	...	...	23	...	6	1	31
3. Coolgardie	...	...	...	...	...	...	...	...	...	18	...	7	...	25
4. North Coolgardie ...	...	...	...	...	...	1	...	...	...	1	...	2	...	4
5. North-East Coolgardie	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6. Broad Arrow ...	2	...	...	...	...	1	...	...	...	1	...	...	2	2
7. Dundas	...	...	...	2	...	2	...	...	...	60	...	14	...	78
8. Yilgarn	...	...	...	...	...	...	...	...	...	4	...	2	...	6
9. Murchison	...	1	3	4	...	1	...	...	...	37	...	22	3	65
10. East Murchison ...	...	...	...	...	...	2	...	...	...	22	1	21	1	45
11. Peak Hill	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12. Yalgoo	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13. Northampton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14. Greenbushes ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15. South-West ...	...	...	...	...	...	...	...	...	...	...	...	10	...	10
16. Phillips River ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17. Collie	...	1	...	39	...	...	...	...	1	202	...	44	1	286
18. Pilbara	...	...	...	2	...	...	...	...	...	8	...	4	...	14
19. West Pilbara ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20. Ashburton	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Totals for 1946 ...	2	7	5	62	...	16	...	...	93	787	1	250	11	1,122
Totals for 1945 ...	1	6	3	50	2	19	...	2	3	608	4	184	12	869

WINDING MACHINERY ACCIDENTS.

There were six accidents involving winding machinery besides some mechanical failures of winding plant which are referred to in the report of the Deputy Chief Inspector of Machinery. Five of these accidents were overwinds and the rope on a counterweight broke.

Overwinds.

(1) This accident, in an underlay shaft, was due to the driver misjudging the tipping mark. Some damage was done to the sheave wheel and its bearing.

(2) The brakes failed to stop the ascending cage and driver reversed his engine. Clamps on rope entered the sheave and damaged the wheel before detaching hook operated.

(3) Reversing lever was placed in the wrong position when lowering skip at tip. Some damage was done to headframe and wheel.

(4) This accident was due to a clutch slipping out and allowing drum to become disengaged. Cage went to the bottom of the shaft but caused no serious damage.

(5) The attention of the driver was distracted by another person and the cage was overwound. Detaching hook operated and the end of the rope came into the engine room. No serious damage occurred.

(6) The rope on a counterweight broke. Slight damage to shaft timber resulted.

PROSECUTIONS.

Three persons were prosecuted under the provisions of the Mines Regulation Act. All prosecutions were successful and fines were imposed in every case.

All prosecutions were related to breaches of the regulations for safety in the use of explosives. One miner was prosecuted for drilling in a development face before all broken ore had been removed. Another was prosecuted for firing nine charges of explosives without giving proper warning in adjacent workings while a third was prosecuted for removing an unexploded charge with compressed air instead of firing it.

EXEMPTIONS.

In accordance with the provisions of Section 34, Subsection 4 of the Mines Regulation Act, 1906-38, 64 permits were issued, exempting the holders from the operation of Subsection 1 (b) of the same section. In 1945 the number issued was fifteen.

SUNDAY LABOUR.

Permission to work on 11 Sundays was granted under the provisions of the Mines Regulation Act while 67 permits were issued under the provisions of the Coal Mines Regulation Act.

ADMINISTRATION.

(Amendments of Acts.)

The Mining Act, 1904-1937.

This Act was consolidated and the new Act No. 48 of 1945 received assent on 30th June, 1946.

Mine Workers' Relief Act, 1932-43.

(1) Regulation 14 amended.
(2) Regulation 16 amended.
(3) New Regulation 16A.
(4) Regulation 18 amended.

(5) New Regulations 18A and 18B. Gazetted 11th October, 1946.

Mine Workers' Relief (War Service) Act, 1940-1945.

Proclamation under provisions of Section 4. Gazetted 22nd November, 1946.

Mines Regulation Act, 1906-38.

Regulation 2B amended. Gazetted 19th July, 1946.

VENTILATION.

Inspector Lloyd's report on his work as Ventilation Officer is quoted in full hereunder. Activities during the period of Inspector Lloyd's absence are covered by a report from Assistant Inspector Haddow.

> During the early part of the year—January to April—I was engaged on a ventilation survey of the coal mines at Collie at the same time attend-

ing to departmental matters owing to Inspector Gillespie having been admitted to hospital for operation.

General ventilation conditions on the Kalgoorlie mines have been included in Assistant Inspector Haddow's report and apart from an underground fire which broke out at the Lake View and Star No. 2 Horseshoe shaft covers the principal mines.

The abovementioned fire occurred in the pumping station 1300 plat on the 8th January, and as the workings of the Lake View and Star and Great Boulder are connected, smoke fumes penetrated into the Great Boulder mines. All men were withdrawn from the mines affected and following heavy work in getting fire hoses to the No. 3 lode where the heat had set alight the timbers of a sand filled stope, stoppings were erected in all adjacent connections.

Shortly after my arrival in Collie a fire broke out in Section 14 of the Proprietary Colliery and following withdrawal of the men work was commenced on erection of stoppings.

In both instances the fires were successfully dealt with and no loss of life or injury resulted.

In addition to underground ventilation, numerous complaints of fumes were investigated and requests made for improving conditions in the roaster sections of the treatment plants on various mines.

During the year inspections were carried out in the principal mines of the Mt. Margaret and Dundas Goldfields and are briefly described as follows:—

Sons of Gwalia.—As a result of recirculation, high temperatures were recorded on the lower levels.

Following the sealing up of all openings above the 26 level, erection of doors and stoppings in the south end of the workings and opening of all doors leading from the shaft between No. 9 and 20 levels the volume of air entering the mine increased by 12,000 cfm. giving a total handled by both fans of 65,346 cfm. with a temperature of 87 degrees dry, 78.5 degrees wet.

E.M.U., Agnew.—Following the installation of a fan in the 900 main crosscut ventilation conditions throughout the mine were found to be very satisfactory, maximum temperature being 75 degrees dry, 74 degrees wet.

Central Norseman (Phoenix).—Ventilation conditions in all sections of the mine have been maintained in a very satisfactory manner, no effort having been spared in providing secondary ventilation in development ends.

Proposals are in hand for sinking a new shaft north of the "All Nations" shaft and to connect with the 14 level which will further improve ventilation in the stopes.

Princess Royal.—The main activity on this mine is driving on the No. 7 and No. 9 levels.

Both drives are in well over 2,000 feet and ventilation by 16-inch Meco fans with boosters and 15-inch pipes. Ventilation in both ends was found to be excellent.

Norseman Gold Mines (Butterfly).—Owing to the workings on the 8 and 9 levels having extended south of the brown shaft—main upcast from the 4 level—considerable difficulty has been experienced with smoke hanging in stopes and the only solution would appear to be the sinking of a new shaft some distance south of the brown shaft, but as values have fallen throughout the mine and consequently the life of same shortened it is quite likely the sinking of a new shaft will never eventuate.

Iron King.—This mine is now down to the No. 5 level (290 feet) and following completion of the south drive a rise is in course of construction to the No. 4 level. On the north driving is in progress with a view to extending the level some 1,700 feet, where drill holes have exposed a thickness of 40 feet of ore.

No signs of further heating were noticeable and ventilation generally should be improved when sinking operations in a shaft on the extreme south end of the workings is completed.

Dust Sampling.

As a result of the appointment of an Assistant-Inspector the Department has been enabled to keep a closer check on the control of dust in the local mines, but on account of transport difficulties the outlying mines were not subjected to the same close supervision in respect to dust sampling.

It is anticipated, however, that in the coming year with the provision of transport and extra equipment for dust sampling and instruments for recording temperatures and by virtue of the appointment of a second Assistant Inspector the outlying mines will be subjected to more frequent inspection.

Ventilation officers as provided for in Regulation 4, General Rule 49 (2) have been appointed on the larger mines. Difficulty has been experienced in securing the necessary instruments. An article on dust sampling and elimination prepared with the idea of assisting these officers is appended to this report. (Appendix No. 3.)

Accidents.

Accidents due to fumes as reported to this office during the year were as follows:—

	Serious.	Minor.
East Coolgardie Goldfield ..	Nil.	22
Dundas	Nil.	4
Coolgardie	Nil.	Nil.
Broad Arrow	Nil.	Nil.
Yilgarn	Nil.	Nil.
	—	26

It will be noted in each case the accident came within the category of minor, and in every case the employee returned to work the following shift.

The above figures are the accidents reported per medium of the Monthly Accident Returns but in addition cases of fuming have been investigated where no evidence could be found that the ventilation was inadequate and although the employee did not complete the shift, he returned to work next day.

During the past three years neither a fatal or serious accident due to fumes has occurred on the above Goldfields.

Prosecutions.

After having charged up 20 holes, seventeen of which were fired, the three top holes were left as it was stated by the machine man he could not see for smoke.

The following shift his cross mate went on bogging and for some unknown reason he decided to pull the rods and blow out the fracteur as a consequence of which he was fumed.

Proceedings were instituted under General Rule 3 (U), Section 35, and a fine of £5 was imposed.

Conclusion.

In the course of inspection throughout the various mines during the past year I have made a special note of the enormous volumes of smoke produced underground as a result of firing and consequently the dust hazard is increased and in my opinion is due to breaking of big dirt in the stopes.

Apart from the normal time for firing, namely crib time, reports of sand blasting and chute firing can be heard continuously, and quite frequently reports of face firing in adjacent mines are heard despite the fact this is a definite breach of the Mines Regulation Act and it is most difficult to obtain evidence necessary for prosecution.

Undoubtedly these factors contribute to ploluting the general mine atmosphere apart from the dust thrown out during tipping in ore passes and in order to reduce the incidence of dust to a minimum I would recommend that firing of any description should be prohibited during working hours and all firing restricted to end of shift.

In addition to restrictions on use of explosives during the working shift, I would further recommend that natural ventilation of mines should no longer be permitted—apart from those falling within the category of prospecting shows—and the Mines Regulation Act amended to provide for compulsory installation of mechanical ventilation and all connections between adjoining mines sealed off, thereby compelling each individual mine to be responsible for the ventilation and control of dust.

Mr. Haddow's report reads as follows:—

During the period under review no radical change in the ventilation systems of the various local mines has been instituted. Due to lack of transport, the work during the year has been confined to the Kalgoorlie District mines, with the exception of one visit to the Norseman area.

An outline of the general ventilation conditions of the Kalgoorlie mines, together with the projected improvements for the coming year, is given hereunder:—

Lake View and Star, Ltd.

Chaffers.—This shaft is a main ventilation intake for the western group of this Company's leases and the workings from it are well ventilated. No work has been done below the 3,400 feet level for the period and the temperatures at this level are good.

Hannans Star.—Adequate volumes of good air are entering this mine and secondary ventilation is given constant supervision.

Horseshoe No. 2.—The ventilation of this shaft is good under the influence of the 3,000ft. fan and upcast from the water shaft.

Ivanhoe.—Conditions at this shaft are only fair as it is on the return side of the system and temperatures and humidities are high.

Associated.—Relies on natural ventilation. The large number of connections to surrounding mines makes this method very effective.

Lake View.—Natural ventilation is good. During the year the main return airway on the 2,000ft. level from the Chaffers workings to the bottom of the Ivanhoe Junction (water shaft) has been stripped over a length of 260 feet from the 7ft. by 5ft. in section to 11ft. by 12ft. Preparation is now being made to strip the water shaft from the surface to 2,000ft. to increase its effective area. A fan to handle 120,000 c.f.m. is proposed for this shaft when stripping operations have been completed.

The ventilation of the western group of leases should be materially improved when this programme is completed.

Great Boulder Proprietary, Ltd.

Lane Shaft.—Ventilation usually good.

Edwards Shaft.—This mine is on the return side of the ventilation circuit and temperatures and humidities are high.

Main Shaft.—Conditions fair.

Hamilton and No. 2 Winze Section.—The temperature at the bottom of the No. 2 Winze section was reduced about 3 degrees by the installation of another electric fan. Conditions have been improved by further development, notably winze sinking. Preparation is in hand to downcast the Edwards Shaft, transfer the 1,930ft. fan to the 2,050ft., and it is hoped the ventilation will be materially improved thereby.

North Kalgurli (1912), Ltd.

Kalgurli, North Kalgurli and Union Jack.—These shafts rely on natural ventilation and with the multiplicity of openings to the adjoining mines this is quite effective. Secondary ventilation is carefully supervised. During the year two winzes were sunk from the surface to provide more adequate intakes to the mines and have considerably improved the ventilation conditions.

Gold Mines of Kalgoorlie, Limited.

Iron Duke, New North Boulder and Oroya Shafts.—Rely entirely on natural ventilation. Secondary ventilation could be improved by use of larger diameter pipes and more effective supervision.

Kalgoorlie Enterprise.

Considerable improvement has been effected at this mine by downcasting the Victoria shaft by means of an electric fan on the bottom levels. Consideration is now being given to duplicating this fan, as the Victoria Shaft is still being sunk, and it will service the lower levels to be opened up.

Boulder Perseverance Ltd.

This mine is naturally ventilated and conditions are good. Secondary ventilation is well supervised.

South Kalgurli Consolidated, Limited.

This mine is also well ventilated naturally.

Paringa Mining and Exploration Co. Ltd.

Ventilated naturally. Secondary ventilation could be improved by use of larger diameter pipes and better supervision.

Hannans North.

Ventilation satisfactory.

During the year a total of 564 dust samples were taken. Included in this total are 33 spots having a count of 1,000 plus p.p.c.c. These spots have not been included in obtaining the average count for the year. In most cases these spots do not represent average working conditions, being obtained mostly when purposely taken in places where conditions are considered to be bad. Such conditions are immediately remedied and the high count is not a true index of the conditions in the place where it is taken. Taking this into consideration, the average count obtained for the year is 257 p.p.c.c.

Appended is a summary of the samples taken during the year.

Temperatures exceeding the limits laid down by the Mines Regulation Act were recorded in a number of instances and immediate action has been taken to have conditions improved.

The ventilation of winzes has been paid particular attention throughout the year and the regulations in this regard are being strictly enforced. Attention has also been given to the dust nuisance in the treatment plants of the local mines and a careful watch is maintained to keep working conditions free from this hazard.

A considerable amount of time has been occupied in investigating fuming cases which are immediately reported to this office. A considerable falling off in the number of cases notified each month can be noted as the result of these activities.

Considerable interest is still being evidenced amongst the miners with respect to aluminium therapy and they await further information on this subject.

DUST SAMPLING.

Summary of Samples taken during 1946.

Month.	Development.		Stoping.		Level.		Number of places showing count of 1,000 plus p.p.c.c.			
	No.	Average Count.	No.	Average Count.	No.	Average Count.	Development.	Stoping.	Level.	Surface.
January	28	274	6	238	...	...	1	...	...	...
February	20	251	23	240	1	170	2	1	...	...
March	14	267	8	223	8	205	3	...	...	...
April	20	264	17	269	1	366	1	...	1	...
May	22	225	29	299	...	...	2	2	...	...
June	7	213	28	261	6	143	1	...	...	...
July	5	425	31	188	15	186	1	2	2	...
August	17	236	28	246	5	294	...	2	1	...
September	12	183	24	297	5	260	1	...	...	...
October	20	266	22	265	5	234	1	1	3	4
November	17	245	17	286	7	399	1	...	1	...
December	27	280	31	280	1	694	2	...	1	...
Total	209	256	264	259	54	245	16	8	9	4

GOLD MINING.

The ore production 2,194,477 tons and the gold yield 618,607 ounces for this year show a satisfactory increase over the corresponding figures 1,736,952 tons for 469,906 ounces for last year.

The average grade 5.64 dwt. per ton is a little higher than the average yield of 5.32 dwt. per ton last year.

The tonnage treated and gold won per man employed were 315.2 tons and 88.87 ounces, respectively and both are less than the corresponding figures 360.51 and 97.53 ounces for the previous year. This trend continues from 1944 and indicates that men are still returning to the industry and that a good deal of the work being done at present is preparatory rather than productive.

Table E which shows the gold output classified by districts according to the output of the individual mines, shows an increase in most groups. There has been a considerable increase in the returns from prospecting.

State Batteries treated 45,476 tons of ore and recovered 23,671 ounces by amalgamation. The tailings cyanided was 22,390 tons and the yield was 4,808 ounces. The total gold recovered was thus 28,479 ounces. This is a big increase both in tonnage and yield as compared with last year's figures.

The number of mines producing 5,000 ounces and over for the year was 19 as for last year. Moonlight Wiluna and Mountain View which were listed last year have not produced 5,000 ounces this year but Big Bell and Hannans North have been added to the list. Ora Banda Amalgamated which is again in production only worked for portion of the year.

Table G shows the output and yield of the principal mines of the State. With the exception of the Wiluna Mines, Mountain View, First Hit and Phoenix, all mines have maintained or improved their output.

The gold produced from tailings treatment by the Lake View and Star and the State Batteries is shown separately from the gold derived from ore treatment in this year's table. In previous years the gold from both sources has been included.

Among the smaller mines the most successful were:—

Mine.	Tons.	Ounces.	Dwt. per Ton.
Boomerang	79	575	145·47
Bronzewing	687	574	16·70
Caledonian	537	609	22·69
Daisy	1,048	755	14·42
Democrat	807	1,069	26·50
Edwards Reward ...	2,805	1,015	7·24
Haoma	1,281	1,113	17·61
Happy Find	191	647	67·86
First Hit (Morley's) ...	188	507	53·89
Local Lady	575	815	28·36
New Brew	1,021	1,212	23·74
Radio	901	1,057	23·47

Table D shows the production statistics for each year since 1929:—

TABLE D.

Gold Production Statistics.

Year.	Tons Treated. (2,240 lbs.)	Total Gold Yield.	Estimated Value of Yield.	Value of Yield per ton.	Number of Men Employed.	Average Value of Gold per Oz.	Average Yield per Ton of Ore.
	tons.	fine ozs.	£A.	shillings A.		shillings A.	dwt.
1929 ...	628,400	372,064	1,580,426	50·30	4,108	84·96	11·84
1930 ...	645,344	419,767	1,874,484	58·09	4,284	89·33	13·01
1931 ...	982,163	518,045	3,042,019	61·94	5,961	117·44	10·55
1932 ...	1,327,021	599,421	4,358,989	65·70	8,695	145·44	9·03
1933 ...	1,588,979	636,928	4,884,112	61·48	9,900	153·36	8·01
1934 ...	1,772,931	639,871	5,461,004	61·60	12,523	170·69	7·22
1935 ...	1,909,832	646,150	5,676,679	59·45	14,708	175·71	6·77
1936 ...	2,492,034	852,422	7,427,687	59·61	15,698	174·27	6·84
1937 ...	3,039,608	1,007,289	8,797,662	57·99	16,174	174·68	6·64
1938 ...	3,759,720	1,172,950	10,409,928	55·38	15,374	177·50	6·24
1939 ...	4,095,257	1,188,286	11,594,221	56·62	15,216	195·14	5·80
1940 ...	4,291,709	1,154,843	12,306,816	57·35	14,594	213·15	5·38
1941 ...	4,210,774	1,105,477	11,811,989	56·10	13,105	213·70	5·25
1942 ...	3,225,704	845,772	8,840,642	54·81	8,123	209·04	5·24
1943 ...	2,051,011	531,747	5,556,756	54·185	5,079	209·00	5·185
1944 ...	1,777,128	472,588	4,966,451	55·89	4,614	210·18	5·32
1945 ...	1,736,952	469,906	5,025,039	57·86	4,818	213·87	5·41
1946 ...	2,194,477	618,607	6,657,762	60·7	6,961	215·25	5·64

TABLE E.

Classification of Gold Output for 1946, by Goldfields and Districts.

Goldfield or District.	Unclassified, Sundry Claims, Alluvial, etc. (fine ozs.)	Under 100 ozs.		100–500 ozs.		500–1,000 ozs.		1,000–2,000 ozs.		2,000–3,000 ozs.		3,000–4,000 ozs.		4,000–5,000 ozs.		5,000–10,000 ozs.		10,000–20,000 ozs.		20,000–30,000 ozs.		30,000–40,000 ozs.		40,000–50,000 ozs.		50,000–100,000 ozs.	
		No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).
Kimberley Goldfield	233	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Ashburton Goldfield	53	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Gascoyne Goldfield	16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Pilbara Goldfield—																											
Marble Bar	385	14	623	3	917	....	....	....	....	....	....	....	....	....	....	1	7,698	....	....	....	....	....	....	....	....	....	....
Nullagine	242	11	487	....	....	....	....	....	....	1	2,139	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Peak Hill Goldfield	167	5	229	4	765	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
East Murchison Goldfield—																											
Lawlers	184	5	89	1	136	....	....	....	....	....	....	....	....	....	....	1	6,977	....	....	....	....	....	....	....	....	....	....
Wiluna	299	10	280	2	284	....	....	....	....	1	3,095	....	....	....	....	....	....	....	....	1	24,775	....	....	....	....	....	....
Black Range	165	2	29	4	837	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Murchison Goldfield—																											
Cue	425	3	65	3	723	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	19,633	....	....	....	....	....	....
Meekatharra	625	13	565	5	1,443	....	....	1	1,212	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Day Dawn	129	2	40	1	168	....	....	....	....	....	....	....	....	1	4,883	....	....	....	....	....	....	....	....	....	....	....	....
Mt. Magnet	501	16	360	4	712	....	....	....	....	....	....	....	....	....	....	....	....	1	12,819	....	....	....	....	....	....	....	....
Yalgoo Goldfield	173	13	355	1	124	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Mt. Margaret Goldfield—																											
Mt. Morgans	425	8	188	1	199	2	1,506	1	1,069	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Mt. Malcolm	239	9	278	2	713	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	27,056	....	....	....	....	....	....
Mt. Margaret	128	11	296	2	504	3	2,033	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
North Coolgardie Goldfield—																											
Menzies	346	8	177	3	693	1	612	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Ularring	254	5	153	4	701	1	507	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Niagara	147	3	187	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Yerilla	371	3	118	1	216	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Broad Arrow Goldfield	1,299	23	729	4	590	2	1,465	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
North-East Coolgardie Goldfield—																											
Kanowna	206	2	17	2	342	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Kurnalpi	46	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
East Coolgardie Goldfield—																											
East Coolgardie	445	32	831	5	1,150	2	1,365	1	1,127	....	....	....	....	....	....	1	8,810	4	60,360	2	51,636	2	74,919	....	....	2	207,335
Bulong	44	5	151	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Coolgardie Goldfield—																											
Coolgardie	583	27	626	13	2,972	1	845	....	....	....	....	....	....	....	....	1	7,584	....	....	....	....	....	....	....	....	....	....
Kunanalling	339	1	41	4	994	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Yilgarn Goldfield	460	29	803	8	1,736	....	....	3	3,097	....	....	....	....	1	4,613	....	....	....	....	....	....	....	....	....	....	....	....
Dundas Goldfield	359	10	285	6	1,609	1	514	....	....	....	....	....	....	....	....	1	5,601	....	....	....	....	1	35,959	....	....	....	....
Phillips River Goldfield	14	2	20	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
State Generally	89	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Totals	9,391	271	8,022	83	18,528	13	8,847	7	7,927	2	5,234	....	....	2	9,496	5	36,670	5	73,179	5	123,100	3	110,878	....	....	2	207,335

TABLE F.

Classification of Gold Output, 1942–1946.

Range of Output.	1946.			1945.			1944.			1943.			1942.		
	No. of Producers.	Production.	Percentage of Total.	No. of Producers.	Production.	Percentage of Total.	No. of Producers.	Production.	Percentage of Total.	No. of Producers.	Production.	Percentage of Total.	No. of Producers.	Production.	Percentage of Total.
		fine ozs.			fine ozs.			fine ozs.			fine ozs.			fine ozs.	
Over 100,000	1	119,992	19·4	...	...	...	...	...	...	...	...	...	1	127,149	15·0
50,000–100,000	1	87,343	14·1	2	159,901	34·1	2	158,870	33·0	3	202,875	38·1	2	146,795	17·4
40,000– 50,000	...	...	...	...	...	...	...	...	...	...	...	...	2	87,082	10·3
30,000– 40,000	3	110,878	18·0	2	66,080	14·0	1	39,030	8·3	...	...	...	4	134,164	15·8
20,000– 30,000	5	123,100	19·9	5	115,034	24·5	5	123,141	26·0	5	121,408	22·8	3	69,679	8·2
10,000– 20,000	5	73,179	11·9	2	30,389	6·5	4	56,193	12·0	8	115,886	21·8	7	101,217	12·0
5,000– 10,000	5	36,670	5·9	8	57,364	12·2	5	43,143	9·1	4	24,407	4·6	7	49,124	5·8
4,000– 5,000	2	9,496	1·5	...	...	...	3	13,125	2·8	2	8,329	1·6	4	19,032	2·3
3,000– 4,000	...	...	...	1	3,779	0·8	...	...	...	3	9,626	1·8	5	16,999	2·0
2,000– 3,000	2	5,234	·8	1	2,739	0·6	2	4,990	1·0	1	2,276	0·4	4	9,692	1·2
1,000– 2,000	7	7,927	1·3	4	5,331	1·1	3	4,435	0·9	4	5,250	1·0	9	12,946	1·5
500– 1,000	13	8,847	1·4	8	5,736	1·2	11	7,614	1·6	14	9,635	1·8	27	18,253	2·2
100– 500	83	18,528	3·0	57	12,771	2·7	72	15,598	3·3	87	21,345	4·0	130	29,963	3·5
Under 100	272	8,022	1·3	175	5,545	1·2	155	4,753	1·0	193	5,127	1·0	330	10,569	1·2
Sundry Claims, etc.	...	9,391	1·5	...	5,238	1·1	...	4,696	1·0	...	5,583	1·1	...	13,108	1·6
Total	399	618,607	100·0	214	469,907	100·0	263	472,588	100·0	324	531,747	100·0	535	845,772	100·0

Note.—Individual producers include private and State Battery cyanide treatment plants.

TABLE G.—MINES PRODUCING 5,000 OUNCES AND UPWARDS FOR THE PAST FIVE YEARS.

Mine.	1946.			1945.			1944.			1943.			1942.		
	Tons treated.	Ounces Gold.	Dwt. per Ton.	Tons treated.	Ounces Gold.	Dwt. per Ton.	Tons treated.	Ounces Gold.	Dwt. per Ton.	Tons treated.	Ounces Gold.	Dwt. per Ton.	Tons treated.	Ounces Gold.	Dwt. per Ton.
1. Big Bell Mines, Limited	153,588	19,633	2·55	....	....	....	....	....	....	26,354	4,220	3·20	376,550	46,117	2·45
2. Blue Spec	8,844	2,139	4·84	....	....	....	....	....	....	....	....	....	....	....	....
3. Blue Bird Gold Mines, N.L.	....	....	....	....	....	....	....	....	....	154	243	31·56	1,590	1,517	19·08
4. Boulder Perseverance, Limited	101,144	29,106	5·75	85,806	23,666	5·52	75,987	20,389	5·37	81,965	22,985	5·61	107,377	32,757	6·10
5. Burbidge Gold Mines	3,850	149	....	....	....	....	....	....	....	4,350	411	1·89	29,920	2,634	1·76
6. Central Norseman Gold Corporation, N.L.	105,640	35,959	6·95	73,488	24,669	6·71	71,521	29,675	8·30	76,864	27,089	7·05	89,085	39,994	8·98
7. Comet Gold Mines, Limited	12,075	7,698	12·75	10,515	6,370	12·12	12,968	13,125	20·02	12,905	13,265	20·56	12,977	13,324	20·54
8. Consolidated Gold Areas	....	....	....	....	....	....	....	27	....	8,127	2,276	5·60	22,195	5,762	5·19
9. Consolidated Gold Mines of Coolgardie, Limited	....	....	....	890	145	3·26	20,745	2,267	2·18	32,983	5,127	3·11	43,169	8,252	3·82
10. Cox's Find (Western Mining Corporation, Limited)	....	....	....	....	....	....	....	....	....	....	....	....	5,636	3,236	11·48
11. Edna May Amalgamated Gold Mines, Ltd.	11,464	4,613	8·05	10,861	3,779	6·96	12,409	4,271	6·88	8,681	3,332	7·68	11,797	5,684	9·64
12. Emu Gold Mines, Limited	28,929	6,976	4·82	27,541	7,017	5·09	18,816	4,539	4·82	28,567	7,049	4·93	30,827	7,792	5·06
13. Evanston Gold Mine	748	245	6·55	....	....	....	....	1,335	....	3,120	796	5·10	9,959	4,448	8·95
14. First Hit Gold Mine	1,730	1,422	16·44	4,410	2,739	12·42	5,850	4,315	14·75	4,260	3,099	14·55	5,624	3,849	13·69
15. Gladiator Gold Mine	....	....	....	....	....	....	....	....	....	....	....	....	18,733	4,876	5·21
16. Gold Mines of Kalgoorlie, Limited	151,871	36,758	4·84	109,334	25,357	4·64	98,544	22,969	4·66	87,928	21,610	4·92	132,651	30,278	4·56
17. Great Boulder Pty. Gold Mines Limited	343,506	87,343	5·09	276,778	71,560	5·17	248,313	64,878	5·22	283,201	63,302	4·47	328,277	81,057	4·94
18. Hannan's North (Broken Hill Pty. Ltd.)	36,504	13,047	7·15	....	....	....	....	....	....	695	441	12·69	38,939	14,298	7·34
19. Hill 50 Gold Mine, N.L.	44,842	12,819	5·72	31,108	8,430	5·42	32,082	9,571	5·98	36,459	10,054	5·52	38,068	11,533	5·90
20. Kalgoorlie Enterprise, Limited	51,112	16,530	6·46	40,889	11,861	5·80	37,349	9,490	5·08	54,027	16,110	5·96	62,241	19,911	6·40
21. Lake View and Star, Limited	453,317	119,992	5·29	279,579	88,340	6·32	278,171	90,990	6·54	260,720	87,196	6·69	402,071	127,149	6·32
22. Moonlight Wiluna, Limited	....	3,095	....	19,117	5,834	6·10	75,375	12,019	3·19	100,577	17,790	3·54	113,791	24,798	4·36
23. Mountain View	1,423	4,883	68·63	1,495	7,745	103·62	....	....	....	....	....	....	....	....	....
24. Norseman Gold Mines, Limited	42,099	5,601	2·66	40,580	5,626	2·74	38,980	6,837	3·52	58,215	11,734	4·03	80,428	18,731	4·66
25. North Kalgurli (1912) Limited	123,550	38,160	6·18	107,737	31,064	5·77	91,444	27,443	6·00	78,181	25,721	6·58	115,488	40,965	7·09
26. North Kalgurli (Croesus Section)	....	....	....	....	....	....	....	....	....	....	....	....	7,488	2,172	5·80
27. Ora Banda Amalgamated, N.L.	1,182	558	9·44	....	....	....	1,295	1,103	17·04	16,230	4,109	5·06	20,745	5,262	5·07
28. Paringa Mining and Exploration Ltd.	99,568	22,529	4·52	81,378	20,550	5·05	67,295	15,446	4·59	74,108	17,104	4·62	83,798	22,185	5·29
29. Phoenix Gold Mines, Limited	29,520	7,586	5·14	29,431	8,263	5·61	28,507	8,061	5·66	24,719	6,695	5·42	28,214	7,942	5·62
30. South Kalgurli Consolidated, Ltd.	75,915	18,571	4·89	63,253	18,528	5·86	56,685	15,603	5·51	63,065	19,135	6·07	75,470	22,696	6·01
31. Spargo's Reward Gold Mine, N.L.	....	....	....	....	....	....	....	....	....	....	....	....	20,533	4,820	4·69
32. State Batteries	45,477	23,671	10·41	20,078	18,113	18·04	18,262	15,595	17·08	19,074	18,591	19·49	40,396	27,309	13·52
33. The Sons of Gwalia, Limited	87,683	27,056	6·17	67,871	20,792	6·13	72,653	22,657	6·24	75,774	24,003	6·34	99,004	31,135	6·39
34. Triton Gold Mines, N.L.	....	....	....	....	....	....	....	....	....	....	....	....	33,272	10,391	6·24
35. Wiluna Gold Mines, Limited	149,172	24,775	3·32	334,638	35,016	2·09	392,246	39,028	1·99	479,069	52,377	2·19	548,226	65,738	2·40
36. Yellowdine Gold Development Ltd.	....	....	....	....	18	....	3,756	1,997	10·64	14,695	5,536	7·53	27,687	8,430	6·09
37. Youanmi Gold Mines, Limited	....	....	....	....	....	....	....	....	....	....	....	....	3,893	2,825	14·51
Total	2,164,753	570,914	5·28	1,716,777	445,482	5·19	1,759,253	443,639	5·04	2,015,067	487,314	4·84	3,067,119	759,867	4·95
Other Sources (excluding large retreatment plants)	29,724	21,863	12·44	19,715	14,066	14·27	17,875	19,766	22·12	35,944	33,739	18·77	158,585	72,786	9·19
Total (excluding large retreatment plants)	2,194,477	592,777	5·40	1,736,592	459,548	5·29	1,777,128	463,405	5·22	2,051,011	521,053	5·08	3,225,704	832,743	5·16
Golden Horseshoe Sands Retreatment	....	8,810	....	....	8,079	....	....	9,183	....	....	10,694	....	....	13,029	....
Lake View and Star Retreatment	....	12,212	....	....	....	....	....	....	....	....	....	....	....	....	....
State Batteries Tailing Treatment	....	4,808	....	....	....	....	....	....	....	....	....	....	....	....	....
GRAND TOTAL	2,194,477	618,607	5·64	1,736,592	467,627	5·38	1,777,128	472,588	5·32	2,051,011	531,747	5·19	3,225,704	845,772	5·24

TABLE H.

Development Footages reported by the Principal Mines for 1946.

Goldfield.	Mine.	Shaft Sinking.	Driving.	Cross-cutting.	Rising and Winzing.	Diamond Drilling.	Total.
		feet.	feet.	feet.	feet.	feet.	feet.
Pilbara ...	Blue Spec Gold Mines, N.L.	...	179	93	498	...	770
	Comet Gold Mines, Limited	177	597	106	327	2,463	3,670
East Murchison	Emu Gold Mines, Limited	...	466	202	255	...	923
	Wiluna Gold Mines, Limited	...	1,462	127	1,017	...	2,606
Murchison ...	Big Bell Mines, Limited	71	3,654	2,537	2,964	*30,256	39,482
	Hill 50 Gold Mines, N.L.	215	911	550	468	1,890	4,034
	Triton Gold Mines, N.L.	...	1,488	256	71	1,118	2,933
Mount Margaret	Sons of Gwalia, Limited	104	325	501	1,004	2,792	4,726
North Coolgardie	Porphyry Gold Mine	332	...	48	...	3,855	4,235
	Timoni Gold Mine	116	493	19	285	...	913
East Coolgardie	Boulder Perseverance, Limited	...	3,890	...	1,744	7,694	13,328
	Gold Mines of Kalgoorlie, Limited ...	...	3,422	1,347	1,671	9,902	16,342
	Great Boulder Proprietary Gold Mines, Ltd.	178	9,320	2,149	3,516	18,015	33,178
	Kalgoorlie Enterprise, Limited	78	1,032	78	744	2,359	4,291
	Lake View and Star, Limited	...	19,252	3,060	9,519	5,783	37,614
	North Kalgurli (1912), Limited	...	4,483	1,422	1,812	6,470	14,187
	Paringa Mining and Exploration, Limited	...	2,529	1,220	839	...	4,588
	South Kalgurli Consolidated, Limited ...	...	2,916	1,543	555	5,500	10,514
Coolgardie ...	Barbara Mine	21	...	...	122	...	143
	Phoenix Gold Mines, Ltd.	...	836	87	356	1,608	2,887
Yilgarn... ...	Edna May Amalgamated	...	117	120	106	496	839
Dundas ...	Central Norseman Gold Corporation, N.L. ...	...	5,251	775	2,167	10,115	18,308
	Norseman Gold Mines, N.L.	...	420	68	1,260	739	2,487
	Norseman Gold Mines (Iron King) ...	83	1,713	36	696	1,414	3,942
Outside Proclaimed Fields	Australian Blue Asbestos, Limited ...	...	903	...	...	...	903
	Totals	1,375	65,659	16,344	31,996	112,469	227,843

OPERATIONS OF THE PRINCIPAL MINES.

EAST COOLGARDIE GOLDFIELD.

The total ore treated on this field during 1946 was 1,445,228 tons and the gold won was 408,170 fine ounces. These figures indicate an increase of about 40 per cent. as compared with similar figures for 1945. The average grade was 5.65 dwt. per ton which is a little lower than the average grade for the previous year. The average number of men employed was 3,297 as against 2,328 for 1945. About 66 per cent. of the State's production was derived from the East Coolgardie field the proportion being practically as for the previous year.

The principal mines are:—

Lake View and Star, Ltd.

The ore treated for the year was 453,317 tons which compares favourably with 279,579 tons treated during the previous year. The average grade this year has been calculated by dividing the gold reported from ore treatment by the tonnage and gives an average return of 5.29 dwt. per ton.

In previous years the gold from retreatment has been included with the gold from ore treatment and the grade this year is apparently lower on this account.

Retreatment of tailings yielded 12,212 ounces of gold.

The tonnage treated is still increasing and at the end of the year ore was treated at the rate of 43,413 tons per month which is considerably above the year's average.

The mines under the management of this company have employed an average of 662 men. The tonnage raised per man is less than for the previous year, and this is accounted for by the work carried out in reconditioning underground workings.

The re-opening of the Ivanhoe Mine in February was a very pleasing development.

The Lake View and Associated contributed 51.7 per cent. of the total ore milled and the balance of 48.3 per cent. came from the western group of mines.

The bulk of the ore was won from shrink stopes only about 34 per cent. being obtained from filled stopes.

The average stoping width was 7.52 feet.

Payable ore has been developed at various horizons between 400 and 2,870 levels and on several different lodes.

A new change house is in course of construction at the Hannans Star Lease.

Additions have been made to the treatment plant these are designed to improve the throughput and to replace wooden structures with steel.

North Kalgurli (1912) *Limited.*

This mine treated 123,550 tons for 38,160 ounces. The ore treated in the previous year was 107,737 tons so that there has been a gratifying increase in production. The average grade of 6.18 dwt. per ton is higher than for the previous year when 5.77 dwt. per ton was recovered.

Interesting developments on this mine are satisfactory developments on the No. 13 and 14 levels of the

Kalgurli Shaft and high grade ore reported from Caunter Lode on 200 level, west branch of the Australia East Lode on 600 level, Birthday Gift Lode on the 750 level cross lode at No. 3 level.

The main shaft has been reconditioned during the year and the Union Jack Shaft has been re-opened and development in this section is proceeding at No. 4 and No. 5 levels.

Approximately 300 men are employed by this Company.

South Kalgurli Consolidated, Limited.

An increase in tonnage treated, no change in gold recovered and consequently a falling off in grade are reflected in the figures 75,915 tons treated for 18,571 ounces of gold, averaging 4.89 dwts. per ton for this year, as contrasted with the figures 63,253 tons for 18,528 ounces of gold averaging 5.86 dwt. per ton for the previous year.

The most important development of the year was at the 2050 level where the west crosscut was carried to 652 feet and intersected to Lake View and Dyke Lodes. No. 1 Cross Lode has been developed at the same level and attention is now being turned to the No. 2 Cross Lode.

Paringa Mining and Exploration Co., Ltd.

This mine treated 99,568 tons for 22,529 ounces which averages 4.52 dwt. per ton. The corresponding figures for last year are 81,378 tons for 20,550 ounces, averaging 5.05 dwt. per ton. In addition to the Paringa Lease this company is obtaining ore from the North Kalgurli Central, Paringa Extended and Block 45.

At the 400 level off No. 1 shaft in Block 45 Lease the extension of the old crosscut a distance of 13 feet exposed a vein of telluride bearing ore.

Payable ore has been developed in the Federal Shaft at 523 level and some good ore has been located in the Paringa at the 640 level and below the 800 level, with the diamond drill.

Boring on the Company's leases in the Hannans Hill area intersected lode channels.

Boulder Perseverance, Limited.

Ore treated amounted to 101,144 tons yielding 29,106 ounces of gold which is an average of 5.75 dwts. per ton.

Underground operations were built up to pre-war scale by the end of the year. Development work was curtailed because of the shortage of explosives. Hydraulic filling has been used on a small scale and the use of this method will be extended.

The steel headframe from the Great Fingal Mine at Day Dawn was purchased and is in process of re-erection at the main shaft.

Kalgoorlie Enterprise Limited.

A yield of 16,530 ounces of gold was obtained from the treatment of 51,112 tons of ore, the average grade being 6.46 dwt. per ton.

Arrangements are complete for increasing the speed and capacity of the winder on Victoria Shaft, but delivery of the 750 h.p. motor required for the conversion is not expected for 12 months.

Further progress was made in the conversion of the mine from shrinkage stoping to cut and fill method. Hydraulic fill with current plant residues was used extensively and old residues were also used.

Shaft sinking was resumed and the Victoria Shaft sunk to 2,254. A new level was started at a vertical depth of 2,175 feet. Winzes on the lode have been sunk to this depth. The main ventilating fan was transferred from 17 level to 20 level.

Gold Mines of Kalgoorlie.

This group of mines treated 151,871 tons of ore for a return of 36,758 ounces, an average return of 4.84 dwt. per ton.

Progress on the various mines is summarised below:—

Iron Duke.—Chief development was above the No. 8 (Intermediate) Level mainly in the vicinity of the Hinchcliffe Shoot and on the northern extensions of B and C Lode shears at No. 5 (Intermediate) Level. A fair tonnage of ore was developed in the Hinchcliffe area.

Australia East.—Breaking from the open cuts has been increased. In the Northern Section an open cut is in progress on the North Lode and an increased tonnage has been developed on the 1160 West Lode above the No. 7 level, New North Boulder.

Oroya Group.—A considerable tonnage of fair grade ore has been developed on the No. 11 level west of the No. 2 Cross Lode and some ore has been added at the No. 1 lens, No. 3 level.

Hillview.—Development in the northern section exposed ore on the southern extension of the Blue Gap Lode.

Idaho.—This shaft has been de-watered to the No. 2 level and exploratory driving is in progress.

Great Boulder Proprietary Gold Mines, Limited.

Ore production for the year was 343,506 tons and the yield was 87,343 ounces of gold which is an average of 5.09 dwt. per ton. Development of the lower levels has been retarded to some extent by the lack of ventilation. Progress for the year is summarised below:—

Main Shaft.—Stoping has been carried out on various lodes at all levels. A little development has been done but nothing of importance was discovered.

Edwards Shaft.—The shaft has been sunk below 2800 level. Stoping has been carried out on levels between 800 and 2600. A crosscut at 2050 level has cut Conroy's lode. This lode lives down from 300 level and values throughout have been good. It has also been cut at 2500 level.

Lanes Shaft.—Stoping has continued on the various lodes between 700 and 1000 feet.

Alluvial Quarry.—Work has continued throughout the year and a large tonnage of good grade ore has been lifted.

Hannans North—Broken Hill Proprietary, Ltd.

During the year the Hannans North Mine was reopened and produced for portion of the year 36,504 tons of ore which yielded 13,047 ounces of gold, which is an average return of 7.15 dwt. per ton. Although this represents only the production from 9 months' work it is almost up to the production for 1942, the last full year for which the mine worked.

MT. MONGER DISTRICT.

The Mount Monger district where several mines are operated on a moderate scale by syndicates or individuals has had a successful year.

The Haoma Mine which employs 10 men raised 1,281 tons from which 1,127 fine ounces of gold were obtained by amalgamation. This is the best year's production to date. Good ore was also developed and the mine has excellent prospects.

At the *Daisy Mine,* six men are employed and 1,047 tons of ore were produced for a yield of 755 ounces of gold by amalgamation. Improvements were made in the main shaft and a half ton geared safety winch was installed.

On the *Caledonian* a reef about 9in. wide is mined. The treatment of 533 tons of ore yielded 609 ounces of amalgamated gold. A west crosscut on the 250 level cut a new reef which has given good returns.

Work on the *Maranoa* was resumed during the year. Some shaft sinking was done and 85 tons of ore were treated for a return of 430 ounces.

The *Dry Mount Mine* changed hands and has been equipped with a new air compressor. Development work yielded 46½ tons of ore containing 58 ounces of gold.

On the *New Milano* work has been confined principally to the treatment of tailings.

The *Big Bull* has been idle for most of the year owing to an injury to one of the partners.

In the *Kanowna and Kurnalpi* Districts work was confined to prospecting.

The East Coolgardie Goldfield has returned to something approaching normal production. Most of the larger mines have exceeded the 1942 figures. Manpower and certain materials such as electrical equipment and steel are still difficult to secure. Supplies of timber for firewood and mining purposes have been barely sufficient.

COOLGARDIE GOLDFIELD.

The ore produced during the year amounted to 40,769 tons and yielded 13,968 ounces of gold, an average grade of 6.86 dwt. per ton. Corresponding figures for the previous year are 37,953 tons for 12,886 ounces of gold, the average grade being 6.80 dwt. per ton.

The *Phoenix* which is the principal mine in the district maintained its ore production with 29,520 tons as opposed to 29,431 tons in the previous year. The gold won was 7,586 ounces which is less than the figure of 8,263 ounces for the previous year and the grade has accordingly fallen from 5.61 dwt. to 5.14 dwt. per ton. A fair amount of payable ore was developed and 87 men were employed throughout the year.

The *Tindals* Mine was idle throughout the year.

The *Barbara* Mine was under option to Yellowdine Gold Development Ltd. in the early part of the year but the option was not exercised. An option was then secured by Western Mining Corporation. After a short development programme, the mine was purchased and plant and men were transferred to the nearby *Surprise* Mine which is also under option to Western Mining Corporation. An average of 20 men is employed here.

Hampton Gold Mining Areas is conducting a prospecting campaign on several blocks in the vcinity of the *Barbara* and *Surprise* which are both on Block 59. Results have not been outstanding.

Baker Bros. who are the owners of the Surprise lease have found a new make of ore about two miles south-east of Tindals from which they have crushed 502 tons of ore yielding 335 fine ounces.

Spargo's Reward is still idle except for the fact that it was de-watered in the latter part of the year.

The output from the Widgiemooltha district has improved.

The *Cardiff Castle Mine* was re-opened after being idle for four years and has produced 627 tons of ore yielding 175 ounces of gold by amalgamation from ore developed since the mine re-opened.

The Mount Mine has been surveyed and sampled by a company holding an option over it.

Ives Reward is being worked by a company holding an option on the property. Eighteen men are employed on erecting equipment and development work.

On the *Lister Mine* the erection of additions to the treatment plant has been hampered by lack of supplies. Ore produced was 605 tons and yielded 323 ounces over the strakes.

The *Paris Mine* was re-opened and crushed 60 tons for 27 ounces.

In the Kunanalling District 1,375 ounces was obtained from the treatment of 1,578 tons of ore from small mines and prospectors.

DUNDAS GOLDFIELD.

The ore mined in the Dundas Goldfield during the year was 151,538 tons and the gold recovered was 44,327 ounces which averages at 5.85 dwt. per ton. Corresponding figures for the previous year are 115,825 tons for 31,891 ounces which is an average of 5.50 dwt. per ton.

The principal mine in the Norseman district is the Central Norseman Gold Corporation. During the year, they milled a total of 105,640 tons for 35,959 ounces of gold, which is an average of 6.95 dwt. per ton.

An extensive development programme exposed good ore and there are encouraging developments at the deepest levels yet explored. An average of 329 men is employed.

In addition to the principal *Phoenix Mine*, the Corporation also operate the *Princess Royal Mine*, which has been extensively developed. Although high values have been encountered, results as a whole have been disappointing. The *Lady Miller* has also been equipped by the same company and it is anticipated that production will commence eary in the coming year.

Norseman Gold Mines have had a disappointing year. Ore amounting to 42,099 tons was treated for a return of 5,601 ounces which is an average of 2.66 dwt. per ton. Winzes below the lower levels have been disappointing, and the prospects of the mine are not very bright. The average number of men employed was 74. The same company operates the *Iron King Mine* for the production of pyrites.

On the *Sun Mine* a five-head battery has been erected and 550 tons of ore crushed for the return of 404 ounces by amalgamation.

The *Empress Mine* was operated by the Dundas Company and produced 477 tons of ore for 235 fine ounces. Development results were not up to expectations.

The *Bronzewing*, employing two men produced 695 tons of ore which yielded 513 ounces of gold.

The *Second Try Mine* produced 505 tons for 374 ounces.

YILGARN GOLDFIELD.

Notable increases in tonnage and grade as compared with the previous year are reflected in the figures of 24,470 tons of ore for 10,709 ounces at an average of 8.75 dwt. per ton for this year and 15,038 tons for 5,938 ounces at an average of 7.89 dwt. per ton last year.

Considerable interest has been shown in the operations of Western Mining Corporation who are investigating *Fraser's Mine* and the *Three Boys* at Southern Cross, the *Copperhead* at Bullfinch and the *Pilot* and *Corinthian* at Hope's Hill.

The *Edna May Amalgamated* at Westonia has failed to find further payable ore and the developed ore should be exhausted during the coming year.

The *Radio* at Golden Valley has produced 901 tons for 1,057 ounces which is an average of 23.47 dwts. per ton. This mine is a consistent producer of high grade ore and the efforts to cut the same ore on the *Radio Deeps* which adjoins the Radio on the east side will be followed with interest. The shaft on the Radio Mine has been reconditioned, haulage arrangements have been improved and the installation of a further five head of stamps is proposed.

Sunshine Reward, Edwards Find, in the Marvel Loch district where 14 men are employed has produced 2,805 tons of ore which yielded 1,015 ounces of gold, while a further 1,014 ounces was obtained from the treatment of 2,345 tons of sands. Development has been satisfactory.

The *Burbidge Mine* has recommenced open cut mining.

A rich patch on the *Christmas Gift* yielded 1,025 ounces from about a ton of stone.

Several other small mines are active in the Marvel Loch area.

In the Mount Jackson district, the *Clampton Mine* is developing with Government assistance. The plant has been overhauled and the mine unwatered and it is hoped that development work will start in the near future.

Evanston Gold Mine has resumed operations after being closed for two years. The mine changed hands during the period when it was closed. On an average 75 men are employed.

BROAD ARROW GOLDFIELD.

The tonnage of ore treated was 5,887 tons and the gold recovered 4,084 ounces which is an average of 13.87 dwt. per ton. The figures for the previous year are 16,530 tons for 1,587 ounces, an average grade of 19.19 dwt. per ton. Although the tonnage produced in this field is modest the relatively high grade of the ore has given a good return of gold.

Ora Banda Amalgamated, the principal producer, returned to production after being closed for over a year. Financial assistance for re-opening was provided by the Commonwealth Government.

Among the smaller mines *Grace Darling, Golden Arrow* and *Wentworth* were successful, while high grade ore was obtained on the *Cat* where 154 ounces was obtained from 16 tons of stone and the *New Mexico* where 149 ounces were obtained from 55 tons of ore.

Stirling Gold Mines exercised their option on the *Kintore Mine* at Kunanalling.

NORTH COOLGARDIE GOLDFIELD.

In this goldfield 7,552 tons were treated for a return of 5,906 ounces, the average value of 15.64 dwt. per ton being the highest reported from any goldfield this year. The figures for the previous year are 5,767 tons of ore produced for a return of 4,836 ounces being an average of 16.77 dwt. per ton.

The principal producer is the *First Hit Mine* at Menzies where tributers obtained 1,730 tons yielding 1,422 ounces, an average of 16.44 dwt. per ton.

On the *Porphyry Gold Mine* at Edjudina option holders are employing 25 men on exploration work. No ore was treated.

The *Yilgangie Queen* was idle but is expected to open in the coming year.

Cosmopolitan South produced 247 tons for 88 ounces of gold, and the *Ruby* produced 116 tons for 98 ounces of gold.

The *First Hit* at Morley's Find treated 188 tons for a recovery of 507 ounces.

Operations were resumed at Timoni where 31 men are employed. An extensive development programme was carried out and 1,025 tons were treated for a return of 444 ounces.

Prospectors were active in several districts and several smaller shows have produced some gold.

MOUNT MARGARET GOLDFIELD.

The ore produced in this goldfield amounted to 96,119 tons and the gold recovered was 34,635 ounces which is an average of 7.21 dwt. per ton. The production figures for the previous year were 70,877 tons for 26,747 ounces which is an average return of 7.55 dwt. per ton.

The principal producer is the *Sons of Gwalia Mine* in the Mount Malcolm district which treated 87,683 tons of ore averaging 6.7 dwt. per ton for a return of 27,056 ounces, showing a fair increase on last year's figures of 67,871 tons for 20,792 ounces, the average grade being 6.13 dwt. per ton. The development programme was limited owing to shortages of manpower and of explosives. Two stoppages due to industrial trouble also occurred.

Among the small mines of the district the *Puzzle* at Tarmoola produced 134 fine ounces from 265 tons, five men being employed and the *British King West* employing seven men produced 299 ounces from 213 tons.

In the Mount Margaret district, the *Boomerang* at Burtville produced 79 tons of ore for 575 ounces. The First Hit Company had an option on this mine but did not exercise it. Six men are employed.

The *Happy Find* also at Burtville treated 191 tons for a recovery of 646 ounces.

Interest in the old *Nil Desperandum Mine* has revived and attempts are being made to bring them to production.

A block of ore on the old *Lancefield Mine* yielded 389 ounces obtained from 3,264 tons of ore. It is expected that treatment of the large dump of residues will be commenced in the coming year.

There were two outstanding mines in the Mount Morgans District. They are the *Democrat* where seven men are employed and where 710 tons of ore were crushed for 1,058 ounces; and the *Local Lady* where 576 tons of ore were treated for a return of 922 ounces and developments were very satisfactory.

In the Mount Margaret Goldfield, the well established mines have improved their position and there has also been a considerable amount of prospecting and exploration of old mines.

EAST MURCHISON GOLDFIELD.

In the Lawlers District, the *Emu Gold Mine* is the main producer. This mine which employs 77 men treated 28,929 tons for a return of 6,976 ounces which is an average grade of 4.82 dwt. per ton. Comparison with the figures 27,541 tons for 7,017 ounces at an average grade of 5.09 dwt. per ton indicates a rise in the tonnage treated and a decline in the average grade of the ore. The installation of a ventilation fan improved conditions on the mine, and an electric pump was installed on the No. 9 level.

A number of small parties are working in the district. The Tallon Doon Battery at Lawlers is not in good order and crushing facilities in the district are not attractive to prospectors.

The Vanguard at Mount Sir Samuel was unwatered and a treatment plant placed on it.

Production in the Wiluna District declined owing to the cessation of mining at the *Wiluna Gold Mines*. Salvage operations now in progress will be completed at the end of January, 1947.

The chloridising process developed for the retreatment of cyanide residue is a metallurgical success. The continuance of the operation will depend largely on operating costs. Treatment of residues will require three years' operation.

In the Black Range District, prospectors were active in the Sandstone Area and some good results were obtained.

MURCHISON GOLDFIELD.

The return to production of the *Big Bell Mine* caused a considerable increase in the production figures. During this year, 210,232 tons were milled for a return of 44,304 ounces at an average grade of 4.21 dwt. per ton. Last year's figures were 37,644 tons for 21,378 tons at an average grade of 11.36 dwt.

In the Cue district, the *Big Bell Mine* resumed ore treatment in June and in approximately six months produced 153,588 tons which returned 19,633 ounces at an average grade of 2.55 dwt. per ton. Ball mill motors have been returned by the Department of Munitions and new diesel engines have been installed in the power house, bringing power generating capacity back to normal. The water supply has been overhauled and all wells put into operation. The hospital was re-opened, and additional houses are being built in the town by the Workers' Homes Board.

The principal mine of the Meekatharra District which is the *Triton Mine* at Reedy has re-opened but it is not anticipated it will reach production before March, 1947.

In the Meekatharra District considerable interest attaches to the operations of Big Bell Mines Ltd. in the area known as *Paddy's Flat*. This centre has a good record of past production and some strong geological features which make it worthy of attention.

In the Day Dawn District, the *Mountain View* continues to produce spectacular results, the figures for the year being 1,423 tons for 4,883 fine ounces at an average of 68.63 dwt. per ton. The rich specimen stone on which this mine relies for the greater part of its gold still shows in the working faces of the mine. It

has already established itself as one of the outstanding bonanzas of the State and the possible future of the deposit arouses keen interest.

PILBARA GOLDFIELD.

An increase in output was recorded from the Pilbara Goldfield, the figures for this year being 24,449 tons for 12,491 ounces, an average of 10.22 dwt. per ton as against 15,630 tons for 14,701 ounces, an average of 18.81 dwt. per ton for the previous year.

In the *Marble Bar District*, the principal producer, the *Comet Mine* was slightly ahead of last year's figures with a production of 12,075 tons for 7,698 ounces which is an average of 12.75 dwts. per ton.

In the *Nullagine District*, the *Blue Spec Mine* produced 8,844 tons of ore. The returns from concentrates sold during the year was 2,139 ounces of gold but there is other gold in concentrates awaiting shipment.

There was very little activity in the Kimberley, Ashburton, Gascoyne and Phillips River Goldfields.

In the *Yalgoo Goldfield*, 1,502 tons of prospectors' ore was treated for a return of 653 ounces at an average of 8.69 dwt. per ton.

COAL MINING.

The output of the Collie Coalfield during 1946 is compared with the 1945 output in the following table:—

Mine.	1946.		1945.	
	Tons.	Value £A.	Tons.	Value £A.
Proprietary	128,963	148,665	127,229	138,154
Co-operative	87,651	102,698	62,113	68,439
Cardiff	69,739	79,174	60,034	62,069
Stockton	100,101	117,101	90,029	97,854
Stockton Open Cut	122,960	142,477	112,781	114,219
Wallsend Open Cut	31,432	37,325		
Total, Amalgamated Collieries	540,846	627,440	452,186	480,735
Griffin	81,289	81,894	77,699	78,303
Wyvern	20,152	20,770	13,478	13,857
Total, Griffin Co.	101,441	102,664	91,177	92,160
Grand Total	642,287	730,104	543,363	572,895

The total output for the year is a record. Of the total amount of 642,287 tons the production from open cut mining was 154,392 while the coal produced from underground workings amounted to 487,895 tons. During the previous year 112,781 tons were produced by opencut mining while the tonnage from underground mining was 430,582 tons. There is thus an increase in the amount of coal won from underground workings of 57,313 tons.

A railway strike caused a loss of two weeks' production and the production for the year must be regarded as very satisfactory.

Proprietary Mine.

The number of available working places in this mine at the end of the year was 109 as compared with 110 last year. A fault was struck in the main dip in 10 Section. The area beyond the fault has been prospected and the displaced seam located 20 feet above the original floor of the seam.

The ventilation of this mine is causing some concern. Four booster fans in the mine are circulating a total quantity of air much greater than the intake.

A fire occurred in the top side of 12 level, early in the year, and the whole of the left hand side below No. 11 haulage road has been sealed off.

Larger pumps have been installed in Section 11 and in the main tunnel.

Co-operative Mine.

At the end of the year 72 working places were available as against 57 for the previous year. Main dip headings struck an upthrow fault which is at present being prospected.

The improvement in the mine since the new haulage road has been put through is reflected in the improvement in the output for the year which has increased to 87,651 as against 62,112 tons for the previous year.

Towards the end of the year the unwatering of the area known as the "siderite" section was commenced.

Stockton Mine.

In this mine 67 places were available at the end of the year as against 46 places last year. Of these 32 are in No. 1 (top) seam. Bottom coal is also being worked from old bords on the eastern side. The top seam is opening up well.

Extra water has been encountered during the year.

Cardiff Mine.

Pillar extraction by mechanical loaders has continued. A little work was done on the main dip. A motor converter was installed underground and this helps to maintain a regular supply of current to the loaders.

Griffin Mine.

The mine had 45 places available for hand miners at the end of the year as against 34 for the previous year. There are also six places where scraper loaders are in use as against four last year.

Towards the end of the year 10 Slant was restarted after being closed for a number of years. The coal in this section is worked by grunching.

The ventilation of this mine gave some trouble at the beginning of the year but this has been remedied by the installation of a second fan at the surface and by repair of stoppings underground.

Wyvern Mine.

The main dip is advanced to a point where a third belt can be installed. Output from this mine has been seriously curtailed by lack of equipment.

Stockton Open Cut.

Pillars in the bottom seam which was formerly worked by underground methods are now being extracted. The coal produced from this open cut was 122,960 tons as compared with 112,781 tons for the previous year. The only colliery to produce more coal than this opencut is the Proprietary.

Wallsend Opencut.

Production from this cut commenced in May and besides 31,432 tons of coal produced a considerable tonnage has been shipped of overburden.

Eradu Coal.

Efforts to reach the coal at Eradu have been continued throughout the year. After placing cement in bore holes round the shaft a start was made at sinking but the pump available could not cope with the flow of water. Further pumps have been obtained and this work will continue.

An attempt was also made in a new shaft by sinking inside a steel cylinder and here again the heavy flow of water proved too much for the pumps.

MINERALS OTHER THAN GOLD OR COAL.

The value of minerals other than gold and coal produced during the year was £280,986 as compared with £304,325 for the previous year. The decrease is due mainly to falling off in the production of arsenic, asbestos and phosphatic guano. Notes on the various minerals are given below.

Alunite.

During the year 34,646 tons of alunite were treated for the production of 3,256 tons of 29 per cent. K_2O potash, containing 1,749 tons of pure potassium sulphate.

Successful results were obtained from a pilot plant to remove the fine insoluble material in the product, and design and construction work to enable this to be done on a plant scale are now proceeding.

Chemical research has shown that a pure salt can be produced commercially and pilot plant equipment is now being designed to test these processes on a small scale.

The tractor and Tournapull formerly used for one extraction have been replaced with a 5/8 cubic yard drag line which gives better service under average weather conditions.

A sixth gas producer is being installed to increase the throughput of the rotary kiln. No difficulty has been experienced in securing sufficient supplies of firewood.

The centrifuge (used for partly dewatering the potash product) has now been replaced with a vacuum filtration and drying unit. The pulp of potash and plant liquor is filtered on a 6-foot American disc filter, and the filter cake discharges into a wood fired rotary drier. The dried product contains less than 1 per cent. moisture.

During this year production exceeded the State's requirement and 1,466 tons was exported.

Antimony.

The Blue Spec Mine has shipped 462 tons of concentrate of which the antimony content is estimated at a value of £23,458. The tonnage of ore treated was 8,844 tons. Revenue is also obtained from a pyritic concentrate carrying considerable gold and from strake gold recovered on the mine.

Arsenic.

Wiluna Gold Mines produced 1,624 tons of white arsenic valued at £33,395. This is less than the figure for last year. With the closing down of the roaster early in the new year, production of arsenic will cease.

Asbestos.

Anthophyllite asbestos was produced at Bindi-Bindi and from Bulong. The total production of 8.5 tons is valued at £121. Mining at Bindi-Bindi was suspended for the greater part of the year but development of the deposit is now proceeding vigorously. The production from Bulong was a trial parcel and milling results were disappointing.

Chrysotile. There was no production of chrysotile asbestos but arrangements are in hand for the resumption of operations at Nunyerri.

Crocidolite. Production for the year declined to 366 tons as compared with 991 tons during the previous year. This was on account of the cessation of operations on the West Australian Blue Asbestos property at Yampire Gorge and of mechanical trouble at the Australian Blue Asbestos Mine at Wittenoom Gorge. Development of the latter property is proceeding and latest reports are encouraging.

Barytes.

A trial parcel of ten tons has been broken from a promising deposit near Coonana on the Trans Australian Railway.

Bentonite.

Production from deposits at Marchagee was 62 tons valued at £186 as compared with 50 tons valued at £120 in the previous year.

Beryl.

Deposits in the vicinity of Port Hedland yielded 15¼ tons of high grade beryl valued at £580.

Clays.

The reported production of clays was 2,682 tons as compared with 2,363 tons for the previous year.

Copper.

One ton of metallic copper was produced during experimental treatment of copper gold ores at Ravensthorpe.

Dolomite.

Local markets absorbed the whole production of dolomite amounting to 98 tons from the Mount Magnet area.

Felspar.

Australian Glass Manufacturer's Co. Pty. Ltd. obtained 1,793 tons from their quarry at Londonderry. Production for the previous year was 1,234 tons.

Glass Sand.

The production of glass sand from East Wanneroo and Lake Gnangarra was 180 tons. During the previous year the production was 175 tons.

Glauconite.

The production of greensand was 1,832.5 tons and this yielded 366.50 tons of glauconite.

The treatment consists of drying greensand in the rotary kiln and screening on a double deck straking screen. Undersize, passing 50 mesh screen, is discarded as the particle size of the contained glauconite is too small for filter work. Oversize is passed through rolls to break up lumps and returned to the screen.

Glauconite is then separated magnetically from the gangue and is treated by washing and chemical processes to produce the activated zeolite.

Gypsum.

The production for this year of 15,350 tons is more than double the previous year's total of 7,232 tons. The whole production is processed by local manufacturers.

Kyanite.

Production from the vicinity of Yanmah amounted to 140 tons.

Lead.

The high price offering for lead has stimulated lead mining. The production amounted to 36 tons of concentrates and a much greater production is anticipated for the coming year.

Magnesite.

A parcel of 10 tons was produced from Bulong.

Pyrites.

The production of pyrites which is used as a source of sulphur for the manufacture of sulphuric acid by the superphosphate industry has increased from 66,504 tons during last year to 77,784 tons in the present year. The whole of this is obtained from the Iron King Mine at Norseman.

Red Ochre.

Production this year amounted to 860 tons as compared with 650 tons in the previous year. Producing centres are Opthalmia Range and Wilga Mia in the Weld Ranges.

Scheelite.

The production for the year amounted to 10,468 lbs. of concentrate containing 6,395 lbs. of tungstic oxide valued at £1,552. Treatment of Edna May Amalgamated tailings yielded 9,558 lbs. and 910 lbs. was produced at Coolgardie.

Silver.

Silver produced as a by-product in gold mines amounted to 171,452 ounces, valued at £42,792 as compared with 146,025 ounces valued at £22,757 for the previous year.

Talc.

The production of 389 tons of talc which is processed at Bassendean, from Mount Monger gave this industry a fair start. Treated talc is shipped abroad for use in the rubber trade.

Tantalite.

Tantalite Limited has produced .362 tons of tantalic concentrate valued at £281 at Wodgina.

Tin.

Production of tin concentrates improved from 21.76 tons valued at £4,370 during the previous year to 28.52

tons valued at £5,838. Greenbushes and the Pilbara Goldfield were responsible for equal parts.

Vermiculite.

Perth Modelling Works produced 201 tons from the deposit at Young River and 2½ tons were produced at Bulong.

CONCLUDING REMARKS.

Following a period of comparative stagnation for the first few months after the end of the war, the mining industry generally has shown marked improvement. The tonnage treated and the gold yield during 1946 are the best since 1942 and showed an improvement on the previous year of approximately 450,000 tons and 150,000 fine ounces respectively, while the average number of men employed on gold mining rose from 4,818 to 6,961 in the same period.

The value of gold per fine ounce reached another all time high record at 215.25s.

The re-opening of mines such as Big Bell, Hannans North, and Ora Banda Amalgamated has given a new impetus to the industry, while most of the large mines which continued restricted operations during the war years have substantially increased their output, and speeded up their development programmes.

Considering the lean period recently passed through, the ore reserve position generally is remarkably healthy.

Several promising prospects have been found during the year and their employment is watched with interest.

Particular attention is being paid to ventilation on mines, as is evidenced by the appointment of two Assistant Ventilation Inspectors during the year. It is somewhat disappointing, however, that it has been found extremely difficult to obtain the necessary instruments to equip these officers satisfactorily.

At the end of the year a copy of the report on Aluminium Therapy for Silicosis Prevention by Dr. W. E. George, following a visit to Canada and the United States of America, was awaited with great interest. It is proposed to follow up this matter energetically.

A revised and consolidated Mines Regulation Act was completed during the year and passed through Parliament. Revision of the regulations to conform with the new Act is in hand. Similar action has been taken with the Coal Mines Regulation Act and Regulations.

Progressive advances in the rehabilitation of the gold mining industry are anticipated during the current and subsequent years.

Coal production for the year showed a marked improvement on recent years and a record output of 642,287 tons was reached. The previous highest year's total was 604,792 tons in 1938. A second open-cut commenced operations during the year and produced 37,325 tons in approximately six months.

It is expected that this increased output will be maintained. Shortage of labour due largely to the somewhat unsatisfactory position with regard to housing shortage at Collie, is probably responsible for keeping production down from an even more satisfactory figure. Hopes are entertained that in the near future a considerable market for coal will develop in Kalgoorlie, which will require a still greater regular output.

The value of minerals produced other than gold and coal showed a slight decline, but it is anticipated that increased production of such minerals as asbestos, kyanite and lead will overtake this lag.

I wish again to record my appreciation of the loyal and valuable support received from the Assistant State Mining Engineer, who, incidentally, is the compiler of the bulk of this report, and from all Inspectors of Mines, who largely furnished the subject matter herein.

I also acknowledge the assistance and friendly co-operation which I have received during the year from all members of the departmental staff.

JOHN S. FOXALL,
State Mining Engineer.

APPENDIX. No. 1.

Coal Mines Regulation Act, 1902-1926.

ANNUAL REPORT OF THE BOARD OF EXAMINERS FOR MINE MANAGERS, UNDER-MANAGERS AND OVERMEN.

Office of the State Mining Engineer,
Mines Department,
Perth, 28th April, 1947.

The Under Secretary for Mines:

Sir,

We submit herewith, for the information of the Hon. Minister for Mines, the Annual Report of the Board of Examiners for the year 1946.

Examinations for both First and Second Class Certificates were advertised to be held in April and October, but no candidates were forthcoming.

Meetings.

As there was no business to be transacted, it was considered unnecessary to call any meeting of the Board during the year.

No examination being held, there were no papers available for exchange with kindred Boards.

We have the honour, etc.

JOHN S. FOXALL,
State Mining Engineer,
Chairman.

H. S. ELLIS,
Government Geologist,
Member.

JAMES GILLESPIE,
Inspector of Mines, Collie,
Member.

APPENDIX No. 2.

REPORT OF ACTIVITIES OF BOARD OF EXAMINERS FOR UNDERGROUND SUPERVISORS FOR THE YEAR 1946.

Mines Department,
Kalgoorlie, 25th February, 1947.

The Chairman,
Board of Examiners for Underground Supervisors,
Perth.

I beg to submit the report of the activities of the Board of Examiners for Underground Supervisors during the year ended 31st December, 1946.

A total number of forty candidates sat for examination; twenty-six at Kalgoorlie; nine at Norseman and one each at Leonora, Menzies, Wiluna, Southern Cross and Mount Magnet.

Examinations were held in May and October. The oral examinations in May were conducted by Mr. J. S. Foxall, Mr. W. H. Fletcher, and Mr. Verran in Kalgoorlie, Norseman and Leonora and in Wiluna by Mr. C. Adams. The oral examinations in October were conducted by Mr. Foxall, Mr. Fletcher and Mr. Verran in Kalgoorlie, Norseman and Menzies, by Mr. J. Boyland at Mount Magnet and by Mr. M. Ryan at Edward's Find.

Of the forty candidates who sat for examination, thirty were successful in gaining certificates. One was restricted to the asbestos mines, Wittenoom Gorge.

One certificate of Competency was issued without examination.

One duplicate Certificate of Competency was issued during the year.

No Certificates of Service or duplicate Certificates of Service were issued.

Following are the names of persons to whom certificates were granted:—

Underground Supervisors' Certificates of Competency, 1946.

601 Anderson, J. S.
629 Bail, R. M.
607 Birmingham, C. F.
604 Baldwin, W. J.
613 Boundy, C. A. P.
619 Cartledge, G. M.
624 Christopher, F.
620 Collins, T. C.
606 Davis, R. W.
612 Edwards, F. W. E.
617 Edwards, J. T.
609 Hancock, L. C.
626 Harris, A. J.
623 Hart, G. D.
605 Hayward, E.
603 Ismay, C. H.
615 Keitel, W.
599 Kelly, F. R.
608 McGillivray, A.
621 McMahon, W. T.
628 Orton, R.
627 Peek, K.
618 Purdue, E. C.
616 Read, W.
625 Salmond, R.
622 Smith, P. P.
610 Tait, T.
614 Thomas, R. G.
611 Turner, K. R.
630 Webb, J.
602 Woodham, P. B.

Duplicate Certificates of Competency.

597 Hume, A.
596 Goss, J. E.
598 Naumoff, G.

(Sgd.) R. N. MORRIS,
Secretary to Board of Examiners,
For Underground Supervisors.

APPENDIX No. 3.

DUST SAMPLING AND DETERMINATION IN THE MINES OF WESTERN AUSTRALIA.

As this phase of goldmining has already been reported upon fully by the Hon. James Cornell, M.L.C., and the late Mr. W. Phoenix, Senior Inspector of Mines, Kalgoorlie, as applied to South Africa, the purpose of these notes is to set out the practice adopted here in Western Australia, in the light of knowledge gained and handed down by those gentlemen.

Although we are not able to carry out the same systematic dust inspection as in South Africa, nevertheless great strides have been made towards the control and elimination of dust which are due to the fact that both management and men have grown to be more dust conscious, a fact which is borne out by repeated application of the men to view the sample, taken in their particular place, under the microscope.

The elimination and control of dust is naturally the function of ventilation allied with the use of water, but the purpose of these notes is not to show the methods of control but to give a brief description of the method adopted in taking a dust sample and estimating the number of particles.

All sampling is done by means of the konimeter, which consists of a spring actuated pump which draws air through a jet so that it impinges at a high velocity on to a glass slide coated with adhesive, and for the purpose of examining the slide at the place in which the test is made, is provided with a direct vision lens with a magnification of 75 diameters.

By means of this lens the operator is able to show the man in what conditions he is working, and thereby prompts him to become a little more cautious in the matter of his health.

The only parts which require attention from time to time are the jet and pump.

Dust laden air being continually passed through the jet causes same to become partially blocked, and so does not allow the standard velocity of air to impinge on the slide, therefore it is necessary for the jet to be examined and cleaned frequently.

As the size of the jet is so small and the material of brass, it can be readily understood that if a piece of wire or other hard substance be used for cleaning purposes, wear would soon take place and again impair the standard of velocity, calculated at between 30 and 80 metres per second. In order to avoid the above possibilities, cleaning of the jet is done by passing through a single thread of damp wool or cotton, followed by a thread of dry.

In the pump, the plunger has a tendency to become dry and hard, this is overcome by smearing with a thin film of light oil.

The konimeter measures approximately 5in. x 1¾in. x 1⅛in. and is carried in a box together with 12 slide holders, each holder carrying two slides, which are held in position by a rubber band. For purpose of slide identification, each holder is numbered and marked alphabetically from 0 to 23 and A to L, the letters being also marked against the recess for each holder.

Preparation of Slides.

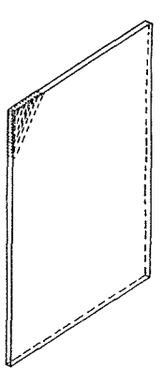
The glass slides are first examined under the microscope and only those which are clear and have a scratch free surface are selected.

The dimensions of the slide are 3in. x 1in. and that of the metal holder 1½in. x 1 in., so that by careful cutting each half will fit either side of the holder. Quite often a slide may be found to have a fault at one end only. This is duly cut and reduced to the size of the holder.

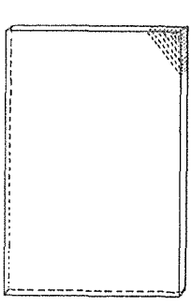
The top left hand corner of each slide is then placed lightly on a carborundum wheel in order to roughen the surface at that point. This is done for two reasons:—

(a) By means of the finger nail the operator is enabled to feel for the side which is to be treated with the adhesive.

(b) Underground the operator can see that the slide is in its correct position—the treated side resting on the rubber washer and facing the impinging jet—as the roughened portion of the slide is now reversed to the top right hand corner.



Face of adhesive treated Side



Position of Slide in Konimeter

Washing of Slides.

The slides are removed from the holders and placed ready for immersion in warm water to which has been added a little soap or grease-removing powder.

The face of each holder is then lightly wiped over with a damp cloth in order to remove any dirt with which the holder may have become contaminated from the previous dust sampling, and placed on one side to dry.

Each slide is placed in the warm water, treated side uppermost, for a few seconds, following which the slide is re-immersed in the reverse position.

The slide, having now been thoroughly coated with soap or powder, is gently rubbed between the thumb and fingers, until all signs of previous jelly application have been removed. It is then placed in a second bowl of clear warm water and again rubbed between the thumb and fingers, until all trace of soap or powder have been removed. This operation is repeated in a third bowl of clear warm water and finally the slide is held in a stream of cold water.

The last stage is important, as otherwise the slide does not dry clearly and prevents the operator from observing whether he has the correct adhesive tarnish, and later when examining the slide under the microscope gives a cloudy field.

The hands are now thoroughly washed, the small finger of the right hand calling for special attention, as it is by this means the jelly is worked on to the face of the slide, and in no circumstance should this finger contact other than the face of the slide until treatment of the slides is completed.

Having completed the washing process, the slide is now placed in the folds of a clean glass cloth, held in the thumb and forefinger of each hand, and whilst being rotated gentle pressure is brought to bear on both surfaces. The slide is then placed face—or side to be treated—downwards on a cloth and the process repeated with each slide.

The slides are now ready for the application of the adhesive, but before doing so, each slide is finally polished by means of a piece of fine silk.

Application of Adhesive.

The adhesive used is Martindales Microscopic Jelly, to which is added a few drops of glycerine and distilled water. Care however should be taken in adding the glycerine, as by adding too much the jelly becomes very sticky and difficulty will be experienced in obtaining a uniform thickness of film over the slide. By means of a pointed glass rod a small quantity of the adhesive is placed on the slide—this should amount to no more than the size of a small pin head—and the resultant spot worked on to the surface by a rotary motion of the small finger. Should an amount of adhesive in excess of that mentioned be used, no end of trouble will be experienced in ridding the surface of excess film, and invariably it will be found necessary to re-wash the slide.

Further, should the film be too thick, the result when examining the slide under the microscope will be a series of ridges left by the skin of the finger, and each ridge containing innumerable small air bubbles which may quite easily be included in the dust count.

In applying the adhesive, it has been my experience that far better results are obtained when the process is carried out under an electric light, the slide being held in the left hand, is moved over to an angle which permits same to act as a mirror. The finger tip is then rotated about the area from which the light is being reflected and is approximately half-inch diameter. By adopting this method, it will be found that the requisite amount of adhesive will have been applied when the surface of the slide emits a blueish coloured tarnish and as the amount used is merely a tarnish, it will be readily understood the adhesive quickly dries, and slides should not be used forty-eight hours after preparation.

Finally the slide is placed in the holder, and the rubber bands adjusted in the slots provided. As a rule two rubber bands are used, one being quite sufficient, but where only one is used there is a possibility this may break, and slide fall from the holder and the record lost.

On the other hand, if more than two bands are used, the pressure which has to be exerted in overcoming the elasticity of the rubber, and in order to raise the slide over the lip of the holder, will be found to be such that the slide which is already very brittle through continuous immersion in warm water is readily broken.

Dust Sampling.

The box containing the konimeter and slides is carried by means of a strap over the shoulder, and on arrival at the point at which the sample is to be taken the strap is placed over the head and the box suspended from the neck, the lid opening outwards and away from the body.

Placing the konimeter in the hollow of the left hand, the clamping screw is released by means of the thumb and index finger of the right hand, slight pressure of the fingers of the left hand depresses the clamping lever and with the thumb and index finger of the right hand the circular brass focussing ring is opened, thus exposing the slide platform before the impinging jet. The thumb and fingers of the left hand are now extended and the slide holder placed between them, thus enabling the operator, by means of the thumb and fingers of the right hand, to slip the slide from the holder and place against the hard rubber washer the treated slide facing the impinging jet. The focussing ring is now closed, the clamping lever depressed with the fingers of the left hand, the thumb and fingers of the right hand finally screwing down the clamping screw.

In the case of making a test in the vicinity of a machine, the machine is stopped whilst the konimeter is being charged, and the lid of the konimeter box is closed, the reason being to keep the slides as clean as possible. The machine working and the hole at least 6 in. deep, the konimeter is held near the mouth of the machine man and three samples are taken.

By means of the direct vision lens an examination is made of the last sample taken, and the miner invited to view the result. This has the effect of dispelling the old theory among the men that if you could not see the dust, the place was quite alright, and proves to them that dust which is so minute and cannot be seen with the naked eye is the most harmful.

Quite often a place is found where the venturi has not been extended to the machine, and in such a case samples are taken before and after the venturi has been extended, on each occasion the machine man having an opportunity to examine the slide. As the capacity of the pump in the konimeter is 5 c.cms. a double stroke of the pump is necessary for each sample in order to obtain the amount of dust contained in 10 c.cms. the reason for which is explained when describing the method of dust counting.

Whenever possible, samples are taken with the machine working, but never whilst collaring a hole or after the operation of blowing out holes when a heavy concentration of dust is always recorded and would not be an indication of average working conditions.

When taking samples in stopes, care should be taken to see that the sample is taken at a time when the ventilation is not contaminated by smoke from sand blasts, as this invariably gives a heavy dust count which may easily be accredited to the machine under test and it would not be necessary to see the smoke as it has been noted that where a faint smell has been detected the result is a high count.

During the winter months it is advisable to place the box containing the instrument and slides, with the lid open, near a stove or other heating apparatus in order that the slides may be brought up to a temperature fairly in keeping with that underground, otherwise condensation takes place on the slide and prevents the operator from observing the result of the test by means of the direct vision lens.

Method of Dust Counting.

The microscope having been set up and all necessary adjustments made, the slide is removed from the holder face or treated side downwards, and in order to remove all dust or other matter from the upper side of the slide it is breathed upon and cleaned with a silk cloth, otherwise these particles interfere with the focus.

The slide is now placed in position, and the spot brought into focus by racking the condenser up or down, which is followed by insertion of the "central stop" in order to obtain the necessary "dark" ground illumination.

In the Zeiss microscope the eyepiece micrometer or ruled diaphragm has an intersecting angle of 18 degrees and this intersection is centred over the spot to be counted.

It is within this sector that all particles are counted, and since the sector between v's is 18 degrees both v's cover 36 degrees or one-tenth of the whole spot. By counting the particles in both v's we therefore count the dust in 1 cc. and as the capacity of the pump in the konimeter is 5 c.cms. a double stroke of the pump is made with each sample in order to obtain 10 cc.

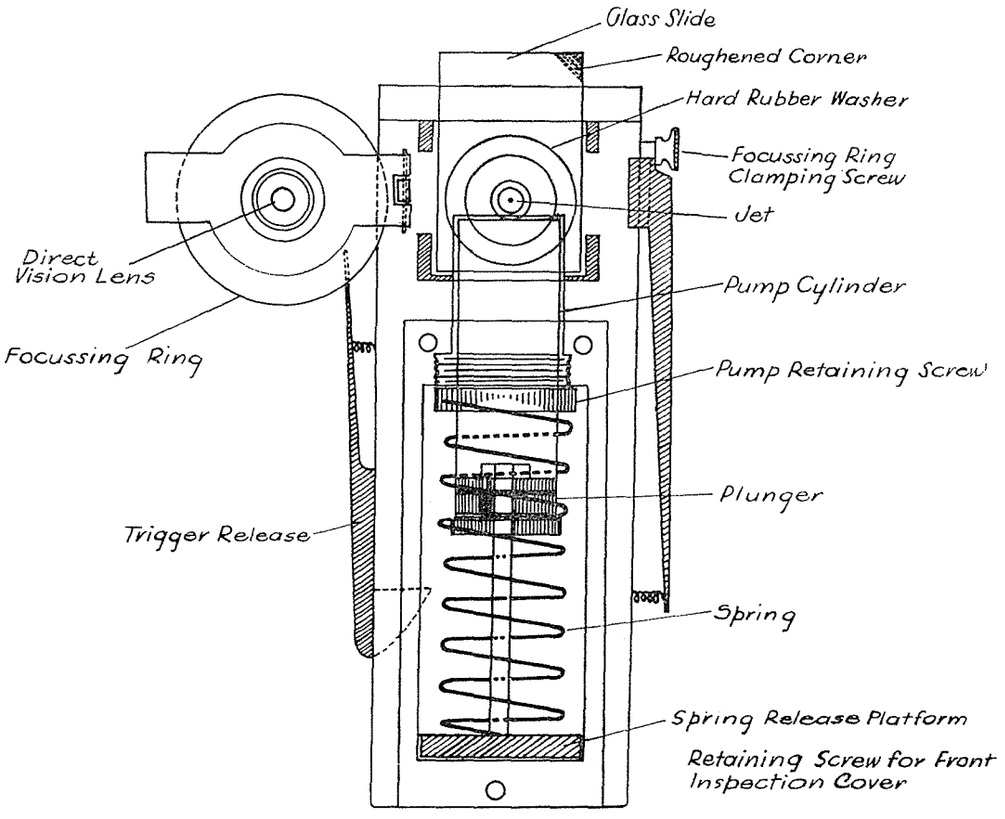
MINES DEPARTMENT OF W.A.

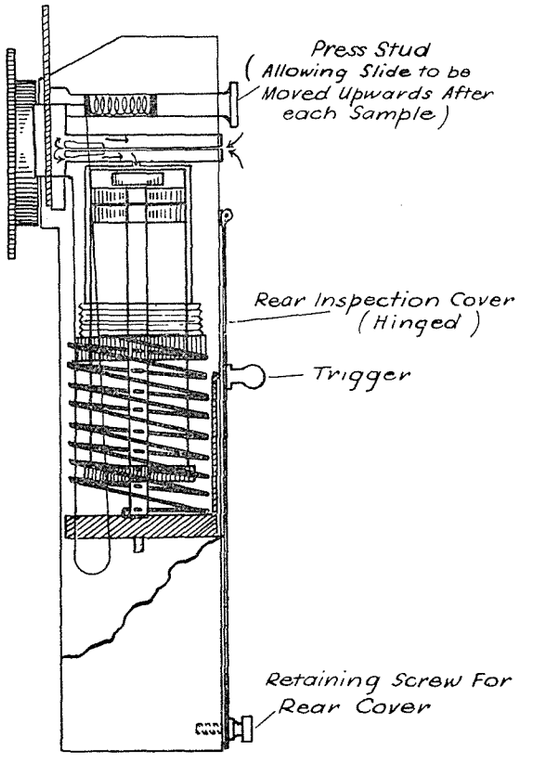
DUST SAMPLING

Sketch of Kotze Konimeter

NOT TO SCALE

J.E.L 30·3·42





The eyepiece micrometer is also marked with two parallel lines on either side of the intersection which serve the purpose of measuring particles below 5 microns, but as all particles within the sector are counted irrespective of size no measuring is done.

After the spot has been brought into focus and before the "central stop" is inserted the slide is examined for signs of oil, which on examination in the konimeter whilst underground, gives the appearance of fogging, but under examination in the microscope show up as a mass or irregular shaped globules.

Where fogging has taken place, the spot loses the usual circular shape and becomes more like that of a wheel where the spokes project beyond the outer periphery and the particles are most difficult to count.

Central stop for dark ground illumination.

Two apochromatic objectives 16mm. and 8mm. respectively.

Low power eye piece 5x.

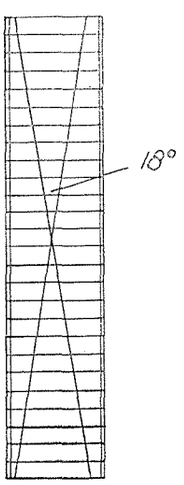
Eye piece micrometer 18 degrees.

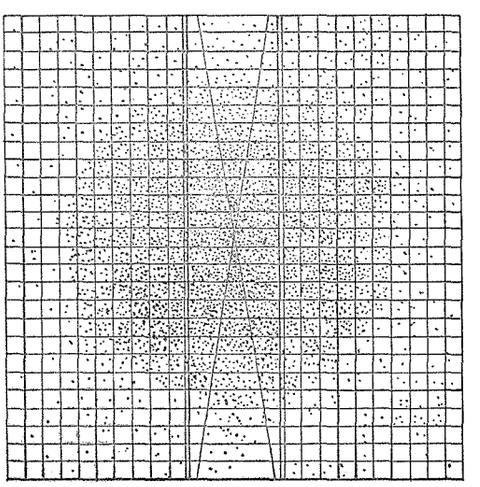
The above combination gives a magnification of 150 diameters.

Lighting.

75 watt, gas filled, fully frosted lamp, placed approximately six inches from the mirror and four inches above the table.

Double sided mirror, plane and concave, the latter side being used.





Typical Machine Dust Sample of 300 p.p.c.c.

Eyepiece Micrometer
ACTUAL SIZE

When counting a sample of heavy concentration, to obtain a figure in the vicinity of 400 within the sector, entails severe eye strain, and therefore the sample would be placed in the category of 1000x. It is our practice to count the top sector and double the figure obtained, but where the sample is light, particles are counted in both sectors.

As previously mentioned, three samples are taken in all places under test, each spot is counted and the average number of particles of the three samples is recorded. Where the test has been carried out in a mine using carbon lamps, the microscopic examination of the slide invariably shows deposits of carbon and in the case of tests in wet places—especially in warm weather when the slide has had time to dry off any moisture—deposits of salt crystals, these extraneous particles are quickly identified and are ignored in the count.

In examining a slide of very light concentration, it frequently happens that the spot cannot be discerned by means of the micrometer eyepiece in which case the eyepiece is removed and the low power eyepiece substituted. The microscope is then racked until the particles are brought into focus and the slide is then moved up, down or across by means of the mechanical stage until the spot is found. The low power eyepiece is then removed and the micrometer eyepiece re-inserted, followed by racking down until the spot is brought into focus.

The Microscope—By Carl Zeiss and comprises the following:—

Stand with mechanical stage.

Condenser.

Conclusion.

As stated in the opening remarks, these notes have been compiled with a view to describing our method of dust sampling, namely by means of the Konimeter, and although we are in possession of the apparatus for taking samples by means of the sugar tube or gravimetric method, such apparatus has been rarely used.

In my opinion I am convinced that konimetry sampling is the best method as yet known, and whilst admitting, it is purely one of estimation, it does serve the purpose of bringing home to the men concerned—and after all it is their health which is being safeguarded—the conditions of the atmosphere in which they are working, and I think it will be generally agreed that miners as a whole, are rather sceptical of anything savouring of the theoretical but having been enabled to see for themselves, readily respond to any suggestions or practice for eradicating or minimising the dust nuisance.

In this connection I should like to state that when the times permit, the department will be able to provide the necessary apparatus for carrying out work in photo-micrometry and thus carry on the work of propaganda a stage further. Whilst acknowledging the assistance of management and staff, with a few exceptions—the reservation being applicable to those who are concerned more about output than the health of the men—it is the miner himself on whom one has to rely for carrying out the methods adopted for suppression and laying of dust.

(Sgd.) J. E. LLOYD,
Ventilation Inspector of Mines.

Index to State Mining Engineer's Annual Report, 1946.

DIVISION III.

Report of the Superintendent of State Batteries.

The Under Secretary for Mines:

I have the honour to report for the information of the Honourable Minister on the operations at State Batteries for the year ending 31st December, 1946.

The tonnage crushed jumped from 20,078.25 tons in 1945, to 45,476.5 tons, an increase of 126%, and generally we had sufficient labour to crush all available ore within reasonable time, though only one battery ran full time, namely, Meekatharra.

The value of the ore crushed declined from 23 dwt. 22.6 gr. per ton in 1945 to 14 dwt. 20.4 gr., mainly due to the rich Cue crushings results being diluted by the much larger tonnage crushed at other mills.

This average is above pre-war figures, and resulted in an estimated recovery of £A281,345 compared with £202,324 in the previous year.

Cue again headed the list with the high average of 33 dwt. 13 gr. per ton for 3,964.50 tons, followed by Sandstone and Meekatharra, with identical figures of 20 dwt. 21 grs. pe rton, and Marble Bar—20 dwt. 3 gr.

Difficulty was still experienced in obtaining material and labour for reconstruction and working of our tailing plants.

Notwithstanding the high average yield per ton, only 24,759 tons of tailing exceeded 2 dwt. 8 gr. in value, or just over 50% of the tonnage crushed. Only 22,390 tons of tailing were treated but at the time of writing the position has improved, and unless unforeseen difficulties crop up, the tonnage treated this year should be up to production.

A comparison of the tonnage crushed and cyanided for the last three years is as follows:—

	1944	1945	1946
Tons milled ..	18,261	20,078	45,476
Tons cyanided	17,267	12,216	22,390
	35,528	32,294	67,866

Detailed figures for production since inception are as follows:—

	£
Production at par:	
By amalgamation	7,570,439.470
By tailing	1,852,045.526
	9,422,484.996
Gold premium:	
By amalgamation	2,560,585.591
By tailing	780,698.480
	12,763,769.067
Tons of tin ore milled:	
Production.	
By black tin	93,883.160
By residues	572.000
	12,858,224.227

Value of Production.

Seven hundred and thirty-one parcels were treated, an average of 62.21 tons per parcel for 27,930.1 oz. of bullion recovered by amalgamation, estimated to contain 23,671.25 oz. of fine gold worth £234,079.

Tailing plants produced 4,807.56 fine oz. worth £47,801, bringing the total value of bullion recovered to £281,880.

Value of Ore Per Ton Treated.

45,476.5 tons crushed yielded 23,671.25 fine oz. or 10 dwt. 9.8 gr. per ton. The average value of tailing produced was 4 dwt. 10.6 gr., bringing the average value of the ore treated to 14 dwt. 20.4 gr. per ton.

The average head value in 1945 was 23 dwt. 22.6 gr. per ton and in 1944, 18 dwt 10.1 gr.

Estimated Percentage Recovery.

The whole of the tailing was not treated and approximately 4.7% was untreatable, but applying the average extraction of 76.99% obtained at all batteries to the average value of tailing, the estimated percentage of recovery at our plants was as follows:—

Head value—14 dwt. 20.4 gr.

Recovery by amalgamation 10 dwt. 9.8 gr. =	70.08%
Recovery by tailing treatment 3 dwt. 10.08 gr. =	23.03%
Total extraction	93.11%

Receipts and Expenditure.

Receipts from all sources were £39,154 5s. 8d. as against £20,425 13s. 8d. in 1945. Expenditure amounted to £61,519 2s. 2d. as against £38,138 19s. 5d. the previous year

A comparative synopsis shown later in this report gives details of receipts and expenditure under the respective headings

There is a fairly steep fall in milling expenditure per ton, but revenue declined from 10s. 1.7d. to 9s. 4.5d. Tailing expenditure per ton fell from 19s. 2.7d. to 15s. 8.2d., but revenue dropped 1s. 1d.

Milling.

Excluding Mt. Sir Samuel, Linden and Darlot plants which are leased, one 20-stamp, seven 10-stamp and eight 5-stamp mills crushed ore for the public, and Mt. Ida was put in order after being idle for some years, at very considerable cost, and crushed its first parcels early this year.

Warriedar and Wiluna were both re-started again but Yalgoo remained closed, and certain of the plant was transferred elsewhere, but the main features of the plant are still intact and it could be re-started at short notice if necessary.

Seven hundred and thirty-one parcels were treated, averaging 62.21 tons and aggregating 45,476.5 tons as against 336 parcels averaging 59.76 tons in 1945. Practically all plants showed increases and Warriedar and Wiluna had their first crushing for some years. The main producers, with the previous year's tonnage in italics, were as follows:—

Kalgoorlie, 8,230½ tons (1,140.5); Coolgardie, 6423.25 (5,220.25); Laverton, 4,990.75 (554.75); Ora Banda, 4,179.25 (1,423.25); Cue, 3,964.5 (2,750); Peak Hill, 2,209.5 (203).

Cost Per Ton.

The gross cost was 19s. 4.5d. per ton, a decrease of 6s. 11d. per ton on the previous year's figure.

Very heavy expenditure was incurred in getting these long idle plants into operation, and unfortunately in some cases for quite small tonnages. The constant shifting of staff and employees from one plant to another, and even making provision to feed the men requires considerable organisation and is expensive.

Repairs and renewals cost 3s. 5d. per ton and stores which include certain items which might be included in renewals and repairs were much higher per ton than in normal years.

Laverton and Ora Banda, two of our newest plants, ran about half time for costs of 13s. 0.2d. and 13s. 10.7d. respectively.

Revenue Per Ton

The revenue per ton was 9s. 6.7d., a drop from 10s. 1.7d. in 1945, due to most of the tonnage being crushed at our larger and most efficient plants, and the previous year's revenue being inflated by the inclusion of some sales of material.

The revenue per ton at Warriedar for a small round was only 7s. 0.2d. and at Ora Banda, where we pay 7s. per thousand gallons for water, only 8s. 0.4d. Kalgoorlie and Laverton were other plants with revenue below 9s per ton, viz., 8s. 5.2d. and 8s. 9.6d respectively.

Tailing Treatment.

Only nine plants treated tailing, and handled 22,390 tons for a clean-up of 4,80756 oz., valued at £47,801 (A) after the deduction of Federal gold tax.

The low tonnage handled was due to the want of labour and short supply of material for rehabilitation. Kalgoorlie, Boogardie, Yarri, and Peak Hill treated no tailing, but all will be operating on fair tonnages this year, and at the moment Kalgoorlie is treating 60 tons per day.

The highest extraction was obtained at Cue, which is the last stronghold of the quartz mines, and producing mostly highly silicious tailing, which leaches readily.

With a head value of 3.62 dwt. and a tail value of 0.62 dwt., an extraction of 82.45% was obtained. Coolgardie treated the highest tonnage, viz., 4,293 tons for an extraction of 77.7% from a head value of 5.11 dwt. with an average residue value of 1.14 dwt.

The difference between these two extractions, approximately 5%, is due to the physical natures of the ores crushed.

The lode material, which comprises most of the ore on the Eastern Goldfields and some Murchison batteries, produces a tailing with a large proportion of colloidal slime and is difficult to leach.

The lowest extraction was obtained in the Norseman plant, which treated 3,780 tons, worth 2.63 dwts. The residue value was 0.73 dwts. and the extraction 70.98 per cent.

The three centres produce tailing which can be taken as a cross section of that being produced today, and the residue values of 0.62 dwts. at Cue and 0.73 at Norseman could not be improved upon by fine grinding if the cost of so doing is taken into consideration.

The Coolgardie residue of 1.14 dwts. could be lowered by fine grinding and double filter pressing but the material is not amenable to settling and treatment by filter pressing, and experience has proved that it is more economical to treat it by the present method.

The average theoretical extraction at all batteries was 76.99%.

The recovery at £4/4/11½ per oz. was worth £20,415 or £47,739 (A) and was within £330 of the call. Most of this shortage will be recovered from slags.

CLEAN AND REFRACTORY TAILING.

On a 90% basis the segregation of tailing produced is as follows:—

	Tons.	Head Value. dwt. grs.	Per cent
Over 2 dwts, 8 grs. per ton. ...	24,759	5·20	60·5
Over 1 dwt. 18 grs. and below 2 dwts 8grs.	4,437	2·24	10·1
1 dwt. 18grs. and under ...	10,108	1·31	24·7
Refractory	1,915	7·23	4·7

The refractory tailing included 592 tons worth 3 dwts. 2 grs. at Marble Bar and 966 tons at Meekatharra. The latter is very high grade, being worth 11 dwt. 21 grs. and it has been segregated by the owners. Samples have been finely ground to below -200 mesh but the extra gold liberated did not warrant any further treatment along these lines.

COSTS.

The average cost dropped from 19s. 2.7d. to 15s. 8.2d. in sympathy with the increased tonnage handled. A much better cost could have been expected if all the tailing produced had been treated.

At the time of writing we are doing a good deal better as far as tonnage is concerned. Repairs and renewals are shown at 1s. 10d. per ton, approximately 1s. 6d. more than in normal times, due to rehabilitation of plants rusted out through disuse during the war years, all of which expenditure is charged to working.

REVENUE.

The revenue per ton was 15s. 6.5d. as against 16s. 9d. per ton in 1945.

Interest paid to the Treasury on funds used for tailing payments was deducted from revenue and amounted to approximately 1s. per ton.

Poor revenue returns from the North West Batteries, due to wind losses over an extended period offset excellent results from Laverton and Ora Banda where high grade tailing was treated.

COMPARATIVE SYNOPSIS OF RESULTS AT STATE BATTERIES FOR TWELVE MONTHS ENDED 31ST DECEMBER, 1945 AND 1946.

——	1945.			1946.		
	Tonnage.	Expenditure per ton.	Revenue per ton.	Tonnage.	Expenditure per ton.	Revenue per ton.
		s. d.	s. d.		s. d.	s. d.
Milling	20,078·25	26 3·4	10 1·7	45,476·5	19 4·5	9 6·7
Cyaniding	12,216·00	19 2·7	16 9·1	22,390	15 8·2	15 6·5

RECEIPTS AND EXPENDITURE.

——	Tonnage.	Expenditure.	Revenue.	Loss.
		£	£	£
Milling	45,476·5	44,058 11 3	21,755 4 3	22,303 7 0
Cyaniding	22,390·0	17,560 10 11	17,399 1 5	161 9 6
	....	61,619 2 2	39,154 5 8	22,464 16 6

CARTAGE SUBSIDIES.

Year.	Tons Crushed.	State Batteries.			Private Batteries.		Total.
		Tons Claiming Subsidy.	Percentage of ore Crushed.	Amount Paid.	Tons Claiming Subsidy.	Amount Paid.	
				£ s. d.		£ s. d.	£ s. d.
1944	18,261·75	3,686·75	20·1	1,461 7 5	195	85 0 3	1,546 7 8
1945	20,078·25	1,943	9·6	790 11 7	268	121 2 3	911 13 10
1946	45,476·50	6,890·75	15·1	3,169 9 4	1,406·5	514 8 9	3,683 18 1

ERECTION AND RECONSTRUCTION.

£3,769 14s. 11d. was expended from General Loan Fund towards the following works:—

	£	s.	d.
Portable conveyor for Marble Bar, Kalgoorlie and Coolgardie Tailing Plants ...	1,110	19	11
Additions and improvements to tailing plants—			
Coolgardie	122	5	5
Laverton	314	11	1
Meekatharra	851	15	11
Kalgoorlie	5	15	1
Replacing Gates Crusher with Ruwoltz Jaw Crusher, and structural alterations, Coolgardie	849	8	10
Purchase of Ruwoltz Crusher for Wiluna ...	514	18	8
	£3,769	14	11

At all tailing plants where additions were made, considerable expenditure was incurred from working in replacing vats, tanks and reticulation pipes, etc.

Extensive repairs were made to power plants such as the installation of new liners and reconditioned pistons to our main engines at Cue and Kalgoorlie and new scrubbers and expansion boxes at Peak Hill and Yarri.

A general overhaul of the Wiluna plant was completed, including the replacement of the old Gates crusher, which had been in use at Coolgardie, and which in turn will be scrapped in favour of the new Ruwoltz jaw crusher when opportunity occurs. A new deep well pump was installed and the old one left under water for many years recovered and repaired.

One thousand one hundred and ten pounds seven shillings and eightpence was expended at Mt. Ida in renewing one mile of pipeline, installing new tanks and repairs to the power plant and the anticipated expenditure on rehabilitation is expected to cost £1,500.

Warriedar was started up and a small round of crushings was put through at a cost of £196 1s. 11d. Very considerable further expenditure will be required if this district should show a permanent revival.

A good deal of this expenditure is charged to repairs and renewals which show at £6,922 17s. 6d. against milling and £2,085 17s. 2d. to tailing treatment, a total of £9,007 14s. 8d.

Motor Vehicles purchased from working include an ex-Military Chevrolet utility and a new Maple Leaf Chevrolet three-ton truck with special hydraulic tip body for use on the Marble Bar and Bamboo Creek circuit.

STAFF.

This branch lost one of its oldest and most capable officers in the person of Jim Halligan, who had been ailing for some time. Manager of the Norseman State Battery at the time, he had been in charge of numerous plants, including Paynes Find, Boogardie and Cue.

L. P. Bisset, inspector since 1931, retired during the year, his services having been retained for an additional 12 months. Apart from his service to State batteries as inspector and deputy superintendent, he gave valuable assistance to the Civil Defence Department and that concerned with strategic minerals during the war years.

Erection Officer McLean also reached the retiring age. His services were also made use of by the Commonwealth Government in connection with strategic minerals.

Manager W. E. Eyres, one of our most experienced managers, also reached the age of 65, and retired officially at the end of December.

F. Breustedt was transferred from Marble Bar to Yarri, and after relieving at Norseman and Laverton, was appointed to Cue.

Manager Chegwidden's headquarters were transferred from Payne's Find to Boogardie.

Assistant Clemesha was appointed temporarily to the position as acting manager, Marble Bar and Bamboo Creek, with Assayer Ken Mack as assistant.

Leading Hand Sanfead was in charge of Peak Hill and Warriedar as assistant manager.

Leading Hand Bell, Assayer Doig and Cyanider Ball, all returned men, were found positions analogous to those occupied before enlistment.

Applications were called for the position of manager at Cue, the successful applicant being Mr. H. Edwards of the Big Bell staff. Unfortunately, he found it necessary to resign after a few weeks.

From applications received it would appear that present salaries will not attract technically qualified metallurgists.

Administration.

Administration expenditure is shown at £5,243 1s. 10d., against £5,101 11s. 1d. in 1945.

The expenditure is equal to 1s. 6.4d. per ton as against 3s. 1.9d. in 1945, due to the rise in tonnage milled and cyanided from 32,294 to 67,866 tons.

Comparative figures are as follows:—

	1946.			1945.		
	£	s.	d.	£	s.	d.
Salaries	3,419	8	9	3,058	2	11
Pay Roll Tax	860	19	10	626	7	6
Workers' Compensation ...	565	13	9	521	6	5
Postage	16	2	11	12	10	4
Travelling Expenses ...	373	12	5	236	19	11
Retiring Allowance ...	...			625	6	3
Sundries	7	4	2	20	17	9
	£5,243	1	10	£5,101	11	1

Salary increases and the employment of one extra clerk are reflected in the item Salaries.

General Remarks.

The percentage increase in the tonnage crushed was greater than that following the rise in the price of gold but was not as great as expected.

In 1939 activity on the Goldfields was at a high level and practically all districts retained their public crushing facilities at a reasonable state of efficiency to meet post-war demands. Our batteries could have handled more than double the tonnage forthcoming and no long wait occurred even in getting long idle plants into operation.

Special consideration was given to the north-west circuit, consisting of Bamboo Creek and Marble Bar plants. Two old North-West officers, Acting Manager Clemesha and Assistant Ken Mack, were put in charge and two experienced engine-drivers were sent by air.

The response to this effort was not up to expectation despite the fact that the plants were started up when a few hundred tons were available, and all tailing accumulations were treated, and balance of premiums paid.

Tons crushed for the last three years are as follows:—

	Bamboo Creek.	Marble Bar.
	Tons.	Tons.
1944	689·5	940·5
1945	631·0	1,466·25
1946	1,324·00	1,104·00

These plants are in first class condition, but the small tonnages and the cost of transport of labour which is difficult or impossible to recruit locally, makes for very high costs. Unfortunately, as mentioned previously under the heading "Tailing Revenue" a considerable quantity of very high grade tailing was lost by windage, due to a long wait for cement and other commodities necessary to repair the worn-out vats.

Our 5-head hand fed batteries in remote centres are very expensive—the wages alone in most cases exceed the revenue collected. Associations in the less remote

places when asking for concessions should bear in mind the above facts, and also that no extra charge is made by the Department to cover the increased costs in outback centres.

The mechanical conveyors have proved quite a success and apart from the assistance they give in emptying the tailing vats they permit the vats to be built in all round with residue. It has been demonstrated that if the original galvanised iron vats are properly lined with reinforced concrete and completely enclosed on the outside with packed residue their life is at least 20 years.

Two-inch drain pipes are used instead of 1¼ inches to make allowance for incrustation, and to save the cost of unearthing and replacing at short periods. One of the three nests of six vats put into commission at Kalgoorlie has been so arranged, and the others will be cemented as soon as they show signs of wear.

The erection of a central mill to treat sulphide ores which are not amenable to our ordinary treatment has been considered during the year and a report on the probable ore supplies covering the Murchison and Eastern Goldfields Districts has been made by Inspector Adams, the District Inspector of Mines at Cue.

The report disclosed that very few of the old sulphide producing bodies were accessible. His suggestion that a fine grinding and filtering unit be erected as an adjunct to our Coolgardie or Kalgoorlie battery, to deal with those ores which are amenable to fine grinding and direct cyaniding, is being investigated with a view to arriving at the design and cost.

The continuous treatment of public parcels of more or less complex ores varying from day to day, presents problems that may not be successfully solved. Plant is difficult to obtain and is ever-increasing in cost. Skilled labour is at a premium and power costs have risen to such an extent as to offset to a great degree the advantages of mechanisation of plants dealing with any but large tonnages.

Our leased batteries at Sir Samuel and Darlot are in very poor condition, which is to be expected with so little activity and only a few small parcels to crush each year.

The Linden plant has been fairly active under Lessee Dellar, and the Department has supplied a rockbreaker from the "Lady Mae" Mine at Laverton to replace the old worn one, and also the necessary material for the erection of five new vats and an engine cooling tank. A new producer will be installed and sufficient conveyor belt provided.

The Weerianna Battery originally erected by an Adelaide Company from Commonwealth funds, was leased to Mr. A. F. McColl, and equipped with a 40 h.p. Southern Cross engine, electric light plant, pumping engine, and the necessary tools and stores, and the Government now has a well equipped plant.

An estimate of the plant and work required to put the 20-mile Sandy plant in operation under a lessee was made and the preliminary work started.

A special subsidy which provides for owners crushing under similar charges as at State batteries was granted temporarily.

CONCLUSION.

Although the ore milled for the year was more than double that treated in 1945, a further increase of at least 100% will have to be made to permit our plants to work economically. We are at the present moment faced with ever-increasing labour costs and the consequent rise in the price of commodities.

Strangely enough, housing accommodation is short, even in the most isolated places, and there is little inducement for married men to settle away from wherever their present homes are.

The only factors which can keep costs within limits are increased output, and complete mechanisation, which only large tonnages warrant. Tonnage forthcoming to our State batteries has not been up to expectations and with the exception of one or two plants, crushings are intermittent and crews have to be transferred at considerable expense from place to place, and unfortunately plants which have been put in order at considerable cost are experiencing again the deterioration which is inevitable when they are left idle for long periods.

Before completing my report I would like to express my appreciation of the help and assistance rendered me by the Goldfields and head office staff.

D. F. BROWNE,
Superintendent of State Batteries.

SCHEDULE NO. 1.

Return showing Tons Crushed, Gold Yield by Amalgamation, Average per Ton in Shillings, and Total Value without Premium for Year ended 31st December, 1946.

Battery.	Tons Crushed.	Gold Yield Bullion.	Value per Ton in Shillings and Pence.	Total Value without Premium.
		Ounces	s. d.	£
Bamboo Creek	1,324·25	599·90	32 8	2,159·64
Boogardie	1,608·00	757·40	33 11	2,726·64
Coolgardie	6,423·25	3,217·10	36 1	11,581·56
Cue	3,964·50	6,885·70	125 1	24,788·52
Kalgoorlie	8,230·50	2,753·00	24 1	9,910·80
Laverton	4,990·75	1,561·26	22 6	5,620·53
Marble Bar	1,104·25	805·00	52 6	2,898·00
Meekatharra	4,281·00	3,576·70	60 2	12,876·12
Norseman	2,534·50	2,010·40	57 1	7,237·44
Ora Banda	4,179·25	2,915·55	50 3	10,495·98
Payne's Find	970·75	360·36	26 9	1,297·26
Peak Hill	2,209·50	651·86	21 3	2,346·69
Sandstone	869·00	828·35	68 8	2,982·06
Warriedar	252·50	56·75	16 2	204·30
Wiluna	841·25	132·90	11 4	478·44
Yarri	1,693·25	817·90	34 9	2,944·44
	45,476·50	27,930·13	44 3	100,548·42

SCHEDULE NO. 2.

Number of Parcels Treated, Tons Crushed, and Head Value for Year ended 31st December, 1946.

No. of Parcels Treated.	Battery.	Tons Crushed.	Yield by Amalgamation, Bullion.	Yield by Amalgamation, Fine Gold.	Gross Contents of Tailings on 100% (including refractory).	Total Contents of Ore, Fine Gold.	Average per ton, Fine Gold.	Gross Value per ton, at £4 4s. 11½d. per oz.
			ozs. dwts.	ozs. dwts.	ozs. dwts.	ozs. dwts.	dwts. grs.	£ s. d.
26	Bamboo Creek	1,324·25	599 18	508 8	389 1	897 9	13 13	2 17 6
55	Boogardie	1,608·00	757 8	641 18	216 0	857 18	10 16	2 5 4
109	Coolgardie	6,423·25	3,217 2	2,726 11	1,372 12	4,099 3	12 18	2 14 2
67	Cue	3,964·50	6,885 14	5,835 15	813 1	6,649 5	33 13	7 2 5
149	Kalgoorlie	8,230·50	2,753 0	2,333 4	1,203 4	3,536 8	9 14	2 0 8
47	Laverton	4,990·75	1,561 5	1,323 4	1,413 10	2,736 14	10 21	2 6 2
7	Marble Bar	1,104·25	805 0	682 4	453 9	1,135 13	20 13	4 7 3
48	Meekatharra	4,281·00	3,576 14	3,031 6	1,439 0	4,470 6	20 21	4 8 8
71	Norseman	2,534·50	2,010 8	1,703 17	314 14	2,018 11	15 20	3 7 3
63	Ora Banda	4,179·25	2,915 11	2,470 18	1,406 19	3,877 17	18 13	3 18 9
14	Payne's Find	970·75	360 7	305 8	112 8	417 16	8 14	2 0 8
15	Peak Hill	2,209·50	651 17	552 9	249 17	802 6	7 6	1 10 9
17	Sandstone	869·00	828 7	702 1	205 19	908 0	20 21	4 8 8
18	Wiluna	841·25	132 18	112 12	191 8	304 0	7 5	1 10 7
2	Warriedar	252·50	56 15	48 3	37 18	85 1	6 19	1 8 10
23	Yarri	1,693·25	817 18	693 7	287 19	981 6	11 13	2 9 0
731		45,476·50	27,930 2	23,671 5	10,107 8	33,778 13	14 20½	3 3 1

Average tons per parcel .... 62·21.
Average yield by amalgamation per ton (fine gold) .... 10 dwts. 9·8 grs.
Average value by amalgamation per ton .... £2 4s. 3d.—Australian, £5 2s. 11d.
Average head value of tailings per ton (fine gold) .... 4 dwts. 10·6 grs.
Average value of tailings per ton .... 18s. 10d.—Australian, £2 3s. 10d.

SCHEDULE NO. 3.

Return showing Tailing Payable and Unpayable and Gross Contents for year ended 31st December, 1946.
(Tonnage at 90 per cent.)

Battery.	Payable.			Unpayable Tailing.						Refractory.			Total.		
				2 dwts. 8 grs. to 1 dwt. 18 grs.			1 dwt. 18 grs. and under.								
	Tons.	ozs.	dwts.	Tons.	ozs.	dwts.	Tons	ozs.	dwts.	Tons	ozs.	dwts.	Tons	ozs.	dwts.
Bamboo Creek	1,125	343	17	16	1	15	50	3	12	....	....	....	1,191	349	4
Boogardie	605	162	....	249	25	12	593	45	13	....	....	....	1,447	233	5
Coolgardie	3,144	1,068	6	560	55	7	2,077	130	9	....	....	....	5,781	1,254	2
Cue	2,700	670	12	64	6	2	804	56	4	....	....	....	3,568	732	18
Kalgoorlie	3,701	826	15	887	93	11	2,819	145	10	....	....	....	7,407	1,065	16
Laverton	4,345	1,214	3	74	7	11	73	3	15	....	....	....	4,492	1,225	9
Marble Bar	404	315	7	....	....	....	....	....	....	592	94	14	996	410	1
Meekatharra	1,800	615	7	905	99	12	183	13	3	966	576	....	3,854	1,304	2
Norseman	1,135	221	1	182	18	1	963	56	....	....	....	....	2,280	295	2
Ora Banda	2,866	1,105	5	231	25	9	664	38	12	....	....	....	3,761	1,159	6
Paynes Find	89	10	16	255	24	15	442	24	4	87	41	5	873	101	....
Peak Hill	612	158	2	414	42	18	962	25	1	....	....	....	1,988	226	1
Sandstone	598	155	16	17	1	19	167	11	2	....	....	....	782	168	17
Warriedar	....	....	....	....	....	....	....	....	....	225	25	4	225	25	4
Wiluna	435	116	13	233	26	18	38	2	14	45	25	5	751	171	10
Yarri	1,200	239	19	50	5	3	273	15	2	....	....	....	1,523	260	4
Totals	24,759	7,223	19	4,137	434	13	10,108	571	1	1,915	762	8	40,919	8,992	1

SCHEDULE NO. 4.

Direct Purchase of Tailing for Year ended 31st December, 1946.

Battery.	Tons of Tailing Purchased.	Amount Paid at £4 4s. 11½d. per oz.	Amount Paid A/C. Premium.
		£ s. d.	£ s. d.
Bamboo Creek	1,015·25	644 2 3	1,035 9 7
Boogardie	591·25	205 2 5	132 17 8
Coolgardie	3,187·50	2,498 15 0	3,375 8 1
Cue	2,322·00	841 13 10	1,018 12 2
Kalgoorlie	3,487·25	1,137 18 5	976 16 3
Laverton	3,588·75	2,291 9 0	2,780 1 4
Marble Bar	182·00	355 18 0	2,088 13 6
Meekatharra	1,697·75	1,139 6 0	1,450 14 0
Norseman	1,442·75	350 15 9	512 10 3
Ora Banda	2,754·25	3,353 16 8	3,687 6 2
Payne's Find	89·00	1 3 7	0 15 4
Peak Hill	615·50	272 2 5	117 12 1
Sandstone	575·25	284 3 4	1,098 12 2
20-Mile Sandy Creek	424·25	168 15 2	145 2 4
Wiluna	390·50	169 9 4	110 2 1
Yarri	879·25	270 7 4	158 6 11
	23,242·50	13,984 18 6	18,688 19 11

SCHEDULE NO. 5.

Tailing Treatment for 1946.

Battery.	Tonnage.	Yield.	Value.	Premium.	Total.
		fine ozs.	£	£	£
Bamboo Creek	868	233·08	990·395	1,312·752	2,303·147
Boogardie	...	3·50	15·000	21·000	36·000
Coolgardie	4,239	845·53	3,591·814	4,763·770	8,355·584
Cue	2,968	433·07	1,840·041	2,440·596	4,280·637
Kalgoorlie	...	2·87	12·146	16·258	28·404
Laverton	3,244	812·42	3,454·437	4,576·574	8,031·011
Marble Bar	1,250	682·39	2,898·957	4,125·795	7,024·752
Meekatharra	3,096	402·82	1,711·464	2,270·635	3,982·099
Norseman	3,780	355·22	1,525·572	2,000·600	3,526·172
Ora Banda	2,729	947·04	4,023·501	5,325·884	9,349·385
Sandstone	216	89·62	379·525	504·319	883·844
	22,390	4,807·56	20,442·852	27,358·183	47,801·035

SCHEDULE No. 6—MILLING.

Statement of Receipts and Expenditure for the Year ended 31st December, 1946.

Battery.	Tonnage Crushed.	Expenditure.									Receipts.		Profit.	Loss.
		Management.	Wages.	Stores.	Total Working Expenses.	Cost per Ton.	Renewals. and Repairs.	Sundries.	Gross Expenditure.	Cost per Ton.	Receipts.	Receipts per Ton.		
		£ 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	1,324½	118 0 1	687 7 7	359 15 11	1,165 3 7	17 7·1	88 0 1	233 13 1	1,486 16 9	22 5·4	694 17 10	10 5·9	....	791 18 11
Boogardie	1,608	212 19 4	515 9 0	412 11 11	1,141 0 3	14 2·3	383 16 10	309 3 2	1,834 0 3	22 9·7	852 1 3	10 7·1	....	981 19 0
Coolgardie	6,423½	436 12 3	1,666 4 6	1,183 1 11	3,285 18 8	10 2·7	739 19 8	743 12 10	4,769 11 2	14 10·1	2,979 8 11	9 3·1	....	1,790 2 3
Cue	3,964½	385 9 9	899 13 2	1,018 1 6	2,303 4 5	11 7·4	606 19 10	473 18 3	3,384 2 6	17 0·8	2,150 5 7	10 9·6	....	1,233 16 11
Kalgoorlie	8,230½	826 13 7	1,933 19 11	2,036 4 9	4,796 18 3	11 7·9	1,081 17 0	1,188 13 6	7,067 8 9	17 2·0	3,477 4 2	8 5·2	....	3,590 4 7
Laverton	4,990¾	312 19 8	1,236 9 7	665 3 3	2,214 12 6	8 10·5	381 2 2	652 15 10	3,248 10 6	13 0·2	2,204 2 4	8 9·6	....	1,044 8 2
Linden	....	....	....	....	....	....	....	....	....	....	111 15 3	....	111 15 3	....
Marble Bar	1,104½	127 16 3	472 4 3	300 9 9	900 10 3	16 3·7	315 9 11	247 12 7	1,463 12 9	26 6·1	604 7 11	10 10·8	....	859 4 10
Meekatharra	4,281	308 12 5	1,691 6 1	1,355 18 3	3,355 16 9	15 8·1	495 9 10	640 19 11	4,492 6 6	20 11·8	2,396 18 10	11 2·1	....	2,095 7 8
Mount Ida	....	112 17 2	....	154 16 8	267 13 10	....	697 7 9	45 6 1	1,010 7 8	....	....	....	....	1,010 7 8
Mt. Sir Samuel	....	....	....	....	....	....	....	30 13 10	30 13 10	....	....	....	....	30 13 10
Norseman	2,534½	536 11 1	1,485 18 7	1,135 17 2	3,158 6 10	24 11	290 4 4	305 7 3	3,753 18 5	29 7·4	1,308 1 5	10 2·8	....	2,445 17 0
Ora Banda	4,179½	246 10 1	790 15 1	1,167 4 7	2,204 9 9	10 6·5	192 1 7	507 15 6	2,904 6 10	13 10·7	1,680 15 10	8 0·4	....	1,223 11 0
Paynes Find	970½	126 13 0	517 18 7	175 3 8	819 15 3	16 10·6	134 9 10	166 5 8	1,120 10 9	23 1	516 13 2	10 8·1	....	603 17 7
Peak Hill	2,209½	226 18 1	985 17 8	421 1 5	1,633 17 2	14 9·4	210 15 6	362 1 8	2,206 14 4	19 11·6	946 16 2	8 6·7	....	1,259 18 2
Pinjin	....	....	....	....	....	....	25 0 0	5 0 0	30 0 0	....	5 0 0	....	....	25 0 0
Sandstone	869	134 19 4	462 1 3	165 16 11	762 17 6	17 6·7	89 3 1	171 2 9	1,023 3 4	23 6·5	480 2 5	11 0	....	543 0 11
Warriedar	252½	38 8 1	103 4 4	64 7 3	205 19 8	16 3·7	49 10 6	29 5 8	284 15 10	22 6·6	88 13 11	7 0·2	....	196 1 11
Wiluna	841¼	129 12 8	263 15 8	258 6 11	651 15 3	15 5·9	252 0 4	157 7 11	1,061 3 6	25 2·6	410 8 2	9 8·8	....	650 15 4
Yalgoo	....	....	37 3 2	23 6 9	60 9 11	....	70 0 0	2 15 3	133 5 2	....	....	....	....	133 5 2
Yarri	1,693½	251 1 4	986 18 4	426 15 3	1,664 14 11	19 7·9	819 9 3	268 18 3	2,753 2 5	32 6·2	830 19 7	9 9·6	....	1,922 2 10
Youanmi	....	....	....	....	....	....	....	....	....	....	10 0 0	....	10 0 0	....
20-Mile Sandy	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Head Office	....	....	....	....	....	....	....	....	....	....	6 11 6	....	6 11 6	....
Total	45,476½	4,532 14 2	14,736 6 9	11,324 3 10	30,593 4 9	13 5·4	6,922 17 6	6,542 9 0	44,058 11 3	19 4·5	21,755 4 3	9 6·7	128 6 9	22,431 13 9
														128 6 9
Total Loss	....	....	....	....	....	....	....	....	....	....	....	....	....	22,303 7 0

SCHEDULE No. 7—Tailing Treatment

Statement of Receipts and Expenditure for the Year ended 31st December, 1946.

Battery.	Tonnage Treated.	Expenditure.									Receipts.		Profit.	Loss.
		Management.	Wages.	Stores.	Total Working Expenditure.	Cost per Ton.	Renewals and Repairs.	Sundries.	Gross Expenditure.	Cost per ton.	Receipts.	Receipts per Ton.		
		£ 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	868	53 16 9	363 18 4	174 4 3	591 19 4	13 7·6	31 15 0	77 8 10	701 3 2	16 1·8	435 11 8	10 0·4	....	265 11 6
Boogardie	....	37 11 5	19 15 6	2 6 0	59 12 11	....	67 0 4	7 7 2	134 0 5	....	36 0 0	....	....	98 0 5
Coolgardie	4,239	301 12 1	1,226 5 3	818 2 7	2,345 19 11	11 0·7	257 14 3	543 4 4	3,146 18 6	14 10·1	2,762 1 5	13 0·3	....	384 17 1
Cue	2,968	266 13 5	679 6 4	612 7 2	1,558 7 6	10 6	71 17 8	445 15 11	2,076 1 1	13 11·5	2,479 1 10	16 8·4	403 0 9	....
Kalgoorlie	....	90 2 3	73 19 6	273 2 3	437 4 0	....	372 4 9	18 12 4	828 1 1	....	14 10 10	....	....	813 10 3
Laverton	3,244	202 6 10	678 13 8	517 3 6	1,398 4 0	8 7·4	148 11 7	320 13 10	1,867 9 5	11 6·1	3,399 1 6	20 11·4	1,531 12 1	....
Marble Bar	1,250	84 13 11	340 14 6	373 0 11	798 9 4	12 9·3	321 7 8	162 2 1	1,281 19 1	20 6·1	376 6 1	6 0·2	....	905 13 0
Meekatharra	3,096	122 14 10	879 9 0	1,108 11 8	2,110 15 6	13 7·6	136 10 4	293 15 3	2,541 1 1	16 4·9	2,118 18 9	13 8·2	....	422 2 4
Mount Ida	....	....	....	9 18 7	9 18 7	....	....	7 19 6	17 18 1	....	....	....	....	17 18 1
Norseman	3,780	271 0 6	819 8 5	842 3 1	1,932 12 0	10 2·7	211 1 3	422 3 5	2,565 16 8	13 6·9	2,372 17 10	12 6·7	....	192 18 10
Ora Banda	2,729	134 19 1	615 5 5	600 3 9	1,350 8 3	9 10·7	323 13 5	233 7 10	1,907 9 6	13 11·6	2,976 12 5	21 9·7	1,059 2 11	....
Paynes Find	....	....	....	5 10 0	5 10 0	....	....	17 6 5	22 16 5	....	....	....	....	22 16 5
Peak Hill	....	....	25 4 0	40 16 3	66 0 3	....	134 18 4	0 12 0	201 10 7	....	....	....	....	201 10 7
Sandstone	216	35 3 0	62 8 7	88 7 8	185 19 3	17 2·6	9 2 7	41 1 6	236 3 4	21 10·4	427 14 1	39 9·4	191 10 9	....
Wiluna	....	....	....	6 13 11	6 13 11	....	....	6 11 6	13 5 5	....	....	....	....	13 5 5
Yalgoo	....	....	....	11 0 7	11 0 7	....	....	....	11 0 7	....	....	....	....	11 0 7
Yarri	....	....	....	4 14 3	4 14 3	....	....	3 2 3	7 16 6	....	....	....	....	7 16 6
20-Mile Sandy	....	....	....	....	....	....	....	....	....	....	0 5 0	....	0 5 0	....
Total	22,390	1,600 14 1	5,784 9 1	5,488 6 5	12,873 9 7	11 5·9	2,085 17 2	2,601 4 2	17,560 10 11	15 8·2	17,399 1 5	15 6·5	3,195 11 6	3,357 1 0
														3,195 11 6
Total Loss	....	....	....	....	....	....	....	....	....	....	....	....	....	161 9 6

STATE BATTERIES.

General Working Account for Year ended 31st December, 1946.

	Milling. £ s. d.	Cyaniding. £ s. d.	Total. £ s. d.		Milling. £ s. d.	Cyaniding. £ s. d.	Total. £ s. d.
To Wages	19,269 0 11	7,385 3 2	26,654 4 1	By Revenue	21,755 4 3	17,399 1 5	39,154 5 8
,, Stores	10,164 3 10	4,782 4 7	14,946 8 5	,, Loss Carried Down	18,833 7 0	....	18,833 7 0
,, Repairs and Renewals	6,922 17 6	2,085 17 2	9,008 14 8				
,, Battery Spares	973 0 8	....	973 0 8				
,, Water	2,259 7 0	1,133 17 2	3,393 4 2				
,, General Expenses	1,000 1 4	400 7 0	1,400 8 4				
,, Profit Carried Forward	....	1,611 12 4	1,611 12 4				
	40,588 11 3	17,399 1 5	57,987 12 8		40,588 11 3	17,399 1 5	57,987 12 8
To Loss Brought Down	18,833 7 0	....	18,833 7 0	By Profit Brought Down	....	1,611 12 4	1,611 12 4
,, Administration	3,470 0 0	1,773 1 10	5,243 1 10	,, Gross Loss Brought Down	22,303 7 0	161 9 6	22,464 16 6
	£22,303 7 0	£1,773 1 10	£24,076 8 10		£22,303 7 0	£1,773 1 10	£24,076 8 10

General Profit and Loss Account.

	£ s. d.	£ s. d.		£ s. d
To Gross Loss Working Account Brought Down—				
Milling	22,303 7 0			
Cyaniding	161 9 6			
		22,464 16 6	By Balance Net Loss Carried Down	44,775 5 8
,, Interest	....	20,390 0 0		
,, Sinking Fund	....	1,418 13 10		
,, Superannuation	....	501 15 4		
		44,775 5 8		44,775 5 8
To Balance Brought Forward		1,406,967 19 9	By Balance Carried Forward	1,451,743 5 5
,, Balance Brought Down		44,775 5 8		
		£1,451,743 5 5		£1,451,743 5 5

STATE BATTERIES.

Balance Sheet as at 31st December, 1946.

Liabilities.	£ s. d.	Assets.	£ s. d.
Capital Account—		Plant and Buildings	73,833 18 0
General Loan Fund	409,933 19 6	Motor Vehicles and Horses	1,167 17 10
Consolidated Revenue Fund	95,246 16 3	Stores Account—	
Assistance to Gold Mining Industry	28,621 13 5	Outstations	14,503 18 9
Commonwealth Assistance to Metalliferous Mining	13,786 8 0	Head Office	125 4 2
Sundry Creditors	3,443 19 7	Sundry Debtors	4,556 19 3
Treasury Account	159,990 15 0	Battery Spares	956 3 1
Superannuation	1,857 6 3	Cash Order Control Account	446 19 10
Interest on Capital	607,018 0 0	Profit and Loss Account	1,451,743 5 5
Sinking Fund	137,435 8 4		
	1,547,334 6 4		1,547,334 6 4
Purchase of Tailings—		Purchase of Tailings—	
Advance Account	23,500 0 0	Amount paid for Tailings not treated (includes Advances)	18,678 1 0
Interest Reserve	18 16 7	Amount Due but not Paid for Tailings Untreated (includes Advance)	3,769 12 11
Sundry Creditors for Tailing Payments	2,636 6 3	Estimated Balance of Gold Premium Due	2,362 18 9
Sundry Creditors—Advance of Premium	1,133 6 8	Purchase of Tailings Cash Account	4,840 15 7
Sundry Creditors—Balance of Premium (Estimated)....	2,362 18 9		
	£1,576,985 14 7		£1,576,985 14 7

ANNUAL PROGRESS REPORT OF THE GEOLOGICAL SURVEY BRANCH OF THE MINES DEPARTMENT FOR THE YEAR, 1946.

Contents.

Division IV.

Annual Progress Report of the Geological Survey of Western Australia for the Year Ended 31st December, 1946.

The Under Secretary for Mines.

I have the honour to submit, for the information of the Honourable the Minister for Mines, my report on the operations and progress of the Geological Survey for the year ended 31st December, 1946.

STAFF.

The active strength during the year was as follows:—

Professional.		*Total.*
Ellis, H. A., B.Sc., A.O.S.M.	Government Geologist	6
Hobson, R. A., B.Sc. (Hons.)	Senior Geologist	
Matheson, R. S., B.Sc.	Geologist, 1st Class	
Ward, H. J., B.Sc.	Geologist, 2nd Class	
Lord, J. H., B.Sc.	Geologist, 2nd Class	
Johnson, W., B.Sc. (Hons.)	Geologist, 2nd Class	
Office.		
Outtrim, I. F.	Clerk	3
Meredith, E. M.	Typist (Temporary)	
Meyer, T. H.	Junior Clerk-Messenger	
Laboratory		
Everard, G. B.	Laboratory Assistant up to August (resigned August)	1
Fimmell, L. J.	Laboratory Assistant as from and including September	

Promotions, Resignations, New Appointments.

Mr. R. A. Hobson, B.Sc. (Hons.), was reclassified in the 1946 reclassification as Senior Geologist. His previous classification was Geologist 1st class (senior).

Mr. J. C. McMath, B.Sc., joined the staff as Geologist 1st class on December 30th, ex Royal Artillery, British Army.

Mr. J. H. Lord, B.Sc., joined the staff as Geologist 2nd class on February 4th, ex Royal Australian Air Force.

Mr. W. Johnson, B.Sc. (Hons.), joined the staff as Geologist 2nd class on March 4th, ex Royal Australian Navy.

Mr. I. F. Outtrim, ex 2nd Australian Imperial Force, was appointed as Clerk on January 21st.

Mr. L. Fimmell, ex 2nd Australian Imperial Force, was appointed as Laboratory Assistant on September 3rd, to fill a vacancy created by the resignation of Mr. G. B. Everard, who had filled the position as a temporary employee. The Public Service Commissioner agreed to make this position a permanent one during the year.

The position of Geologist 1st class, filled late in the year, by the appointment of Mr. J. C. McMath, was accepted consecutively by two previous applicants who were offered more lucrative employment immediately prior to the date on which they were due to report for duty. The year proved to be one in which geologists with previous field experience were in keen demand by other States, the Commonwealth Government, and private enterprise.

Increase in Staff.

The increase in Professional Staff enabled the programme of field work set out in my last annual report to be commenced, except for items 3 and 5 under the heading "Field Work" in that report. The unexpected delay in filling the Geologist 1st class position, combined with circumstances over which I had no control, prevented work on these two items being commenced.

The following tabulated statement shows the relation between the area of the State and the availability of geologists during the year.

Period.	No. of Geologists available including Govt. Geologist.	Area of State.	Square Miles per Geologist.	Population.
1946—		sq. miles.		
Jan.	4	975,920	243,980	494,000
Feb.	5	....	195,180	....
Mar.-Nov.	6	....	162,650	....
Dec.	7	....	139,410	....

This effective strength of seven geologists enables only the most urgent requirements of geological investigation to be met.

ACTIVITIES OF PROFESSIONAL OFFICERS.

H. A. Ellis, Government Geologist.

In addition to administrative duties, the following field work was undertaken:—

Places Visited.	Purpose of Visit.	Period.
Geraldton District	Geological Reconnaissance—possibility of occurrence of artesian water	January
Mt. Monger	Inspection talc and soapstone deposits—collecting bulk samples	,,
"Edna May" Goldmine	Inspection development work	,,
Hampton Plains	Inspection Geological Survey in progress	,,
Collie	Inspection—progress boring for coal at Ewington	February
Greenbushes	Inspection—sluicing operations M.C. 4	,,
Norseman	Inspection—"Iron King" Pyrite Mine and "Second Try" G.M.L.	,,
Coorow	Inspection silica sand deposit S.W. Coorow	March
Yallingup Caves	Inspection after local earthquake	April
Witchcliffe	Inspection reputed garnet sand deposit	,,
Glen Lynn	Inspection soapstone deposits	,,
Greenbushes	Inspection—sluicing operations, M.C. 4	,,
Coolgardie	Inspection—progress of Geological Survey, Coolgardie District	May
Kalgoorlie	Inspection bore core from "Porphyry"	,,
"Porphyry"	Inspection diamond drilling operations	,,
Edjudina	Geological reconnaissance of structure lines—Jaspilites	,,

Places Visited.	Purpose of Visit.	Period.
Norseman	Inspection "Iron King" Pyrite Mine	,,
Edward's Find	General inspection mining operations	June
Felstead's Find	General inspection mining operations	,,
"Edna May" Goldmine	Inspection development work	,,
Collie	Two visits—Inspection geological and geophysical survey—Field work in progress	July
Norseman "Edna May" Goldmine	Inspection "Iron King" Pyrite Mine, and "Edna May" Mine with Director, Commonwealth Mineral Research Survey, and Mr. Cook, Mining Engineer attached to Mineral Research Survey, in reference to applications for financial assistance from Commonwealth Government	August
Coolgardie	Inspection progress of Coolgardie Geological Survey	,,
Collie	Inspection Geological and Geophysical Survey in progress	,,
Nabawa	Inspection workings on Heinson Bros. Lead Mine near old "Protheroo" Lead Mine—advice *re* development	August
Murchison District	Inspection progress of Geological Reconnaissance Survey, Murchison District	,,
Mt. Magnet	Geological Reconnaissance with view to future detailed mapping	September
Coorow	Hand bored silica sand deposit, S.W. of Coorow	,,
Marble Bar, Nullagine	Inspection of "Comet" G.M. and "Blue Spec" Gold Antimony Mine with Dr. Fisher of Commonwealth Mineral Research Survey. Investigation Water Supply Problem "Blue Spec" Mine	,,
Three Springs, Northampton	Investigation of possibility of obtaining domestic water supplies for P.W.D.	October
Lake Muir (S.W.)	Investigation of reported limestone deposit on eastern side of Lake Muir	November
Norseman	Inspection of Development work on Norseman G.M. and "Iron King" Pyrite Mine	December

R. A. Hobson, Senior Geologist.

January-March: Supervising percussion boring for coal on coalmining leases at Ewington, Collie.

March-June: Finalisation of reports and preparation for Murchison Reconnaissance Survey.

June-November: In charge of Reconnaissance Geological Survey of large portion of the Murchison Goldfield.

December: Office work in connection with Murchison Survey.

R. S. Matheson, Geologist 1st Class.

January: Geological Survey of the Hampton Group, Coolgardie, in conjunction with Mr. Ward.

February-March: Office work on Hampton Group geological map; finalising report and plans of East Kimberley Geological Survey; preparation for field work in Coolgardie District.

April-December: In charge of re-survey of portion of Coolgardie District.

H. J. Ward, Geologist 2nd Class.

January: Assisting in Geological Survey of Hampton Group, Coolgardie.

February: Investigation deep lead deposit on G.M.L. 1530, "Second Try," Norseman.

March: Assisting in compilation of information in connection with re-survey of portion of Coolgardie Goldfield.

April-December: With Mr. Matheson on field work in Coolgardie District.

J. H. Lord, Geologist 2nd Class.

Appointed in February.

February-May: Assisting in compilation of data for Coolgardie Survey and in the field during April and May with Mr. Matheson in Coolgardie District.

June-December: In charge of a geological survey of the Collie Coalfield, based at Collie. A geophysical party from Commonwealth Mineral Resources Survey commenced operations simultaneously with Mr. Lord's geological work.

W. Johnson, Geologist 2nd Class.

Appointed in March.

March-June: Compiled two Mineral Resources Bulletins.

June-November: In the field with Senior Geologist Hobson on a Reconnaissance Survey of a large part of the Murchison and Yalgoo Goldfields.

December: Office work in connection with Murchison Reconnaissance Survey.

FIELD WORK.

Field Work in Progress as at December 31st.

(1) Geological Reconnaissance of an area of approximately 12,000 square miles in the Yalgoo, Murchison and Gascoyne Goldfields—Messrs. Hobson and Johnson.

(2) Detailed geological examination of an area of approximately 900 square miles surrounding Coolgardie, Coolgardie Goldfield—Messrs. Matheson and Ward.

(3) Geological and Geophysical Survey of the Collie Coalfield—Mr. Lord.

Field Work Authorised for 1947.

(1) Continuation of Items 1, 2 and 3 above.

(2) Participation in an Oil Survey of the Fitzroy Basin, West Kimberley District, in conjunction with geologists from Mineral Resources Survey, Canberra (contingent upon the appointment of another geologist, 2nd class, to the existing staff).

TRANSPORT.

Tabulated details of transport at present in use by the Survey are as follows:—

Type.	Load Capacity.	Speedo Reading 31st December, 1946.	Mileage for Year.	Purchased.
Dodge Utility	15 cwt.	95,158	12,478	1935 (new)
Dodge Utility	15 cwt.	88,363	8,440	1935 (new)
Ford Utility	18 cwt.	41,264	8,840	1945 (2nd-hand)
International Utility	15 cwt.	34,300	11,650	1945 (2nd hand)
Ford Utility	15 cwt.	6,354	*9,604	1946 (new)
Ford Utility	15 cwt.	6,700	6,700	1946 (new)

* Includes 3,250 miles calculated while speedometer NOT working.

With the exception of the two new vehicles added to the fleet during the year, the cost of maintaining these vehicles in a safe and efficient condition for the type of work they are called upon to perform, was high. An additional vehicle will be needed for the 1947 field season.

SERVICE TO THE GENERAL PUBLIC AND MINING INTERESTS.

As usual, the demand for geological information continued to be strong during the year, and in most cases the requirements of personal callers and written applications were satisfactorily met by some member of the professional staff who happened to be not in the field, or by Mr. Outtrim, clerk to the Survey, when no professional officers were available.

The extensive activities of the field staff during the year enabled the usual help to be given on the spot to prospectors, mining companies and syndicates, engaged in prospecting, goldmining and coal mining.

Emphasis has been laid on the necessity of conveying to those vitally concerned, the information collected by the field geologists in the course of their investigations. In the case of the Coolgardie Survey, a map of the district was displayed at the Mining Registrar's Office, showing the geological structure lines and the areas deemed worthy of intensive prospecting. This information was released to the Press periodically, and the geological maps were open for inspection at the Geological Survey camp at specified times.

In two instances notable discoveries were made in localities indicated by Mr. R. S. Matheson on the map posted to assist prospectors.

In January the need arose for the rapid production of a 10 chains one inch geological map of the productive area in the vicinity of Baker's Find, Location 59, Hampton Plains, in order to provide a guide to future prospecting operations. This work was undertaken by Messrs. Matheson and Ward, and within six weeks of commencing the work, the map was on issue at Coolgardie and Kalgoorlie, thanks to the combined efforts of the Geologists, the Mines Drafting Office, and the Government Lithographer. The area mapped in detail covered approximately six square miles.

It is satisfactory to be able to report that this type of service is fully appreciated by those actively engaged in mining, and that it has resulted in the actual discovery of new auriferous localities.

Other Government Departments utilised our services during the year on problems involving dam sites, underground water supply, and open-cut sites for coal at Collie.

LIAISON WITH THE COMMONWEALTH MINERAL RESOURCES SURVEY.

During the year the services of two geophysical parties from the above organisation were made available for work in W.A. One party commenced a gravimetric survey of the Collie Coalfield in June, and the work there is still in progress. The other party carried out some trial traverses and detailed work, using electrical methods on selected areas of Loc. 59, Hampton Plains, towards the end of the year. In both instances geological survey work was proceeding simultaneously with geophysical work, and experience has taught us in the past that geophysical work, to be of value, must be done in the closest co-operation with the geologists. This co-operation has been manifested in the work at present in hand, and valuable results are anticipated on its completion.

Arrangements have been made for the Survey to participate in an oil survey of the Fitzroy Basin, Kimberley District, to be commenced in April, 1947. The Geological Survey of W.A. is to provide one geologist in a party of four geologists.

In several instances an officer of the Survey has been in close liaison with officers from the Commonwealth Mineral Resources Survey in matters affecting the granting of loan money to various mining concerns. Relations have been cordial in the first year of these combined activities.

PUBLICATIONS.

Issued during 1946.

Annual Progress Report of the Geological Survey of Western Australia for 1944.

Mineral Resources of Western Australia, Bulletin No. 3—Tantalum and Niobium.

In the Press.

Annual Progress Report of the Geological Survey of Western Australia for 1945.

Mineral Resources of Western Australia, Bulletin No. 4: The Dandaragan Phosphate Deposits, by R. S. Matheson, B.Sc., Geological Survey of Western Australia.

Geological Survey of Western Australia, Bulletin No. 101: The Mining Groups of the Yilgarn Goldfield, North of the Great Eastern Railway, by R. S. Matheson, Geological Survey of Western Australia.

Geological Survey of Western Australia, Bulletin No. 102: The Greenbushes Mineral Field, by R. A. Hobson, B.Sc. (Hons.) and R. S. Matheson, B.Sc., Geological Survey of Western Australia.

Compiled and Awaiting Authority to Print.

Geological Survey of Western Australia, Bulletin on the Geology of Portion of the Mt. Margaret Goldfield, by R. A. Hobson, B.Sc. (Hons.), Geological Survey of Western Australia.

Geological Survey of Western Australia, Bulletin on Some Economic Aspects of the Principal Tantalum Bearing Deposits of the Pilbara Goldfield, North-West Division, by H. A. Ellis, B.Sc., A.O.S.M., Geological Survey of Western Australia.

Mineral Resources of Western Australia, Bulletin, Moulding Sands, by K. R. Miles, D.Sc., F.G.S., Geological Survey of Western Australia, and H. A. Stephens, B.Sc., Council for Scientific and Industrial Research.

Mineral Resources of Western Australia, Bulletin, Silver, Lead and Zinc, by W. Johnson, B.Sc. (Hons.), Geological Survey of Western Australia.

Mineral Resources of Western Australia, Bulletin, Vermiculite Talc and Soapstone, Fullers Earth, Bentonite and Diatomite, by W. Johnson, B.Sc. (Hons.), Geological Survey of Western Australia.

The fifth edition of "The Mineral Resources of Western Australia" was published during the year by the W.A. Mines Department. This publication was compiled by Dorothy Carroll, Ph.D., D.I.C., of the Government Mineralogical and Chemical Laboratories, Perth, under the direction of Mr. H. Bowley, Government Mineralogist and Director of the Government Chemical Laboratories.

In conclusion, I desire to draw your attention to the fact that the progress made during the year has been made possible by the enthusiasm displayed by the field geologists and the able support given them by the office staff.

H. A. ELLIS,
Government Geologist.

December 31st, 1946.

REPORT ON GARNET AND ILMENITE BEARING BEACH SANDS—BEACH DUE WEST OF WITCHCLIFFE, S.W. DIVISION, WESTERN AUSTRALIA.

Approximate Latitude 34° 02′ S.
Approximate Longitude 114° 59′ E.

By H. A. Ellis, B.Sc., A.O.S.M., Government Geologist.

In April, 1946, two samples containing extremely high concentrations of garnet and ilmenite were submitted to the Geological Survey for examination. This material had been collected by a schoolboy, Laurence West, of Witchcliffe, and was forwarded by him to the Correspondence School Teaching Staff, Education Department, Perth, who passed it to the Geological Survey. The occurrences were described by the finder as being local concentrations. An inspection of the locality was made on May 1st, 1946, when it was ascertained that the quantity of garnet and ilmenite in the sand was, on the average, extremely low, and that the locality was not of commercial importance.

General Geology.

The coastline here consists of garnetiferous gneiss overlain by coastal limestone forming rugged headlands with considerable stretches of sandy beach backed by low sand dunes to a depth of four chains (max.). The limestone cliffs are up to 60 feet in height in some places. The general relief away from the beach is low and undulating.

The original concentration of garnet and ilmenite was found just north of and adjacent to a low gneiss cliff and small rocky headland at the southern end of a 20 chain sandy stretch of very steep beach. It was described by the finder as having an area of 100 square feet and being about three inches thick. Nearby was a streak about three feet wide and two inches deep (length not stated), consisting of mixed ilmenite and garnet concentrates. These local concentrations are extremely difficult to explain, as the gneiss in the vicinity contains only a very small proportion of visible garnet and ilmenite and showed no indication of abnormal concentration in the rock mass.

The 20 chain length of beach was sampled at five chain intervals with an auger to a maximum depth of six feet, but no material containing garnet or ilmenite in sufficient concentration to be considered of economic importance was discovered.

The mineral content of the original concentrations is as follows (Govt. Chemical Laboratory Nos. 1874/46, 1875/46):—

Sample "A" consists mainly of garnet (var. almandine) and ilmenite with some shell fragments, a little quartz and zircon and traces of rutile, hornblende and epidote.

The approximate percentage mineral composition is as follows:—

	Per cent.
Almandine garnet	64
Ilmenite	23
Shell fragments	10
Other minerals	3
	100

The garnet grains are rounded to sub-angular and appear to be much water-worn.

Grain Size.—The garnet was screened on Standard Tyler sieves with the following results:—

Tyler Screen No.	Size of Aperture. Inches	Garnet Retained. Per cent.
20	·0328	*Nil*
32	·0195	0·8
42	·0138	18·0
60	·0097	57·8
80	·0069	22·6
100	·0058	0·8
		100·0

Sample "B" consists mainly of ilmenite and garnet (var. almandine) with some shell fragments, a little zircon and quartz and traces of rutile, hornblende and epidote. The approximate percentage mineral composition is as follows:—

	Per cent.
Ilmenite	53
Almandine garnet	28
Shell fragments	15
Other minerals	4
	100

The garnet grains are similar in appearance to those in sample "A."

Grain Size.—The garnet was screened on Standard Tyler sieves with the following results:—

Tyler Screen No.	Size of Aperture. Inches.	Garnet Retained. Per cent.
20	·0328	*Nil*
32	·0195	1·8
42	·0138	8·9
60	·0097	33·9
80	·0069	44·7
100	·0058	8·9
115	·0049	1·8
		100·00

The best sample obtained in the sampling of the 20 chain beach had the following mineral composition (Govt. Chemical Laboratory No. 2174):—

Consists mainly of shell fragments, with some quartz, garnet (var. almandine) and ilmenite, and little zircon and traces of epidote.

The approximate percentage mineral composition is as follows:—

	Per cent.
Shell fragments	89·1
Quartz	6·0
Almandine Garnet	2·7
Ilmenite	2·0
Zircon	0·2
	100·0

The garnet fragments are rounded to sub-angular and appear to be much water-worn.

Conclusion.

It is obvious that the beach sands in this locality do NOT contain garnet or ilmenite in commercial quantities.

H. A. ELLIS,
Government Geologist.

May 9th, 1946.

"BLUE SPEC" GOLD-ANTIMONY MINE.

Approximately 16 Miles East of Nullagine, Pilbara Goldfield.

Summary of Future Prospects in Depth.

By

H. A. Ellis, B.Sc., A.O.S.M.

I visited the "Blue Spec" Mine during the last week in September, 1946, in company with Dr. N. H. Fisher and Mr. C. Knight, of the Commonwealth Mineral Resources Survey, Melbourne. My chief interest in this locality was the water supply problem and the

general distribution of mineralised areas with a view to future detailed geological surveying to be undertaken by the Geological Survey of W.A.

I was able to spend a few hours underground (after the almost insuperable difficulty of obtaining a miner's hat and lamp had been overcome) and examined the surface in the vicinity of the mine.

Structural Geology.

Interbedded phyllites and quartzites of the Mosquito Creek Series having a general east-west strike and dipping steep to the south have been cut by a series of almost vertical shears crossing the general strike of the beds at an angle of from 10 to 15 degrees. These shears have a relatively short length in the direction of strike and are confined to a series of relatively thin bedded phyllites and quartzites which form an incompetent zone in the major series. The main phyllite horizons contain numerous thin bands of quartzite, and the main quartzite horizons contain numerous thin bands of phyllite, and in the actual beds which have been sheared to form the Blue Spec veins, phyllite predominates. The presence of quartzite bands in this horizon has played an important part in localising mineralisation, as much of the ore is replacement of quartzite which has shattered more freely than the phyllites.

The mine has been opened up to 300 feet V.D. and stoping above this level is in progress. Two winzes were being sunk below this level at the time of inspection (September, 1946), one being down 75 feet, the other 16 feet below the rails, both in good antimony ore all the way.

Systematic sampling of the stopes and development work is not being carried out, and it is therefore necessary to rely on the manager's statement as to values, arrived at by sporadic sampling.

It is obvious that future production depends on development in depth as the shoots are short in drive length. An urgent necessity exists therefore, to push the two winzes down to 150 feet below No. 3 level, and in the event of satisfactory development in these two winzes to sink the main shaft another lift of 150 feet.

Geological structure is favourable to the possibility of this new development work being successful, as there is a fairly strong horizon of interbedded quartzite and phyllite with the former predominating, outcropping as a low ridge just north of the mine, and dipping towards the main vertical shear. It is anticipated that this bed will be cut by the lode shear below the 300 feet level, and according to the behaviour of similar beds which have been intersected by the lode shear above this level, should produce ore.

It would be wise to anticipate that a new level will require to be opened up each year to maintain the present tonnage of 1,200 tons per month.

H. A. ELLIS,
Government Geologist.

8th October, 1946.

WATER SUPPLY.

"Blue Spec" Gold-Antimony Mine.

Approximately 16 Miles East of Nullagine, Pilbara Goldfield.

The Problem in Outline.

(a) No surface water is available except in temporary water holes in stream beds adjacent to existing pumping facilities after heavy rain.

(b) No shallow reservoirs of water exist in the sandy beds of the main stream channels because the creek beds have a shallow rock bottom with only a comparatively thin sandy cover—mostly under four or five feet thick and of short length. The wide deep stretches of sand and gravel which hold water in the lower reaches of the Nullagine drainage system are markedly absent in the 20 Mile Sandy area.

(c) The tightly folded phyllites of the Mosquito Creek series occupy the main tributary valleys of the larger 20 Mile Sandy Creek, and experience has shown that bores and wells sunk in these beds are not capable of producing the required quantity of water.

(d) The present plant and domestic requirements for the production and treatment of 1,200 tons of ore per month is 28,000 gallons per day.

(e) This quantity of water is at present assured from a series of two bores and one well situated in the Branchi locality some four miles east of the mine, and from the two bores situated on Middle Creek some two to three miles south of the mine.

(f) The inevitable result of continually drawing large quantities of ground water from bore holes in metamorphic rocks in low rainfall country is realised locally, having been learned the hard way—by practical experience—and some apprehension is felt as to the continuity of future supply.

Suggested Solutions.

(a) Avoid sinking wells or bores in the areas occupied by the thin banded phyllites. This means avoiding areas which naturally suggest themselves as being potentially water-bearing, since many of the strong minor drainage channels occupy the relatively softer phyllite horizons.

(b) Confine all attempts at water finding to the banks of the main 20 Mile Sandy Creek and the 1½ miles of Middle Creek upstream from its junction with 20 Mile Sandy Creek.

(c) Select bore sites in positions which preferably have coarse grained grits or quartzites running parallel to the stream bed for some distance.

(d) If the ideal conditions as outlined in (c) are not available, then select those spots which are underlain by the coarser grained rocks in those parts of the 20 Mile Sandy Creek where the stream direction and strike of rocks are as nearly coincident as possible. A wide bed of coarse grained rocks is a better potential aquifer than the phyllites, even if the stream bed crosses it at right angles.

(e) Always endeavour to have two bores completed and in reserve ready to use long before those in use have reached their minimum production stage. One of the bores recently drilled at the "Branchi" locality is reported to yield at the rate of 900 gallons per hour. This is an exceptionally good bore and it must be realised that it cannot continue to yield at this rate indefinitely.

Suggested New Bore Sites.

Four bore sites were selected on the principles outlined above, and their positions were shown to Mr. Thompson, engineer of Blue Spec Gold Mines. Three of the sites were marked with small stone cairns. The positions of the sites are shown on the attached plan, and are marked "Proposed Bore Site, A, B. C & D," respectively.

It will be noted that three of the sites are fairly close to existing pipe lines, while a fourth would require a new pipe line to bring it into the system.

The order in which the sites should be tested is a matter of future immediately requirements, but in a well planned scheme this order could be—

1st	Site	B
2nd	„	A
3rd	„	D
4th	„	C.

Several holes should be sunk in the vicinity of Site D if the first proved unsuccessful, and a search made upstream along the bank of Middle Creek for about 1½ miles from its junction with 20 Mile Sandy would probably reveal suitable sites which would meet with the requirements sets out above.

H. A. ELLIS,
Government Geologist.

September 10th, 1946.

McKINNON'S AND COMET GOLD MINES, MARBLE BAR, PILBARA GOLDFIELD.

Ore Reserve Position.

Both of these mines are practically without ore reserves, living from week to week on small makes of ore discovered haphazardly.

There is some oxidised ore in McKinnon's above the No. 1 level, but the quantity is small, and would only be worked as a salvage proposition.

The history of McKinnon's is one of a weakening of the fracture pattern and accompanying mineralisation in depth, together with a marked fall in values. These features have made the mine entirely dependent on the Comet ore to carry the combine operations over the last 12 months, and further development of McKinnon's below the No. 3 level is most unlikely to be successful. The Comet ore body, after producing from a shoot some 800 feet long on the pitch has bottomed on a strong pre-ore transverse fracture system. Extensive diamond drilling in search of the possible continuation of the main shoot in the direcion of pitch has failed to locate ore.

In September, 1946, a narrow make of high grade ore, roughly parallel to the main shoot now worked out, and separated from it by about 15 feet of country rock, was located on the south side of the main shear system in the level below the main open cut. This ore was exposed in a bench made during mining operations on the main ore body some years ago.

Diamond drilling is still in progress on this discovery, and results to date (October 1946) show that values are patchy though high in places, and that the ore shoot is only of small breadth, and thickness. Its possible continuation in the direction of pitch has yet to be determined by diamond drilling. Unless a considerable quantity of payable ore is discovered in this search, the only known ore in the Comet mine is that contained in a few pillars—possibly 1,000 tons—and the end of the Comet mine is definitely in sight.

Before a mine which has produced as much gold as the Comet is finally abandoned, it should be the duty of the owners to explore every geological possibility of recurrence of ore. This has not been done in the case of the Comet, and a long chance exists of a possible recurrence of ore in the plane of the main ore body, now worked out, at some horizon below the main shoot. It was decided during the recent examination of the mine by Commonwealth Geologists Dr. N. Fisher and Mr. C. Knight, and myself that the only hope for a rejuvenation of the Comet mine lay in exploring this possibility, and a diamond drilling campaign was suggested to the owners, and the first series of suggested holes from the bottom of the inclined shaft was marked on the mine plan. Preparations were being made early in October, 1946, to commence this work.

No indication of where this next possible ore-bearing horizon may be situated can be given, and the work suggested is purely exploratory, but has sufficient geological possibilities to justify its being undertaken.

The combined production from the Comet and McKinnon's with a very small contribution from the Manolis lease up to the end of August, 1946, is—

Ore—tons treated.	Fine ounces of gold.
91,768	90,001

Even at a place like Marble Bar, ore of this grade should be able to provide sufficient profit to enable say three thousand pounds to be allocated to exploratory diamond core drilling in search of new ore. This work should have been in progress several years ago.

The Manolis lease is not a promising ore producer and no reliance can be placed on it to provide ore in the future.

H. A. ELLIS,
Government Geologist.

October 14, 1946.

REPORT ON A SILICA SAND DEPOSIT APPROXIMATELY SIX MILES SOUTH-WEST OF COOROW. SOUTH-WEST DIVISION.

Approx. Lat. 29°-53′ S.
Approx. Long. 115°-58′ E.

By H. A. Ellis, B.Sc., A.O.S.M.
Government Geologist.

The writer's attention was drawn to the occurrence of a very fine silica sand about six miles south-west of Coorow by Mr. Le Mesurier of the Mineral Section, Government Chemical Laboratory. Analyses of some material sent in for determination showed that the sand contained up to 98 per cent. SiO_2 and that 98 per cent. would pass through a 200 mesh screen.

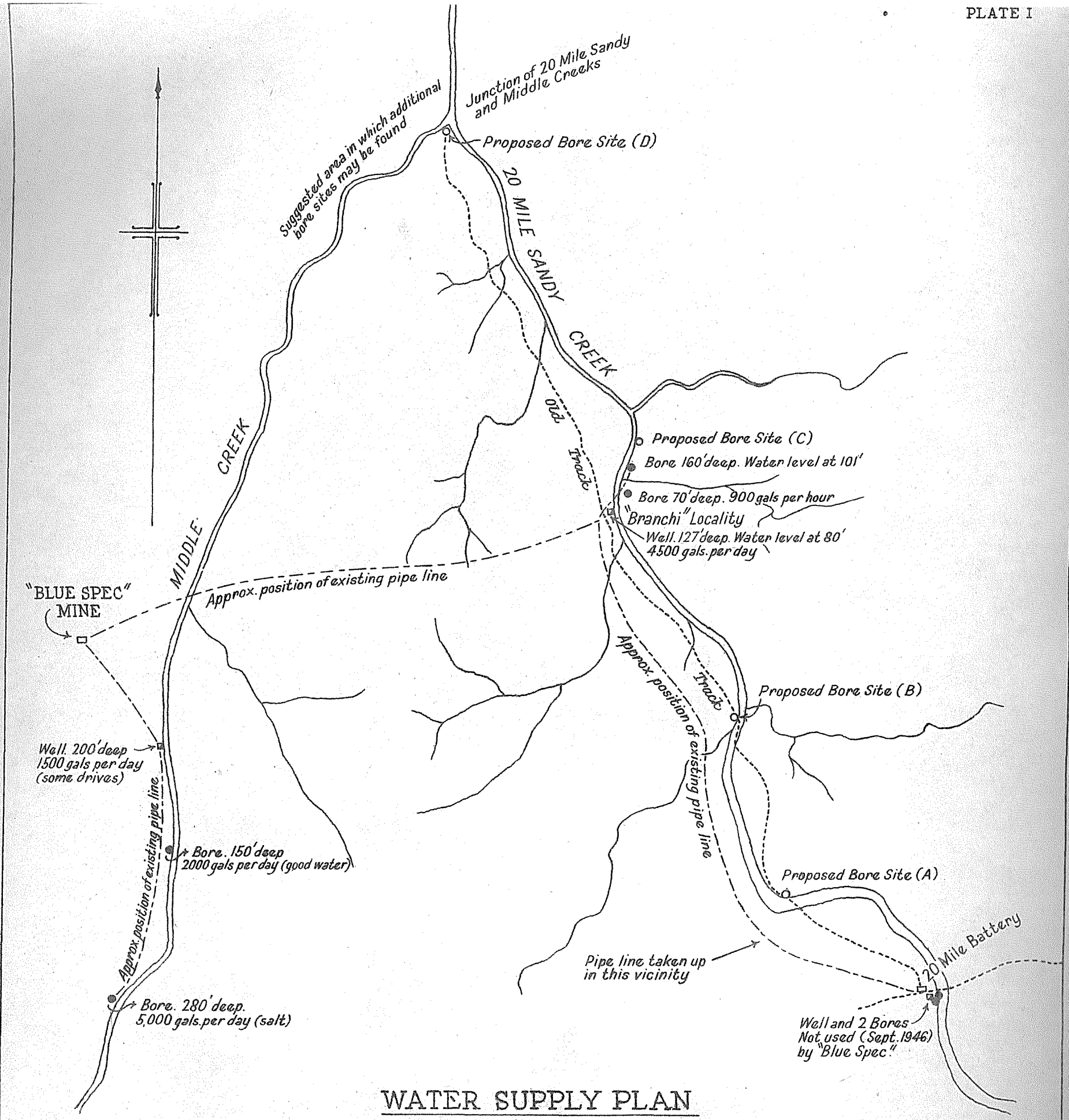
The extreme fineness of grain of this sand is unusual, and the occurrence was investigated in March and again in September, 1946.

Locality.

The silica sand is exposed in the bottom of a conical shaped sink hole some 12 feet deep and about 14 feet top diameter approximately in the centre of Victoria Location 8733, about six miles south-west of Coorow. A road from Coorow passes about 20 chains west of the sink hole. The country is undulating sand plain covered with dense low scrub and some belts of timber. Coorow is 162 miles by rail north of Perth.

General Geology.

The country surrounding Loc. 8733 is broadly undulating scrub-covered sand plain on a Pre-Cambrian basement of granite, gneiss, quartzite and metamorphic rocks, all intruded by epidiorite dykes. It forms part of the general West Australian peneplain and lies at



WATER SUPPLY PLAN

Showing Existing Pipe Lines, Main Useful Wells & Bores

Proposed New Bore Sites

"BLUE SPEC" MINE

Approx. 16 miles E. of Nullagine

Scale 60 chains to an inch

60 0 60 120

To accompany report on Water Supply, "Blue Spec" Gold & Antimony Mine by H. A. Ellis, Sept. 1946.

a general elevation of about 200 feet above sea level. Practically all of the loose, grey to white sand covering the area was formerly drift sand, now fixed in low dunes by vegetation. Some of it on the flat areas on the crests of major undulations is residual, forming the upper layer of the typical West Australian sand plain soil profile.

Circumstances of Occurrence of the Fine Silica Sand.

The fine sand is exposed at the bottom of a sink hole previously described and is overlain by 10 feet of coarse red sand. A small cave of some 8 feet long by 2½ feet high by 5 feet wide extends to the east from the bottom of the hole, and a face of fine, white, compact and hard silica sand is exposed on the walls. On first inspection the only obvious silica content is long thin patches of a coarser silica grit irregularly dispersed through the dense white mass which itself could be easily mistaken for kaolin. The surrounding red cover sand is being gradually washed into the hole and it will not be long before the exposure is filled in.

The greater part of the area exposed consists of this compact, white, extremely fine silica sand which is quite angular under the microscope.

Gently undulating to flat sandy surfaces extend for a considerable distance to the north-east, north and north-west of the sink hole, but the country rises quickly to the south where travertine limestone occurs in conjunction with a basic dyke.

When first visited in March, 1946, the loose sandy surface of the sand plain was difficult to negotiate by ordinary motor transport and was far too dry to enable any test holes to be dug with a post-hole auger.

In September, 1946, a series of uncased post-hole auger holes was put down in the damp sand after the winter rain. These were placed as follows:—

Hole No.	Magnetic bearing and distance from sink hole.	Section.	Remarks.
1	312° 122 feet	0ft. to 11ft.: Red and slightly clayey sand	
		11ft. to 14ft.: White quartz grit—would not stick to auger	Not fine enough to be the same as the sand in the bottom of the sink hole.
2	337° 208 feet	0ft. to 8ft.: Yellow sand	
		8ft. to 8ft. 6in.: White quartz grit	Could not get auger further down owing to hard nature of the coarse grit.
3	118° 138 feet	0ft. to 7ft. 6in.: Red clayey sand	Bottomed on boulders of travertine limestone.
4	35° 117 feet	0ft. to 7ft. 6in.: Yellow sand	Still in grit at 10ft.—auger would not hold the load or work into the compact grit
		7ft. 6in. to 10ft. Fine yellow quartz grit	

The fine white silica sand was not reached in any of the holes, and the attempt to ascertain the extent of the deposit was unsuccessful because the post-hole auger is not a suitable tool to penetrate the overlying grits.

More elaborate equipment is necessary to effectively bore this ground to prospect for the extensions of the deposit—if any.

Nature of the Fine Silica Sand.

Two samples were collected from the exposure in the bottom of the sink hole. In sample B the obviously coarser patches of quartz grit were omitted from the sample cut. These were examined by the Mineral Section, Government Chemical Laboratories with the following results:—

Lab. No.	Sample.	Results of Examination.
1403	From Victoria Loc. 8733, about 6 m. S.W. of Coorow, Midland Railway A.	Grit consisting mainly of quartz with a little altered felspar and clay substance, small amounts of organic matter and sodium chloride and traces of zircon and apatite. The quartz particles vary in size from less than 0·0024 inch to about 0·125 inch with a preponderance of the coarser grains. Silica, SiO_2 96 per cent. approximately. Water suspension, pH 7·40.
1404	B.	Fine grit consisting mainly of quartz with a little altered felspar and clay substance and small amounts of organic matter, sodium chloride and limonite. Silica, SiO_2 94 per cent approximately. Water suspension, pH 7·58. Portion of the sample was gently crushed in a wedgewood mortar and sized on standard Tyler screens with the following result:—

	Per cent.
Refuse 115 mesh	0·10
pass 115 mesh refuse 200 mesh	1·00
pass 200 mesh	98·90
	100·00

Remarks: No alunite was detected in either of the above samples.

Origin of Deposit.

The material has been deposited from running water under conditions of varying load carrying capacity. It is suggested that it was formed during sheet flooding under an arid cycle of erosion.

It is difficult to explain how the material becomes exposed in a sink hole, which requires the existence of some soluble or very loosely consolidated material below the more compact fine silica sand bed for its formation. It may be that the deposit is underlain by travertine limestone derived from the weathering of the basic dyke which outcrops strongly some 150 to 200 feet to the south.

Economic Considerations.

If material of this grade and composition is required by industry the following factors are relevant—

(1) The material would have to be hauled approximately 6½ miles by road to the nearest railway siding situated 162 miles by rail from Perth.

(2) There is at least 10 feet of worthless sand cover and the test holes show that this is more than 14 feet thick in one place.

(3) At present (October 1946) no information exists by which the probable extent of the deposit can be estimated. It would need systematic boring to secure this information.

(4) The grade of the deposit is not uniform as shown by the present exposure. Screening would be necessary to ensure a product of uniform grade if the deposit were proved to be of workable dimensions.

H. A. ELLIS,
Government Geologist.

22nd October, 1946.

REPORT ON FUTURE DEVELOPMENT OF THE EDNA MAY (W.A.) AMALGAMATED GOLD MINES.

Main Workings—G.M.Ls. 3308, 3447, 3490, 4038, Yilgarn G.F., W.A.

By H. A. Ellis, B.Sc., A.O.S.M., Geological Survey of W.A.

Introduction.

An examination of the above mine was carried out during the period July 21st-August 2nd, 1945, at the request of the owners, with the object of advising on what lines, if any, future search for payable ore should proceed.

The stage as been reached in this mine when the reserves of payable ore in known ore-bodies are nearing depletion owing to impoverishment in depth, and to the lack of payability of certain portions of the reefs in the levels already worked. The mine plans and critical sections of the underground workings were examined during the investigation, and the writer is greatly indebted to Mr. W. Cayzer, mine superintendent, for the invaluable assistance rendered by him during this investigation.

General Geology.

No identifiable rocks outcrop on the leases, and the mine workings provide the only information enabling the distribution and attitude of the principle rock types to be approximately delineated. The general geological picture in its economic aspect consists of a belt of replacement biotite gneiss—the "Edna May Gneiss"—running about N. 80° W. and S. 80° E. and of varying thickness (see later), flanked to the north and south by schistose and massive amphibole rocks—the Greenstones; the whole series dipping N. 10° E. at an average angle of about 45°. Mining operations have proved the existence of the gneiss over a length of 2,100 feet on the footwall side, with gneiss continuing east and west. The main productive zone occupies about 1,200 feet in the central section of this length.

Earth movement subsequent to the formation of the gneiss fractured and sheared the latter in a curved fracture pattern, permitting the entry of pegmatitic material and subsequent siliceous mineralising solutions forming the various auriferous reefs worked of their gold content.

Subsequent to the formation of the gold reefs, the gneiss has been fractured in a series of major joints which traverse the reefs, and which have provided access to a swarm of dykes consisting of pegmatitic granite, granite, aplite and one basic dyke cutting through everything. All joints were not occupied by dyke material, and these unoccupied joints carry large quantities of underground water. Beyond their water bearing capacity, these large joints and their associated dykes have no economic influence on the gold reefs, except that where they cut through the reefs so much ore has been lost and so much dilution occurs. Except at the 810ft. level of the Edna May shoot, they are not of serious dimensions. The dykes are NOT accompanied by faulting. The Edna May Gneiss contains all of the productive gold reefs so far discovered, and the greenstones are not known to contain any. The fracture system has failed to penetrate the greenstones, and the quartz-felspar-biotite aggregation which comprises the bulk of the gneiss, though possessing a well marked gneissosity prior to being subjected to fracture-forming differential movement between the flanking rocks, has acted as a comparatively brittle member, fracturing across planes of gneissosity under tension, and shearing parallel to planes of gneissosity under lateral pressure.

It is important to note that in general the boundary between the gneiss and footwall greenstone is quite sharp, and in the one unoxidised exposure of the contact between the gneiss and hanging wall greenstone the boundary was also sharp, in both instances being accompanied by a development of fine scaly biotite in or on the greenstone. Quartz reefs sometimes occur along these junctions, showing that differential movement was able to take place between the rock types.

The Width of the Edna May Gneiss.

The width here referred to is the plan width, and below is set out the extent of what is known in this respect, based on plan positions of known boundaries and short projections of boundary lines (underground). These approximations are thought to be correct within 20 feet when boundaries have had to be projected.

Reduced Level at which Plan width measured.	Plan Width.	Boundary Projected.	Nearest N–S co-ordinate on Mine Plan.
— 375 ft.	340′	No	1,100′ E.
— 73 ft.	410′	No	400′ E.
— 225 ft.	440′	Yes	400′ E.
— 290 ft.	300′	Yes	100′ W.

The main Edna May shoot runs approximately along N.-S. co-ord. 200 feet E.

The hanging wall boundary is known for sure over a length of 1,150 feet in five places only, all at different reduced levels at varying intervals along the boundary, namely -73 feet, -225 feet, -260 feet, -290 feet and -375 feet, while the footwall boundary is known at many points from -60 feet to -575 feet R.L. over a length of 2,100 feet, and a partially complete but useful contour plan can be prepared of the footwall gneiss-greenstone boundary.

What is known about the true width is as follows:—

Reduced Level of known point on hanging wall gneiss-greenstone boundary from which true width is measured at right angles to dip of footwall boundary.	True	Degree of Estimate.	Nearest N-S co-Plan.
— 375 ft.	230′	Reliable.	1000′ E.
— 73 ft.	310′	,,	400′ E.
— 225 ft.	310′	,,	400′ E.
— 260 ft.	250′	Approx.	100′ E.
— 290 ft.	200′	,,	100′ W.

It will be seen that the attitude and shape of the hanging wall greenstone-gneiss contact is very imperfectly known, and that a considerable amount is known about the dip and shape of the footwall gneiss-greenstone contact.

The Fracture Pattern.

The fracture pattern consists essentially of two components, one transverse to the gneissosity hinging on the gneiss-greenstones contact, and linking up in a gradual curve with the other component running parallel to the gneissosity some distance out from the greenstone, the whole forming an anticlinal pattern in plan.

The key to the origin of this pattern would appear to lie in the footwall gneiss-greenstone contact immediately under the Edna May Shoot, in the levels above 575 feet. This shape indicates that the horizontal components of the differential movements which caused this drag-folding was to the west on the hanging wall, and to the east on the footwall side of the gneiss, causing a ridge of greenstone some 50 feet high, with the western slopes steeper than the eastern slopes, to be apparently thrust into the gneiss. This ridge pitches in a general direction of N. 10° W. at about 45° and has some slight bends in its crest.

This moulding took place under conditions which would not permit of rock fracturing, but the subsequent elevation of the rock masses into the zone of fracture was probably accompanied by the same tangential compression forces which caused the schistosity

to form in the greenstone and in the rock now replaced to gneiss—the "Edna May" gneiss.

Under the influence of this pressure, the Edna May gneiss has sheared parallel to the gneissosity under compression, and has fractured under tension oblique to the gneissosity, particularly over the prominent ridge of greenstone under the main Edna May shoot. This is a possible explanation of the mode of formation of the Edna May fracture, and a similar type of fracture pattern occurs in the South Reef, some 350 feet east of the Edna May, although in this case it is not nearly so certain that the reef is underlain all the way by a prominent, strong fold, owing to lack of definite information about the footwall contours above the 375ft. level.

The other structures to the east which have contained payable quartz reefs have much the same pattern, but are not clearly associated with footwall bulges, and are not nearly as strongly defined as are the Edna May and the South Reefs.

All of the structures have a curving pitch line in plan, the direction of which is N. 20° W. down to the 225ft. level in the case of the Edna May Reef, then N. 10° W. down to the 810ft. level. The South Reef, the next to the east, pitches in a direction of N 50° W. down to the 225ft. level, and then curves gently to N. 30° W. down to the 566ft. level. The structures further to the east show the same general tendency to a curving pitch line and a convergence in a general north-westerly direction.

In the case of the Edna May and South Reefs, which have limbs developed approximately parallel to and near the footwall gneiss-greenstone boundary, the pitch of the fracture structure is greater than the dip of the footwall greenstone, and this footwall limb is truncated in the vicinity of the 300ft. level; the reefs continuing in depth with a strike of N. 20° E. (tension) to N. 60° E. (compression) without the accompanying strongly marked curved hinge near the footwall greenstone.

The fracture pattern in general is one that has given rise to payable shoots on those portions of the reefs which cross the planes of gneissosity in the Edna May gneiss (the tension fractures), with generally wide developments of quartz (up to 25 feet in the case of the Edna May shoot), and to relatively thin quartz development with unpayable values in the reefs parallel to and dipping with the gneissosity (the compression shears).

Possible Repetitions.

The principal possibility of a repetition of the fracture pattern in the hanging wall section of the Edna May gneiss rests on the following deductions:—

(1) That the footwall gneiss-greenstone contact is not an intrusive one, but one whose shape has been determined by the lateral limits to granitisation in a direction at right angles to the strike, and by folding caused by compression and differential movement.

(2) That the fracture pattern was primarily induced by a continuation of differential movement in the same direction as caused the drag-folding or buckling of the footwall gneiss-greenstone contact.

(3) That a corresponding drag-folding or buckling took place in the hanging-wall greenstone-gneiss contact in the direction of pitch opposite the footwall bulges.

The main hope lies in a repetition on the hanging-wall greenstone-gneiss contact of the prominent drag-fold or bulge known to occur under the Edna May shoot, whereby a ridge of greenstone would protrude into the gneiss, and which, if it did exist, could produce another tension fissure comparable in size to the Edna May fissure, under the stresses applied at the same time as the formation of the main known productive fracture pattern near the footwall gneiss-greenstone contact.

Such a fracture pattern if it did exist, should have the same general characteristics as the one already known, but would be opposite in shape and would lie not directly opposite the known pattern but to the west of the pitch line of the Edna May shoot. The prominent anticlinal bend would face east, and the pattern would tend to be truncated in the upper zones by the greenstone hanging-wall and to be more fully developed at the deeper zones. The testing of this geological possibility is dealt with under the heading "Future Underground Prospecting" (p. 8).

The existence of ore in the fracture pattern is contingent upon there having been a sufficient supply of ore-bearing solutions to operate in the fracture pattern, and with the type of mineralisation characteristic of the Edna May reefs, namely, the siliceous replacement of original pegmatite dykes, the writer's experiences elsewhere in Western Australia indicates that this is perhaps the main consideration limiting the possibility of recurrence of ore.

The Present Development and Underground Prospecting Position—July, 1945.

Development.

All known ore bodies have been fully developed to the limits of payability and known reserves are approaching exhaustion. In many cases the reef formations are wide and are known to continue on the strike or underfoot, but do not contain payable values.

Impoverishment in depth and the gradual swing of the ore-bodies into the compression shears which have proved to be far less valuable than the ore in the tension fractures, is the cause of unpayability in the main Edna May and South Reefs, while in those further east, the same influences are combined with a general weakening of the structure in the direction of pitch.

Underground Prospecting.

An examination of the mine plan shows that the ground east of the main Edna May Reef has been systematically and thoroughly tested by diamond drill holes and cross-cuts, obviously sited by a management possessing a full appreciation of the type of structure in which the reefs occur.

It can be confidently stated that no possible reefs of importance have been overlooked in this prospecting work down to the 566 feet level.

Similarly, the footwall gneiss-greenstone zone west of the Edna May reef has been tested by boreholes and drives down to the 300 feet level for a considerable distance, with negative results as far as payable reefs are concerned. The hanging-wall greenstone-gneiss contact has been reached at an R.L. of -375 feet about 900 feet east of the main Edna May Reef in a cross-cut, and again some 200 feet west of the Edna May Reef in an underground diamond drill hole at an R.L. of about -290 feet, without revealing payable formations. The "Deeps" air shaft, and the "New Shaft" penetrate the hanging-wall greenstone-gneiss contact, and a considerable thickness of gneiss below it, without disclosing the presence of payable reefs in the upper gneiss zone. A cross-cut north from the 385 feet level on the Edna May Reef penetrates a considerable thickness of gneiss which is barren of payable quartz reefs.

None of these penetrations, however, covers the presupposed favourable zone near the hanging-wall on, or just west of, the pitch of the Edna May shoot, at a favourable depth.

The prospecting of the Edna May shoot at the 810 feet horizon revealed that the ore channel had been usurped by an intrusive dyke of reported pegmatitic nature, of a proved minimum width of 40 feet, with the hanging-wall of the dyke not exposed. This dyke could easily usurp upwards of 300 feet of ore channel

according to its attitude, and no attempt has been made to prospect the shoot below this horizon.

Future of Underground Prospecting.

This should be confined in the first instance to testing by means of underground horizontal diamond-drill holes, the conception of the possible occurrence of ore in a repetition of the Edna May fracture, close to the hanging-wall greenstone-gneiss contact in the direction of and just west of the pitch of the Edna May structure.

The best horizon from which to undertake this work is from the 566 feet level on the Edna May Reef.

A series of three holes is suggested, the first one to be horizontal and on a bearing of 325° from a point on the 566 feet level as near as possible to a point 200 feet E. and 500 feet N. of datum. Should this hole encounter two limbs of quartz or fail to strike any quartz, a second horizontal hole should be drilled from the same point on a bearing of 305°. A third horizontal hole from the same point on a bearing of 360° would complete a thorough testing of the hanging-wall greenstone-gneiss contact in what is thought to be a possible favourable position. Each of these holes may be up to 400 feet long. Success in these holes would pave the way for further prospecting of the hanging-wall greenstone-gneiss contact, and any resulting successful development would naturally lead in time to the prospecting of the Edna May Deeps from new openings.

Prospecting for the continuation of the Edna May shoot in depth beyond the intrusive dyke at the 189 feet level can only be accomplished by unwatering the mine below the 566 feet level, or by deep diamond-drill holes from the surface.

The shortness of the shoot, the history of gradual impoverishment in depth, the lack of knowledge about the dimensions of the intrusive dyke, and the vagaries of deep diamond-drill holes make it far too speculative an undertaking to be entered into by either method at present, and further prospecting of this structure in depth cannot be recommended.

REPORT ON LIMESTONE DEPOSIT—LAKE MUIR.

Approximately 45 miles East-South-East of Manjimup, South-West Division.

Approx. Latitude 34° — 30′ South.
Approx. Longitude 116° — 45′ East.

By H. A. Ellis, B.Sc., A.O.S.M., Government Geologist.

During 1946, a sample of calcareous material was collected by Mr. Muir from a temporary quarry reserve immediately south of Nelson Location 7097 (Lands Department Litho. 443/86), situated on the eastern side of Lake Muir, approximately 45 miles east-south-east of Manjimup. The sample was forwarded to the Government Mineralogist and Analyst by the secretary of the Manjimup Road Board, and the results of the analysis indicated that the material submitted was a high grade limestone, suitable for agricultural purposes or for burning to form builders' lime.

Representations were made to the Mines Department by the Manjimup Road Board for an inspection to be made. This was done by the writer on November 14 and 15, 1946, Mr. Muir being available in the locality to indicate where he had collected the sample from.

Result of Examination.

The sample collected by Mr. Muir represented residual fragments of "cap-stone" or travertinous limestone of high grade, occurring at or near the crest of a sand dune, now carrying a dense growth of wattle scrub and eucalypt forest trees. Material of this grade does not exist in commercial quantity.

Topography and Geology.

The country in the vicinity of Lake Muir is flat to undulating, and is covered with a dense growth of either eucalypt forest or sand plain scrub. The soils consist of grey and white, very sandy loam, or of a pisolitic gravel. Durierust of the typical pisolitic ferruginous cement type frequently referred to as laterite is common and outcrops of basement rocks were not seen. The underlying rock is possibly gneiss or granite. The lacustrine area now occupied by the large lake, Lake Muir (appro. 6½ miles long by 2½ miles wide), must have been devoid of vegetation at some stage of its history. Wind action has been able to build up a prominent sand-dune ridge running north and south to a height of from 20-25 feet above the general level of the surrounding, more or less, flat country between it and the eastern shore of the lake. This ridge is now about one mile long and about 200 feet wide at the base, and is covered with a dense growth of scrub and large forest trees (Yate).

The soil is grey to brown in colour and very sandy. Occasional loose boulders of travertine limestone occur at or near the crest throughout its length, and loosely cemented calcareous sandstone boulders are seen occasionally.

There are no cliffs of limestone, nor are there any continuous surfaces of calcareous material, or continuous outcrops of any rock along the sides of the dune. There is no evidence suggesting the existence of sink holes.

In all probability the calcium carbonate content of the dune is of chemical origin and the shell fragments mentioned in the mineralogist's report could be remnants of terrestrial gastropods.

Mr. Muir has been a local resident of this area for many years and does not know of any better outcrops of limestone than the ones visited in his company.

The deposit is not of commercial importance. The Government Mineralogist reports as below on samples collected by the writer from this locality:—

Analyses of Two Samples of Calcareous Material for the Government Geologist.

Lab. No.: 5577/46.

Locality: From east side of Lake Muir, approx. 45 miles E.S.E. of Manjimup.

Mark: Lake Muir No. 1.

Partial Analysis:

Lime, CaO	36.77 per cent.
Magnesia, MgO	0.51 per cent.
Insoluble in acid	31.60 per cent.

Lab. No.: 5578/46.

Locality: From east side of Lake Muir, approx. 45 miles E.S.E. of Manjimup.

Mark: Lake Muir No. 2.

Friable sandstone consisting almost entirely of quartz sand cemented with calcite. Minute grains of ilmenite, a few shell fragments and a little clay are also present.

The quartz grains of all sizes are largely rough-surfaced and subangular; a little angular material and odd grains of well-rounded form are present.

Most grains are free from inclusions while some carry minute mineral inclusions; no gaseous inclusions were noted.

The grains are cemented with microcrystalline calcite, mostly attached directly to the sand-grain itself. A small proportion of the grains show an encrustation of banded calcite apparently formed upon the sand-grain prior to its incorporation in the rock.

Acid treatment of the sandstone yielded 73 per cent. clean quartz sand and 2 per cent. clay.

Mechanical Analysis:

The rock was crushed using a rubber-headed pestle and graded on Tyler Standard Sieves.

Examination of the graded sand showed a small proportion of the coarser particles to consist of firmly cemented aggregates.

The calcite and clay were removed from the sand by treatment with dilute acid and washing with water. The acid-cleaned sand was then regraded.

Tyler Sieve.

Meshes per inch.	Size of opening in mm.	Crushed rock.	Acid-cleaned Sand (clay-free).
		%	%
Refuses 32	·500	8·6	7·4
Refuses 60	·250	51·7	49·8
Refuses 100	·149	27·1	31·7
Refuses 200	·074	8·2	10·5
Passes 200	....	4·4	0·6
		100·0	100·0

Sample No. 1 is a representative sample from widely spaced boulders of cap rock found on the surface of the dune over a length of one mile.

Sample No. 2 is a representative sample of the calcareous sandstone which forms isolated harder patches along the ridge.

H. A. ELLIS,
Government Geologist.

January 10th, 1947.

BORING FOR COAL ON M.L. 324, EWINGTON, COLLIE COALFIELD.

Summary Report.

(1) The information contained in this report applies to an area of 10 chains by 6 chains in the extreme north-west corner of M.L. 324, in the vicinity of the old tunnel. The grant of money was inadequate for work elsewhere on the leases originally held by Hard Coals Ltd.

(2) Eleven holes bored—the total footage being 797 feet 4 inches and the average depth approximately 72 feet 6 inches. Coal was intersected in six bores. Boring was commenced on 9/1/46 and completed on 7/3/46.

(3) The total expenditure is approximately £585, which includes the purchase of approximately 120 feet of 5 inch casing.

(4) The tonnage of coal likely to be available, in the area drilled, at a depth of not exceeding 75 feet is 15,500 tons, made up as follows:—

	tons.
Proved	7,000
Probable	6,000
Possible	2,500
	15,500

In making this estimate seams having an average thickness of less than two feet have been neglected, and it has been assumed that the coal can be worked to within 20 feet of the surface.

(5) The coal referred to in paragraph 4 above is contained in one seam—the main seam—having an average thickness not exceeding 6 feet. The maximum thickness is 9 feet 2 inches in number 5 bore, but this includes two sandstone bands having a total thickness of 18 inches and also some thin shale bands. The maximum thickness of clean coal is 7 feet 2 inches in number 3 bore. The minimum thickness is 3 feet 6 inches in number 6 bore. The seam has lensed out in both directions along the strike, and it is likely that it will not continue far down the dip.

(6) From 2 feet to 10 feet above the main seam there is a second seam, which has an average thickness of less than 2 feet, and a maximum thickness of 2 feet 2 inches in number 5 bore. This seam is probably not continuous over the area drilled. It has been neglected in making the tonnage estimate.

(7) Two seams below the main seam were intersected in number 4 bore. The upper of these two seams had a thickness of 2 feet 1 inch and the lower a thickness of 1 foot. Both seams have lensed out in number 6 bore, although the shale horizon, with which they are associated continues through.

(8) All other seams intersected had a thickness of only a few inches.

(9) Information from the bores and the results of analyses are summarised in tables 1 and 2, plate II.

(10) Because of the methods of boring and sampling it is impossible to express an opinion regarding the nature of the coal in situ. The results of analyses show, however, that the calorific value of the coal, calculated to a moisture and ash free basis is similar to those of coals from elsewhere in the field.

(11) Recommendations—

(i) In view of the small tonnage of coal likely to be available, viz., 15,500 tons, no further work is recommended in the area drilled.

(ii) As the shale horizon, with which the main seam is associated, is still continuing southward some boring south of the area already drilled and along the strike of the main seam is recommended.

(iii) Further drilling on M.Ls. 324, 325, 326 and 327 is recommended. Shallow coal is known to occur in three other places on these leases.

(iv) If more drilling is approved this should be commenced as soon as possible to avoid too much work here during the winter months.

PORT HEDLAND WATER SUPPLY—FINAL REPORT.

(1) In November, 1945, the writer visited Port Hedland to investigate two schemes to supply Port Hedland with fresh water—the Turner River scheme and the 12-Mile Creek Scheme. In this work the writer was associated with Mr. S. Byass, then resident engineer for the North-West. Water from various localities was tested in the field, and a number of samples were collected for examination in Perth. Because of the lack of transport, these samples did not reach Perth until late December, and were not delivered to the Chemical Laboratories until 4th January, 1946. Analyses were completed by February, 1946.

(2) An interim report based on field observations and field analyses was submitted in November.[1] In this report it was recommended that the Turner River Scheme, as originally proposed, be abandoned. An area higher up the Turner River was recommended for testing. It was also recommended that further tests be carried out at 12-Mile Creek.

(3) Information regarding the samples, analyses made at the Government Chemical Laboratories, and field analyses are set out in the attached table. It will be seen that for the more saline water the principal salt present is sodium chloride, while for the less saline waters other salts predominate. There is close agreement between chlorides, calculated as sodium chloride, as determined in the laboratory and in the field.

(4) Samples taken in the vicinity of Boodarie Soak, the site of the previously proposed water supply scheme for Port Hedland, contain from 52 to 329 grains per gallon of total salts.

(5) Samples taken from wells A, B, C and Tom's Well, at the 12-Mile Creek, contain from 20 to 92 grains per gallon of total salts.

(6) Samples taken from the Turner River sands (sample No. 18) and from wells (Numbers 17, 19, 20) above the point where the river divides into the east and west branches contain from 18 to 29 grains per gallon of total salts.

(7) The additional information now available does not upset any of the conclusions previously arrived at, and the recommendations made in the interim report are therefore confirmed.

R. A. HOBSON,
Geologist.

25th March, 1946.

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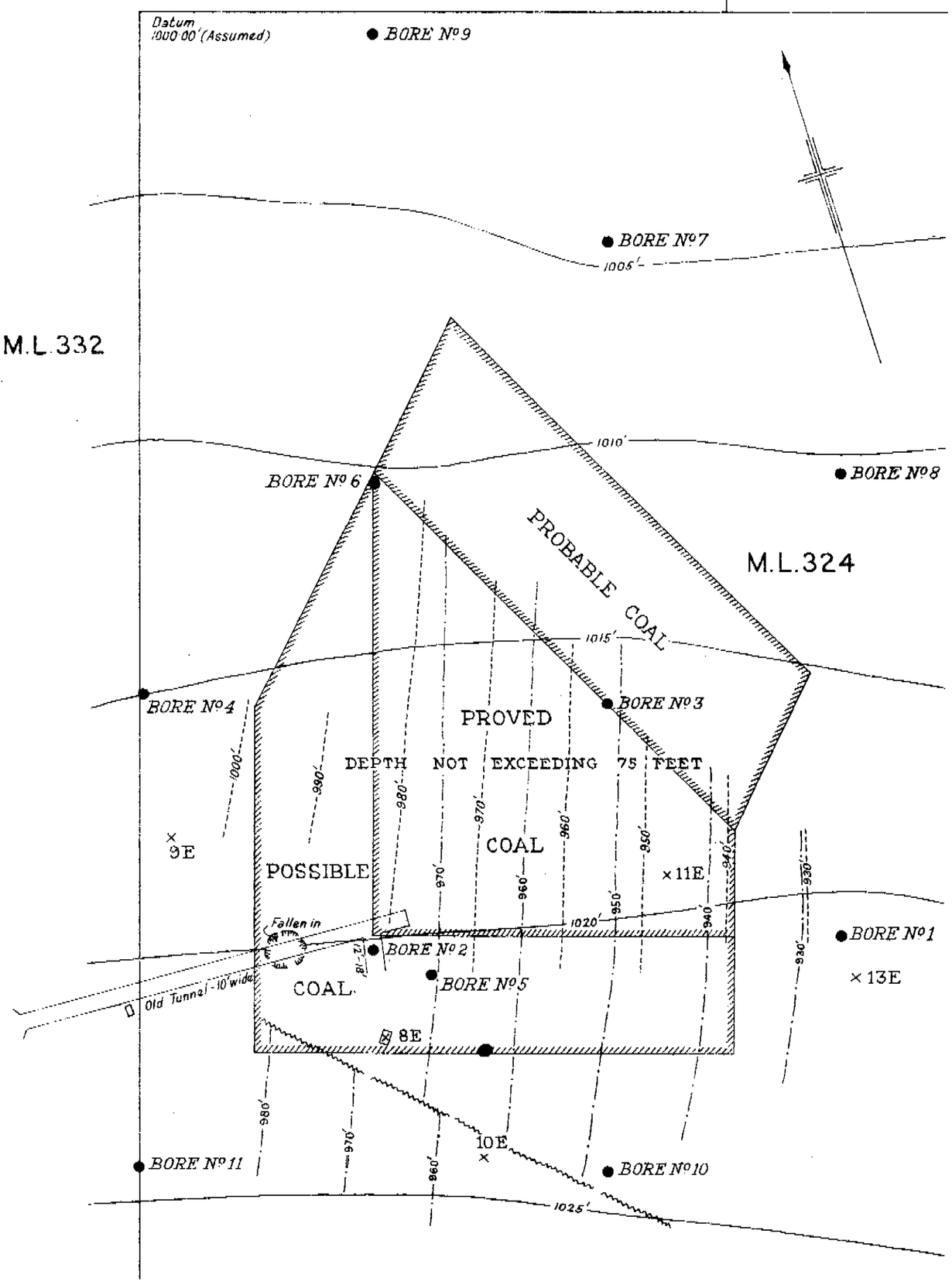
[1]Hobson, R. A., Port Hedland water supply, interim report. Ann. Prog. Rept. Geol. Survey, 1945 (awaiting publication).



REFERENCE

Bores drilled 1946	● Bore No 1
Previous bores by Ewington Coal Mining Co. Ltd	× 10 E
Surface contours	——— 1005' ———
Base of main coal seams	------ 970' ------
Base of shale horizon associated with the main coal seams.	— · — 960' — · —

LOCALITY MAP

Scale · 40 chains to an inch

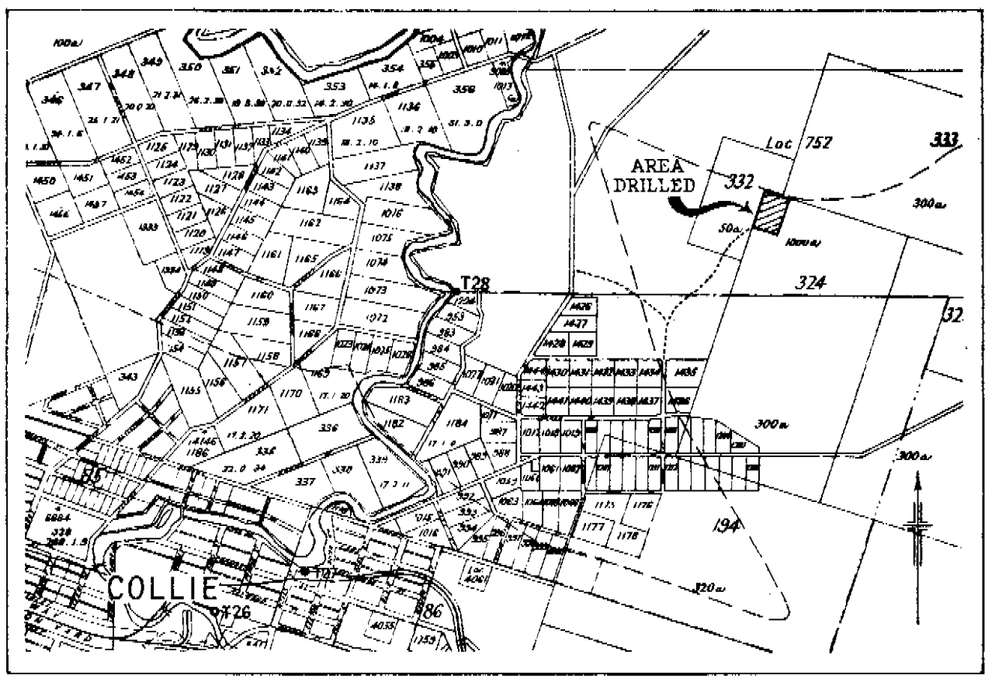


TABLE I.

BORE INFORMATION.

Bore No.	R.L. Assumed datum.	Commenced.	Completed.	Total depth.	Coal. From.	Coal. To.	Coal. Thickness.	Coal. Samples.	Notes.
				ft. in.	ft. in.	ft. in.	ft. in.		
1	1021·0	9-1-46	11-2-46	110 0	22 0	22 3	...	... ...	Thin partings of doubtful coal over a thickness of 3in.
					73 0	73 6	0 6		
					78 3	78 6	0 3		
					86 6	86 9	0 3		
					89 3	89 6	0 3		
					89 9	95 3	5 6	90ft. 8in.—92ft. 8in., 92ft. 8in.—94ft. 9in., 94ft. 9in.—95 ft. 3in.	
2	1,020·3	21-1-46	21-1-46	30 6	28 0	29 6	1 6	... ...	Coal decomposed.
3	1,016·6	22-1-46	28-1-46	85 5	44 6	46 0	1 6	45ft. 5in.—46ft. 0in.	
					54 3	61 5	7 2	54ft. 11in.—56ft. 11in., 56ft. 11in.—58ft. 11in., 58ft. 11in.—60ft. 11in.	
4	1,014·7	29-1-46	31-1-46	74 9	35 9	37 10	2 1	36ft. 4in.—37ft. 4in.	
					45 6	46 6	1 0		
					56 6	56 7	0 1		
5	1,020·8	1-2-46	5-2-46	70 0	29 10	32 0	2 2	30ft. 11in.—31ft. 11in.	
					36 7	45 9	9 2	37ft. 5in.,—39ft. 5in. 39 ft. 5in.—41ft. 5in., 41ft. 5in.—42ft. 5in., 43ft. 5in.—45ft. 6in.—	Includes two sandstone bands, with a total thickness of 18in. and also some shale bands.
					60 8	60 10	0 2		
6	1,010·4	14-2-46	19-2-46	87 11	17 0	18 6	1 6	... ...	Coal partly soft and decomposed.
					20 6	24 0	3 6	20ft. 11in.–22ft. 11in., 22ft. 11in.–23ft. 9in.	
7	1,004·4	20-2-46	20-2-46	50 3	...	...	...		
8	1,010·4	21-2-46	25-2-46	98 9	...	...	...		
9	1,000·8	26-2-46	27-2-46	60 1	...	...	...		
10	1,024·3	28-2-46	5-3-46	86 11	53 7	53 9	0 2		
					55 3	55 6	0 3		
11	1,024·2	6-3-46	7-3-46	42 9	...	...	...		

TABLE 2.

RESULTS OF ANALYSES.

Bore.	Sample Depths.	Lab. No.	Proximate Analyses. On air dry basis. Moisture.	Volatile Matter.	Fixed Carbon.	Ash.	Ref. to footnote.	On moisture free basis. Volatile Matter.	Fixed Carbon.	Ash.	Calorific value by bomb calorimeter. Air dry B.T.Us.	Moisture free B.T.Us.	Ratio fixed Carbon to volatile matter.	Notes.
			%	%	%	%		%	%	%				
1	90 ft. 8 in.–92 ft. 8 in.	732/46	13·51	24·06	51·64	10·79	A	27·82	59·71	12·47	9,773	11,299	2·15:1	
	92 ft. 8 in.–94 ft. 9 in.	733/46	11·73	23·53	40·52	24·22	A	26·66	45·90	27·44	8,290	9,402	1·72:1	
	94 ft. 9 in.–95 ft. 3 in.	734/46	5·81	19·29	23·54	51·36	A	20·48	24·99	54·53	5,054	5,367	1·22:1	Sample may have contained a small amount of sand from the underlying sandstone.
3	45 ft. 5 in.–46 ft. 0 in.	384/46	7·29	25·08	54·21	13·42	B	27·05	58·47	14·48	10,147	10,945	2·16:1	Sample contaminated by sand from the underlying sandstone. See footnote.
	54 ft. 11 in.–56 ft. 11 in.	415/46	9·47	25·41	54·40	10·72	A	28·07	60·09	11·84	10,405	11,493	2·14:1	
	56 ft. 11 in.–58 ft. 11 in.	416/46	11·60	26·18	53·30	8·73	A	29·65	60·46	9·89	10,453	11,827	2·04:1	
	58 ft. 11 in.–60 ft. 11 in.	417/46	11·75	24·52	49·40	14·32	A	27·79	55·98	16·23	9,448	10,706	2·01:1	
4	36 ft. 4 in.–37 ft. 4 in.	803/46	10·95	25·67	50·29	13·09	A	28·54	55·90	15·56	9,768	10,854	1·96:1	
5	30 ft. 11 in.–31 ft. 11 in.	668/46	13·91	31·47	45·48	9·14	A	36·56	52·83	10·62	9,312	10,817	1·44:1	
	37 ft. 5 in.–39 ft. 5 in.	669/46	14·04	24·84	50·30	10·82	C	28·90	58·52	12·58	9,633	11,206	2·02:1	As originally collected the sample contained some shale which was removed by washing in the field. Sample also contained some sand, due to the presence of a sandstone band at 35 ft. 9 in. See footnote. Note shale and sandstone bands in coal.
	39 ft. 5 in.–41 ft. 5 in.	670/46	7·45	26·04	54·63	10·98	C	29·11	59·03	11·86	10,411	11,249	2·03:1	Sample contained some sand, due probably to the presence of sandstone bands. See footnote.
	41 ft. 5 in.–42 ft. 5 in.	671/46	9·81	20·79	40·58	28·82	A	28·05	44·99	31·96	7,066	8,832	1·05:1	
	43 ft. 5 in. 45 ft. 6 in.	672/46	13·54	22·84	47·68	15·94	A	26·42	55·15	18·43	8,929	10,327	2·09:1	
6	20 ft. 11 in.–22 ft. 11 in.	792/46	15·51	23·56	40·62	20·31	A	27·88	48·08	24·04	7,706	9,121	1·72:1	
	22 ft. 11 in.–23 ft. 9 in.	793/46	15·86	25·40	49·52	9·22	A	30·19	58·85	10·96	9,576	11,380	1·95:1	

Footnotes :—The following comments were made by the Government Mineralogist and Analyst :—

A.—Owing to the condition of these samples when received necessitating air drying for several days prior to crushing for analysis, no estimate can be made of the moisture content of the original coal nor of the extent the constitution of the coal has been changed by the procedure adopted for collecting the samples and subsequent air drying.

B.—After the removal by panning of 56 per cent. of sandy material consisting of angular quartz grains with a little kaolinised felspar the coal was air dried for several days before crushing prior to analysis. Consequently no estimates can be given of the original moisture content of the coal nor to the extent its constitution has been changed by the method adopted for collecting the sample and subsequent air drying.

C.—After removal by panning of 33 per cent. of sandy material from Lab. No. 669/46, and 36 per cent. from Lab. No. 670/46, the remainder of the sample in each case was air dried for several days before crushing for analysis. Consequently no estimates can be given of the original moisture content of these coals. The sandy material removed by panning consisted largely of angular quartz grains, with a little coal and associated pyrite, muscovite, kaolinised felspar, and limonite. These minerals occurred in approximately the same proportions in both samples.

TABLE 3.

ESTIMATE OF COAL LIKELY TO BE AVAILABLE.

The tonnage of coal likely to be available, in the area drilled, at a depth not exceeding 75 feet is 15,500 tons, made up as follows :

	tons.
Proved	7,000
Probable	6,000
Possible	2,500
Total	15,500

In making this estimate seams having an average thickness of less than 2 feet have been neglected, and it has been assumed that the coal can be worked to within 20 feet of the surface.

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

BORING FOR COAL ON M.L.324

EWINGTON

COLLIE COALFIELD

Scale : 1 chain to an inch

Boring by the Western Australian Boring Co, using a percussion plant and 5" and 6" casing, under the field supervision of R.A. Hobson, geologist. Geology, sampling and quantities by R.A. Hobson, January to March, 1946. Analyses by Govt. Chemical Laboratories.

PORT HEDLAND WATER SUPPLY—RESULTS OF ANALYSES.

Date.	Sample.	Depth.		Analyses at Government Chemical Laboratories.					Field Analyses.
		To Water.	To Bottom.	Laboratory Number.	Reference to Footnote.	Reaction, pH.	Total soluble salts.	Sodium chloride (calc. from chlorine).	Sodium chloride from chlorine).
		ft. ins.	ft. ins.				grs. per gallon.	grs. per gallon.	grs. per gallon.
9–11–45	12 Mile Creek, Well A ...	21 10	23 10	139/46	A	7·5, neutral ...	38	14	...
	12 Mile Creek, Well B ...	21 10	23 10	139/46	...	7·8, faintly alk. ...	41	11	...
	12 Mile Creek, Well C ...	19 6	23 4	141/46	...	8·0, faintly alk. ...	92	50	...
	12 Mile Creek, Well D ...	34 1	48 6	142/46	C	7·1, neutral ...	270	216	...
10–11–45	4 Mile Creek, bottom sample. Taken 1 ft. from bottom of well	8 0	13 7	143/46	C	8·4, faintly alk. ...	164	131	...
	4 Mile Creek, top sample. Taken 6 in. below surface	8 0	13 7	144/46	C	7·3, neutral ...	159	133	...
12–11–45	Boodarie Soak	5 0	6 3	145/46	C	7·2, neutral ...	329	300	280
	No. 1 hole (Shallow holes in river bed.)	5 0	...	146/46	B	7·3, neutral ...	52	33	36
	No. 2 hole (Shallow holes in river bed.)	4 6	...	147/46	B	8·2, faintly alk. ...	80	48	46
	No. 3 hole (Shallow holes in river bed.)	3 6	...	148/46	B	8·0, faintly alk. . .	175	140	137
	No. 4 hole (Shallow holes in river bed.)	4 8	...	149/46	B	8·0, faintly alk. .	81	62	60
	No. 5 hole (Shallow holes in river bed.)	6 5	...	150/46	B	8·0, faintly alk. ...	120	100	103
	No. 6 hole (Shallow holes in river bed.)	5 6	...	151/46	B	7·9, faintly alk. ...	235	205	197
13–11–45	Well No. 7	17 6	29 0	152/46	...	8·0, faintly alk. ...	240	156	150
	Well No. 8	32 0	33 3	153/46	...	7·8, faintly alk. ...	475	386	360
	Well No. 9	16 3	17 0	154/46	...	7·8, faintly alk. ...	352	306	280
	Well No. 10	26 1	54 6	155/46	...	8·2, faintly alk. ...	128	79	72
	Well No. 11	24 9	35 1	156/46	...	7·8, faintly alk. ...	74	34	32
	Sample No. 12, from shallow hole in river bed	2 6	...	157/46	B	6·7, neutral ...	12	2	3
	Well No. 13	14 3	15 0	158/46	...	8·1, faintly alk. ...	147	80	73
	Meerandaganna Pool, No. 14. Sample from shallow hole in river bed, 15′ east of pool	...	...	159/46	A	7·1, neutral ...	27	11	12
	Meerandaganna Pool, No. 15. Sample from shallow hole in river bed 4 chains above pool	...	...	160/46	A	6·8, neutral ...	14	6	6
	Moorambine Well, No. 16	21 9	42 1	161/46	A	8·3, faintly alk. ...	56	23	24
	Wallam Well, No. 17 ...	22 10	40 1	162/46	...	7·8, faintly alk. ...	31	8	8
	Moorambine Pool, No. 18. Sample taken from shallow hole in river bed 5 chains above pool	...	...	163/46	A	7·6, neutral ...	18	5	5
	Well No. 19	31 4	34 6	164/46	A	8·2, faintly alk. ...	29	11	10
	Well No. 20	30 10	44 9	165/46	A	7·8, faintly alk. ...	27	9	9
14–11–45	12 Mile Creek, Well A ...	21 10	23 10	...	...	... ...	...	...	14
	12 Mile Creek, Well B ...	...	...	166/46	...	7·8, faintly alk. ...	38	12	11
	12 Mile Creek, Well C ...	19 6	23 4	...	...	... ...	...	...	49
	12 Mile Creek, Well D ...	34 1	48 6	...	...	... ...	...	...	214
	12 Mile Creek, Tom's Well	16 4	31 10	167/46	A	7·6, neutral ...	20	6	6
	Port Hedland salt water	...	...	168/46	...	8·0, faintly alk. ...	871	775	765
	Port Hedland drinking water	...	...	169/46	A	8 0, faintly alk. ...	17	4	6

Footnotes (by Government Chemical Laboratories)—

A—Samples had small amounts of brown, rather light flocculent precipitate in them.

B—Samples contained varying amounts of heavy white sediment in the bottoms of the bottles. Sample 147 having about one third of an inch, the others had less than this.

C—Samples 142, 143, 144, and 145 (laboratory numbers) had a putrid odour, with perhaps traces of hydrogen sulphide.

Notes (R.A.H.)—

The sediment referred to in footnote B above is probably material suspended in the water at the time the samples were taken. Samples were obtained from shallow holes dug in the river bed.

The samples were collected between 8th and 15th of November, 1945, but did not arrive in Perth until late December.

They were submitted to the Chemical Laboratories on 4th January, 1946. The precipitate referred to in footnote A evidently formed during this period as the samples were quite clear when collected.

P.A. 3094 (*late P.A.* 2968), *Jumbulyer, Near Mt. Magnet.*

This prospecting area is located approximately 16 chains from the most southerly post of G.M.L. 1321M and is 135 chains east of Jumbulyer, trig. station, K.14. It is 10 miles by road from Mt. Magnet, and is reached by a road, which turns off the Mt. Magnet-Yalgoo road 5.7 miles from Mt. Magnet.

The ground has been held since 1938 by H. V. Corser, and during this time Mr. Corser reports that he has crushed 261.5 tons of ore for 183.59 oz. bullion (gross weight). Production information, supplied by Mr. Corser, is given in Table I, together with the fine ounces of gold produced in 1941-43 (information from the Mining Registrar, Mt. Magnet). The sands are reported to have assayed from 3 dwt. per ton to 7 dwt. 22 gr. per ton. The average grade, not including any gold in the sands, is 14 dwt. (bullion) per ton. If the average fineness for the whole of the bullion produced is taken as the average of the bullion produced in 1942 and 1943 then the average grade of the ore in dwt. (fine gold) per ton is 11.6, again neglecting any gold in the sands.

The P.A. has been under wartime exemption since 1943.

The ore bodies are four small lenticular quartz reefs, all of which are reported to have been worked to water level, which at the time of inspection, was 37ft. below ground level in the water shaft. All stopes are filled with mullock and during Mr. Corser's absence from 1943-1946, surface material has washed into the workings. No portion of the workings in the vicinity of water level is accessible at present. All ore bodies have been stoped to the surface or within a few feet of it. Remnants of the ore bodies were seen in the backs of the stopes.

The largest ore body has a stope length of 60-65 feet and a reported maximum width of 3 feet 6 inches. The maximum width of quartz now visible in the roof of the stope above this ore body is 18 inches. The sizes of the remaining ore bodies are indicated below. More details are given in the accompanying plan (Plate III).

Ore body	Stope length.	Reported max. width.
Shaft A	30-35 feet	2 feet 6 inches
Shaft G	30 feet	1 feet 6 inches
Opencut L	20 feet	3 feet 6 inches

The ore bodies occur in shear zones in a weathered greenstone, which may be a basic lava. Large hills of basic lava occur west of the workings.

There is a small amount of quartz in the backs of the stopes, which, provided values are favourable, can be removed. A number of samples have been taken and are being submitted for assay. Otherwise the known ore bodies have been worked out to water level, and any future development of these must be below the water. The general nature of the ore bodies below the water is likely to be similar to that above the water and no increase in either size or values is likely.

Additional ore bodies may be found by prospecting along the strike of known ore bodies. Special attention should be given to the area between shaft E and the water shaft. The known ore bodies are seen to thin out along the strike and finally only the "indicator" remains. This should be followed to see if the quartz "makes" again.

Parallel ore bodies are known in the vicinity of shaft E and a search should be made for parallel ore bodies elsewhere.

R. A. HOBSON,
Geologist.

28th July, 1946.

TABLE I.

P.A. 3094 (late P.A. 2968)—Production.

Information supplied by H. V. Corser, the holder of the P.A., except for fine oz. 1941-43, which information was supplied by the Mining Registrar, Mt. Magnet.

Date.	Ore Treated.	Gold therefrom.		Sands—Assay.
		Bullion (Gross Weight).	Fine ozs.	
	tons.	ozs.		ozs. dwts. grs.
25-2-38	29·0	18·55	....	0 3 16
6-5-38	15·0	15·76	....	0 6 0
17-6-38	14·0	6·67	....	0 3 0
24-2-39	32·0	21·47	....	0 3 18
26-5-39	15·5	12·59	....	0 3 20
17-11-39	25·0	19·12	....	0 4 20
4-7-40	16·0	23·60	....	0 7 22
28-10-40	25·5	6·00	....	....
9-1-41	8·0	6·51	25·62	0 3 20
27-8-41	37·5	21·02		0 3 8
6-4-42	9·0	7·45	18·51	0 7 20
4-12-42	20·0	14·60		0 6 8
25-5-43	15·0	10·25	8·50	0 4 20
	261·5	183·59	....	....

P.A. 3094 (late P.A. 2968), Jumbulyer, Near Mt. Magnet.

Addendum.

Assay results of the samples referred to in the original report are given in Table II. The localities from which the samples were collected are shown on plate.

Table II.

P.A. 3094 (late P.A. 2968), Jumbulyer,
Assays of Samples.

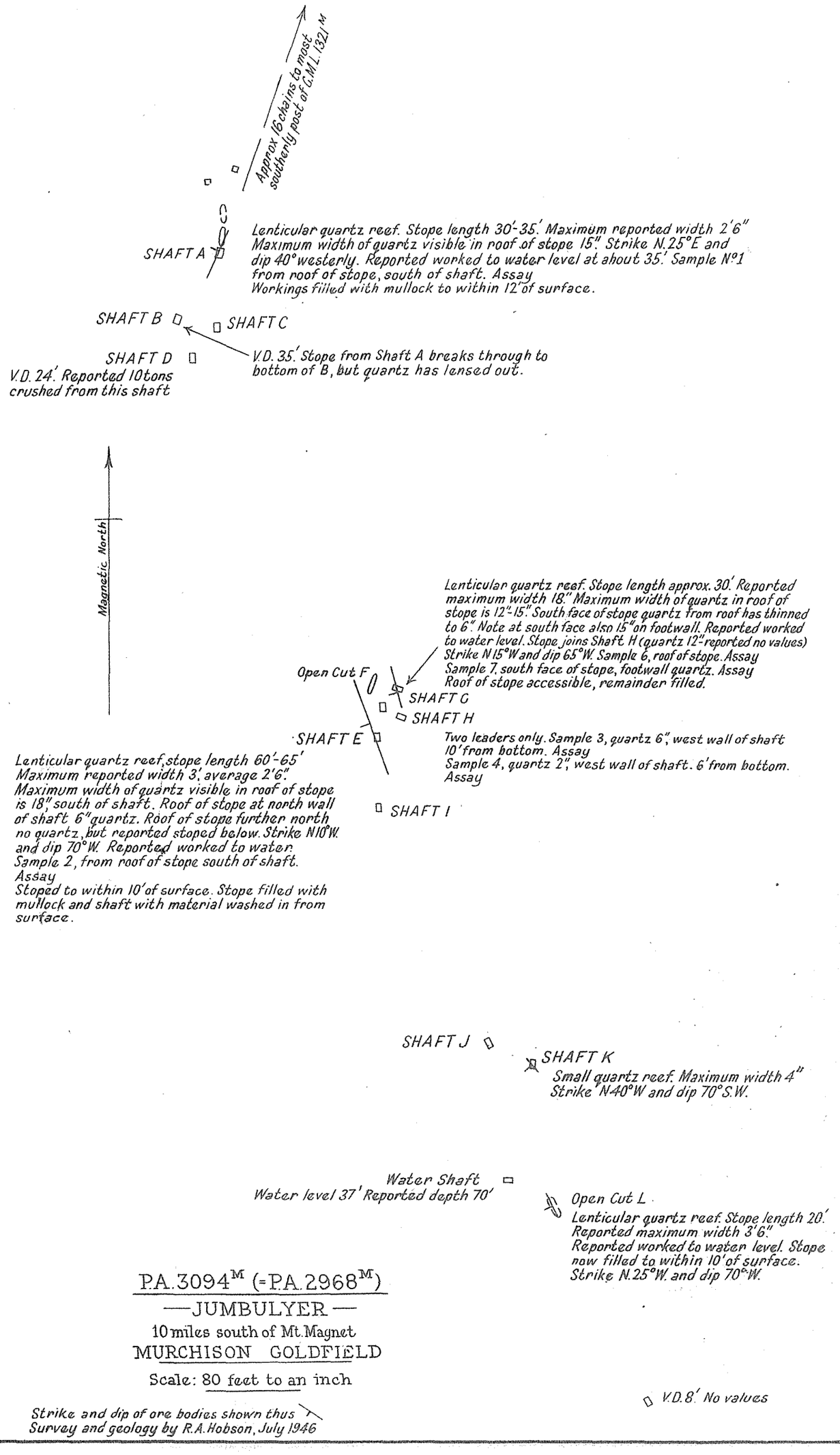
Sample No.	Locality (Plate).	Gold.			Silver.		
		ozs.	dwts.	grs.	ozs.	dwts.	grs.
1	Shaft A.	0	2	19	0	0	7
2	Shaft E.	0	9	8	0	0	12
3	Shaft H.	0	16	5	0	0	18
4	Shaft H.	1	18	17	0	1	9
5	Open-cut F.	0	10	6	0	0	20
6	Shaft G.	4	7	7	0	3	8
7	Shaft G.	0	0	18	0	0	5
8	Shaft K.	0	4	6	0	0	5

PROGRESS REPORT ON THE GEOLOGY OF PORTION OF THE NORTH-WEST DIVISION.

Between Latitudes 24°S. and 29°S. and between Longitudes 115°-30′ E. and 118°-30′ E.

By R. A. Hobson, B.Sc. (Hons.); and W. Johnson, B.Sc. (Hons.), Geological Survey of Western Australia.

CONTENTS.



P.A.3094^{M} (=P.A.2968^{M})

—JUMBULYER—

10 miles south of Mt. Magnet

MURCHISON GOLDFIELD

Scale: 80 feet to an inch

Strike and dip of ore bodies shown thus

Survey and geology by R.A. Hobson, July 1946

V.D. 8'. No values

CONTENTS—*continued.*

INTRODUCTION.

On the Geological Sketch Map of Western Australia, published in 1933 by the Geological Survey, there is an area extending from Yalgoo northwards to beyond the Gascoyne River, which is left uncoloured. At the time the map was compiled no geological information was available regarding this area, and very little information was available regarding much of the country marginal to the uncoloured area.

The objective of the present work is to complete the geological map in this locality—the mapping being extended beyond the uncoloured portion of the existing geological map only when inspection has shown that important changes in the mapping are necessary. It is not intended to remap completely the area defined in the title of this report. The mining belt extending from Mt. Magnet to Meekatharra is excluded from the area under examination. No detailed geological mapping has been done at any of the mining centres within the area so far examined, but some information regarding these has been collected, and it is hoped that a general appreciation of the mineral possibilities of the area under examination will result from the survey. The area under examination includes portions of the Yalgoo, Murchison, Peak Hill and Gascoyne Goldfields. Field work was commenced in 1946 and it is hoped that it will be completed in 1947.

Two geologists, two drivers and one cook were allotted to this work in 1946. Two utility trucks were available for transport. The scheme of work adopted was to establish a main base camp and to examine as much of the surrounding country as practicable by a series of traverses, each of which lasted about one week. The base camp was moved as necessary. Each geologist worked independently, but the work was controlled and co-ordinated by the senior geologist. The whole of the area under examination has been taken up for pastoral purposes, and is readily accessible by roads and numerous station tracks.

Army maps on a scale of four miles to an inch were used as base maps. These maps were compiled from existing Lands Department lithos to which was added information obtained from pastoralists, and sometimes information obtained as a result of reconnaissance by army survey units. They were the best base maps available, but as the work progressed it was found that much of the information was inaccurate. The positions of homesteads, tracks, etc., have been corrected. From time to time trouble has been experienced because tracks shown on maps are not now in existence. With accurate and reliable base maps the work would have been very considerably speeded up, and more attention could have been paid to the geology. Work of this type should not be undertaken in future without reliable base maps.

Field work was commenced in June and ended in November. During this time 15,000 square miles of country were examined and mapped. The area mapped extends from the Mullewa-Mt. Magnet railway line northwards to the Jack Hills at latitude 26°, and is shown on plate IV.

During the course of the work every assistance has been given by managers and owners of stations. Particularly valuable information regarding tracks has been supplied, usually in the form of sketch maps.

Except where otherwise indicated, this report has been written by Mr. Hobson.

There was very little mining activity in the area examined during 1946, and there are no large abandoned gold mines. Gold has been the principal mineral produced. All old workings have been small, and nowhere in the area have these exceeded 300 to 400 feet in depth. Small quantities of scheelite, beryl, red ochre, copper ore, and bismuth minerals have been mined at various place. Deposits of iron ore have been known to exist for many years near Tallering Peak, near Mt. Narryer, in the Jack Hills (Mt. Hale and Mt. Taylor), and in the Weld Range. Except for those in the Weld Range, the iron ore deposits are small, and not ever likely to be of any importance as sources of iron ore. Other minerals such as topaz, muscovite mica, magnetite, epidote and feldspar, occur in the area examined during 1946, but the deposits are small and not likely to be of importance.

The main gold production has been from areas of greenstone, but there has also been a small production from areas of sedimentary rocks. The combined area of the various belts of these rocks is only 460 square miles. The largest belt of these rocks is in the vicinity of Yalgoo, and has an area of 85 square miles. All belts appear to have been prospected, at least to some extent.

The survey has not disclosed any extensive belts of likely mineral country. The principal rock in the area examined is granite. Extensive areas in the vicinity of both the larger rivers and the smaller creeks consist of alluvium. On the western side of the area mapped there is a fairly extensive belt of gneiss, which appears to have been formed by the granitisation of greenstone and sedimentary rocks.

This report is accompanied by the following maps:—

Plate IV—Geological sketch map of portion of the Yalgoo and Murchison Goldfields. Scale ten miles to an inch.

Plate V.—Map showing the mining groups in the vicinity of Yalgoo and Noongal (Melville). Scale two miles to an inch.

Field work will be continued during 1947.

PHYSIOGRAPHY.

The General Land Form.

The area under examination consists essentially of a plateau—portion of Jutson's "old plateau"—which has been dissected by the Murchison River and its tributaries, by the Greenough River and its tributaries, and by a number of smaller southerly flowing creeks, which cross the railway between Wurarga and Mt. Magnet. The rivers flow in broad flat valleys filled to an unknown depth with alluvium. These broad flat valleys constitute Jutson's "new plateau." The surface of the "old plateau" is gently undulating and may be either sandy or lateritic. The vegetation is either low scrub, or mulga (Acacia sp.) and native pine (Callitris glauca) trees, which grow to a height of 20 to 25 feet. Rising above the general level of the "old plateau" are a number of hills, of which the Woodrarrung Range (A8)[1], Mt. Murchison (D9), Mt. Luke (F8), Dalgaranger (G5), Tallering Peak (A4) are examples. The "old plateau" is least dissected on the western and south-western sides of the area mapped. Further east, where dissection is more complete, remnants of the old plateau are smaller and underlying rocks are more frequently exposed. Rounded granite hills are of frequent occurrence.

[1] "A8" is a map reference. See Plate IV.

Generally it can be said that the topography is the result of the erosion of a plateau by streams and that the hilly country constitutes the divides between the various drainages. The distribution of hills, however, is not entirely controlled by the drainage. The shape of hills in the areas of greenstone or metamorphosed sediment is controlled principally by the strike of the rocks.

The areas of alluvium, which constitute the major portion of the "new plateau," are extensive flat plains, with a mulga vegetation. It is noticeable that, at many localities on these plains, the mulga is in very poor condition due to lack of rain and overstocking of stations in the past.

Drainage.

The principal river in the area so far examined is the Murchison, and approximately two-thirds of the area is drained by the Murchison and its two tributaries, the Sanford and Roderick Rivers. These rivers flow through broad flat valleys filled with alluvium and bounded for the most part by breakaways. The nature of the valleys is well shown on Plate IV. It has been noted in the previous section of this report that the "old plateau" is least dissected towards the western and south-western portions of the area. As the Murchison River approaches the western side of the area mapped, its valley narrows, until in the vicinity of Yallalong Homestead (A7) the valley is very narrow. The Murchison valley was not examined below Yallalong Homestead, but it is known that further down the river flows through a gorge. It was thought that these facts may have indicated that at some previous time there was a divide between short coastal rivers flowing westward and longer rivers flowing inland. There is little indication from the mapping, however, that either the Sanford or Roderick Rivers have ever flowed in an eastward direction. Jutson[2] has suggested that the Murchison River, above its junction with the Sanford River, once flowed in a north-westerly direction and joined the Wooramel River. Subsequently the direction of flow of portion of the Murchison River was reversed as a result of river piracy. At the conclusion of the present field season it is proposed to review the drainage system for the whole of the area under examination.

The south-western portion of the area so far examined is drained by the Greenough River and its tributaries.

The south-eastern portion of the area is drained by a number of southerly flowing creeks which cross the railway line between Wuraga and Mt. Magnet. South of the railway these creeks appear to be lost in an extensive area of alluvium, in which there are a number of large claypans.

Hills.

It has already been noted that the area consists essentially of a plateau in process of erosion by rivers and creeks. The hills can be divided into two major types—those whose distribution is controlled entirely by the drainage system, and those whose distribution is also influenced by the nature of the underlying rocks.

Good examples of the first type of hills are the Dividing Range (C5-F5), which is portion of the divide between the Sanford River drainage and the Greenough River and south flowing drainage basin; the Nicholson Range (E8), which is the divide between Sanford River and Roderick River drainages; and the Scrubby Range (E10), which is the divide between the Roderick River drainage and portion of the Murchison River drainage. The longer axes of all these ranges is parallel to rivers with which they are associated.

Examples of the second type of hills are the Jack Hills (G12), Mt. Murchison (D9), the hills extending north-westwards from Twin Peaks (B7), the hills in the vicinity of Mt. Barloweerie (D8), Mt. Charles and Mt. Farmer (H6), and Tallering Peak (A4). At all these places the longer axes of the hills is parallel to the strike of the rocks.

[2]Jutson, J. T., The Physiography of Western Australia, Geol. Survey West. Aust., Bull. 95, pp. 161-165.

A striking feature of the area is the rounded or elongated granite hills. These may rise direct from the alluvial plains, as for example Meroula Hill (F11), Mt. Welcome (D8), Mt. Hochstetter (G9), Warbadoo (E4), Courin Hill (D4), but more frequently they form part of the first type of hills referred to in the preceding paragraphs. Examples are Mt. Luke (F8), Murdanna (F6), Doothagnungana (E5), Miljanna (D6).

The highest point in the area so far examined is Mt. Hale (G12—2,400 feet), followed closely by Dalgaranger (G5—2,138 feet), and Mt. Charles (H6—2,120 feet). The lowest point for which a height is available is Mullewa, which is 914 feet above sea level.

Plateaux.

Some reference has already been made to the "old and "new" plateaux, and it has been noted that a number of hills extend above the general level of the "old plateau." These are monadnocks or residuals, which have escaped erosion during the formation of the "old plateau." There is some evidence, which will be presented below, for the existence of a plateau older than the "old plateau." The name Woodrarrung Plateau is tentatively proposed for this older plateau.

Woodrarrung Plateau.—The Woodrarrung Range consists of horizontal or nearly horizontal sediments of Nullagine age. The top of the range is quite flat and above the general level of the "old plateau." At Mt. Aubrey (B7) there is an outlier of Nullagine sediments, and a small remnant of the Woodrarrung Plateau. The top of Mt. Aubrey can be seen to be above the level of the "old plateau," occurring west of Mt. Aubrey. The hills already noted as extending above the general level of the "old plateau" may be remnants of the once extensive Woodrarrung Plateau.

"Old Plateau."—It is evident that this once extended over the whole of the area mapped. An appreciation of its present extent can be gained from Plate IV. It occupies approximately 50 per cent. of the area mapped, and has been least eroded in the western and south-western portions of the area.

Its surface is gently undulating and may be either sandy or lateritic. The vegetation varies from low scrub to thick mulga (*Acacia* sp.) and native pine trees (*Callitris glauca*). The mulga and pine trees occur in the south-western portion of the area mapped.

"New Plateau."—This consists mainly of extensive alluvial plains, associated with the rivers and creeks.

Spot levels are available at some of the triangulation stations in the area, but in general very little information is available regarding the height of the country above sea level. From the meagre information available the figures given below have some degree of probability.

Woodrarrung Plateau—average height, over 1,500 feet.

"Old Plateau"—average height, 1,100-1,500 feet.

"New Plateau"—average height, 900-1,200 feet.

Plains.

Extensive alluvial plains are a striking feature of the area so far examined. They form the major portion of the "new plateau," and are found in the vicinity of all rivers and creeks.

GENERAL GEOLOGY.

General Information and Rock Classification.

During the past field season all mapping was on a scale of 4 miles to an inch. In many small areas outcrops are quite good, and detailed mapping would have been possible. This applies particularly to some of the areas of greenstone. Such mapping would have given more information about the nature of the rocks, and also about the structure in the locality. Such mapping, however, was not the objective of the survey. It is believed that the area has been examined in sufficient detail to disclose the distribution of the major rock types. Special attention has been given to areas known to contain minerals of economic value, and also to areas likely to contain these minerals. It is thought that all such areas have been mapped. There may be some very small areas of likely mineral country, however, which have been missed. Such areas are not likely to be of any importance.

The various types of rock in the area are shown on Plate IV., and some information is given about them in the legend. Available information is summarised in Table 1 (at end of report). The distribution of the laterite and the intermediate and basic intrusives referred to in Table 1 is not shown on Plate IV. The nature of the rocks underlying the laterite can generally be found from breakaways, which are of very frequent occurrence. The intermediate and basic intrusives have a very limited distribution, and their extent cannot be shown on a scale of 4 miles to an inch. In some places the nature of their occurrence can be readily observed, while at others more detailed observations would be necessary to determine their distribution.

Approximately 50 per cent. of the area mapped is covered with alluvium. The areas covered by the various rock types shown on Plate IV. are given below:—

Rock Type.	Area in Square Miles.
Alluvium	7,150
Granite	5,000
Gneiss	1,250
Sandplain (Gr/Gn)	900
Greenstone Series	400
Sedimentary Series	200
Nullagine Series	100
Total	15,000

Although no detailed mapping was undertaken in any locality, every effort was made to observe the relationships between various rock types. At some places these relationships could be observed, while at others no conclusion could be arrived at without detailed mapping. A number of specimens were collected and have been examined by Mr. Johnson, who has prepared a report on these rocks (see p. 98 et seq).

Alluvium.

The distribution of the alluvium is shown on plate IV. No information is available regarding its maximum or average thickness. A number of wells and bores have been sunk in the alluvium, but the water level is generally very shallow, and very few of these bores or wells exceed 50 feet in depth. The deepest well in alluvium known to the writer is one in the vicinity of Carlaminda Station homestead (F3), which had been sunk to a depth of 100 feet. At this depth a porous ferruginous laterite was encountered, and satisfactory supplies of water were obtained.

At one to two feet below the surface of the alluvium the top of a hard layer (''cement'') is found. This may extend downwards for 10 to 12 feet.

Abundant fragments of travertine are found at a number of places in the areas of alluvium. A more careful search will generally reveal fragments, sometimes quite abundant, of a grey calcareous shale. A thin section of this shale did not reveal any microfossils. Typical occurrences are to be found on the Yalgoo-Meka road, 13 miles from Meka (F6); on the Meka-Roderick road, five miles from Roderick (F8); on the Yalgoo-Dalgaranga homestead road, nine miles from Dalgaranga homestead (F5).

Laterite.

Very little attention has been given to the laterite, and no attempt has been made to map its distribution. As previously pointed out the nature of the rocks underlying laterite can frequently be seen in nearby breakaways. An interesting occurrence of ferruginous laterite is that from a depth of 100 feet in a well near Carlaminda homestead.

Younger Intrusives.

There are two groups of younger intrusives—one intermediate in composition and the other basic. Available evidence indicates that the rocks of intermediate composition are younger than those of basic composition. Both groups of rocks occur as dykes, but those of basic composition also occur as larger intrusive masses, the boundaries of which have not been mapped. Both groups of rocks intrude both granite and gneiss, and are, therefore, younger than these rocks. The younger intrusives have not been observed to intrude the Nullagine Series in the area so far mapped, but elsewhere in the State the Nullagine Series is intruded by dolerites. The younger intrusives are, therefore, placed above the Nullagine Series in the classification table.

Intermediate Intrusives.

These occur as dykes up to two to three chains in width, usually in areas of granite or gneiss, but also in the vicinity of Dalgaranger trig. station (G5) in an area of greenstone. Here a quartz hornblende porphyrite dyke occurs in a coarse grained greenstone (gabbro or norite), which, in thin section, resembles the younger basic intrusives, and has been correlated with these rocks. The intermediate intrusive rocks are light grey in colour, generally with conspicuous dark coloured blebs of hornblende. They have been determined as porphyrites and tonallites. More information regarding the petrographic nature of these rocks is given on pages 98-101. Dykes of these rocks in granite or gneiss can be seen at the following places: Near Wurarga (D3); on the Yuin homestead-Murgoo road, approximately 21 miles from Yuin (C6); on the Boolardy-Nookawarra road approximately 12 miles from Nookawarra (F11); close to Dalgaranger trig. station (G5).

Basic Intrusives.

At a number of places basic dykes occur in areas of granite or gneiss. Similar basic rocks occur in the Greenstone Series and also in the Sedimentary Series. In some places, e.g., near Dalgaranger trig. station, there appear to be quite extensive areas of rock which is petrologically similar to the younger basic dykes. No detailed mapping has been done and the nature of the occurrence at Dalgaranger is not known. On petrological evidence the rock has been correlated with the younger basic intrusives.

Examples of basic dykes in granite or gneiss can be seen at the following localities: On the Yalgoo-Jingemarra road, approximately 18 miles from Jingemarra (E5); on the Mullewa-Bullardo road, approximately 18 miles from Mullewa (A3); 10 miles north of Mt. Dugel (D12). Larger areas of rocks, which are petrologically similar to the basic dykes, occur at Dalgaranger (referred to above), and in the Wadgingarra Hills, east of Yalgoo.

Nullagine Series.

Rocks of this series occur in the Woodrarrung Range (A8) and at Mt. Aubrey (B7). They consist of horizontal or flatly dipping, massive or bedded quartzites. Current bedding is of very frequent occurrence and ripple marking was occasionally seen. A striking feature of the areas of Nullagine rocks is the complete absence of quartz rubble.

Sandplain.

In the south-western portion of the areas mapped there are fairly extensive areas of sandplain, in which there are no rock outcrops. The soil is generally sandy, but may contain laterite rubble. In this locality the vegetation is dense and native pines (*Callitris glauca*) are of frequent occurrence. Elsewhere the vegetation consists of low scrub.

In the south-western portion of the area mapped it is likely that the underlying rocks are gneisses, but elsewhere (e.g., G4) the underlying rocks are probably granite.

Gneiss.

From plate IV it can be seen that there are extensive areas of gneiss in the south-western, the western and northern portions of the area mapped. This gneiss is granitic in composition. It is believed that the gneiss in the south-western portion of the area mapped consists mainly of granite gneiss, while elsewhere the gneiss has been formed mainly as a result of the *granitisation* of greenstones and sediments.

Typical areas of gneiss believed to be formed as a result of granitisation are the area in the vicinity of Mt. Aubrey (B7), the Mt. Narryer (D10)—Mt. Dugel (D11)—Meegea (D12) area, and the area north of Noonie Hill (F12). Throughout these areas of gneiss there are scattered patches of greenstones and metasediments, which, when followed along the strike, grade into gneiss. These patches vary considerably in size from very small (5 feet by 5 feet) to larger patches, such as those occurring in the vicinity of Mt. Narryer. For the small patches the change to gneiss can be observed over a length of a few chains. In the immediate vicinity of Mt. Narryer the rocks are principally quartzites, but the country to the north of Mt. Narryer consists mainly of gneiss, with patches of greenstone and quartzite. Two traverses were made across this country—one eight miles north of Mt. Narryer and the other 22 miles north. The rocks in the vicinity of Mt. Dugel (D11) are metamorphosed sediments.

Granite.

The distribution of the granite is shown on plate IV, and petrographic information regarding specimens collected is given by Mr. Johnson on pages 98-101. Outcrops are frequent and consist usually of a coarse grained porphyritic granite. Sometimes, e.g., at Mt. Luke (F8), the microline phenocrysts are oriented, and the rock has a somewhat gneissic appearance. At other places gneissosity is more pronounced and the rock is a gneissic granite.

A number of specimens were collected from the areas mapped as granite. Petrographic examination of these show that a variety of granitic rocks are included in these areas. Details are given on pages 99-100.

The most abundant is a porphyritic microline granite, to which reference is made above. A second variety of potash granite is the non-porphyritic orthoclase granite. This is much less abundant than the porphyritic granite. At one place, Poona Hill (D6), the two varieties are found in the one hill. Poona Hill consists mainly of a non-porphyritic, slightly gneissic granite, but also includes some massive porphyritic granite. The boundaries between the two types are not well defined, and it is concluded that both are formed from the one magma.

As would be expected a number of specimens are described as hybrid granites. Some of these appeared to be quite normal granites in the field.

From two localities tonalite and soda granites are described. Both rocks are gneissic when seen in the field. One of these rocks (M60) comes from an area of gneiss, while the other (M127) comes from an area of granite. Both massive and gneissic granite were seen in the locality from which M127 was collected and also porphyritic and non-porphyritic granite. It is proposed to re-examine this locality.

Sedimentary Series.

The best development of these rocks is in the vicinity of Tallering Peak (A4), where the principal rocks are phyllites, micaceous schists and ferruginous quartzites. Elsewhere, e.g., Mt. Murchison (D9), Mt. Narryer (D10), Mt. Dugel (D11), near Noonie Hill (F12), there are smaller areas of sedimentary rocks, principally quartzites which are probably remnants of a once more extensive series.

Greenstone Series.

The rocks of this series consist principally of fine to medium grained amphibolites, derived from basic lavas. Metamorphosed sediments are of fairly frequent occurrence, and in places, e.g., between Yalgoo and Noongal, outcrops of schist are conspicuous. Included in areas mapped as belonging to the Greenstone Series are minor quantities of coarser grained amphibolites, derived from basic intrusives, and minor quantities of ultrabasic rocks.

The principal mineral production has been from areas of these rocks.

STRUCTURAL GEOLOGY.

Insufficient mapping has been done to determine the structure within individual belts of rocks of the Greenstone Series or of the Sedimentary Series. The distribution of the belts of these rocks does not give any clue to the broad structure. It is likely that appreciable areas of these rocks have been granitised, and to get a complete structural picture more detailed mapping would be necessary, not only in the greenstone areas (Greenstone Series) and the sedimentary areas (Sedimentary Series), but also in the adjoining areas of gneiss.

The longer axes of the belts of rocks of the Greenstone Series and of the Sedimentary Series are parallel to the strike of the country, except for the Dalgaranger (G5)—Mt. Charles (H6) belt. Not a great deal of information is available regarding the strike of the country in this belt. At Mt. Charles the general strike is north-north-east. West of Dalgaranger the strike is north-westward, while between Dalgaranger and Mt. Charles the strike is north-eastward.

ECONOMIC GEOLOGY.

During the course of the broad mapping some attention was given to mineral deposits. No detailed mapping was undertaken, but all deposits were inspected. Some deposits were sampled. The principal mineral produced is gold, but small quantities of such minerals as scheelite, beryl, talc, red-ochre, copper ore, and bismuth minerals have also been mined. Deposits of iron ore have been known to exist for many years near Tallering Peak (A4), near Mt. Narryer (D10), in the Jack Hills (Mt. Hale—H12), and in the Weld Range (I9). Except for those in the Weld Range, the iron ore deposits are small and not likely ever to be of any importance as sources of iron ore. Other minerals such as topaz, muscovite mica, magnetite, epidote and felspar, occur in the area but the deposits are small and unlikely to be of importance.

Water supplies for pastoral purposes are generally adequate. Water, of a quality suitable for domestic purposes, is of infrequent occurrence and for these purposes rain water is generally used. During 1946 there was very little mining activity, and there were no regular producers of gold. Old sands were being treated at the late Royal Standard Gold Mine at Yuin. There was a small amount of prospecting activity in the vicinity of Noongal (F4) and in the Weld Range (I9). Red ochre was being mined intermittently from Wilgie Mia (I9).

In the following paragraphs some information regarding the mineral deposits is given.

Gold.

The total production of gold from the area so far examined is 60,752 fine ounces. This does not include gold produced from various areas in the Weld Range. Some attention was given to the Weld Range country in 1946, but the work there is not yet complete.

Available information regarding the various mining groups is summarised in Table 2, prepared by Mr. Johnson. All tables are to be found at the end of this report. The greatest production, 28,108 fine ounces, has been from the Yuin Group—all from one mine, the late Royal Standard Gold Mine. Appreciable quantities of gold have also been produced from the vicinity of Yalgoo, Noongal and from the Kylie Group (G6), north of Warda Warra (G6). The positions of the various groups referred to in Table 2 are shown on plates IV and V—those near Yalgoo and Noongal being shown on plate V, and those away from these centres on plate IV.

In the area so far examined there are no large abandoned gold mines, and no workings have exceeded 300 to 400 feet in depth. The main workings have been in rocks of the Greenstone Series, but there has been a small production from the Coolinga Group (B4), which is in an area of rocks belonging to the Sedimentary Series. All belts of rocks belonging to the

Greenstone Series appear to have been prospected at least to some extent. One locality, which may have been overlooked and which is worthy of attention, is near trig. station K.P. (B5). It is 11½ miles north-west of the late Royal Standard Gold Mine at Yuin, and the country is similar to that at Yuin. The Dalgaranger-Mt. Charles belt of rocks of the Greenstone Series is much larger than shown on previous geological maps. It is known to local prospectors, but very little work appears to have been done in this belt of rocks.

On the western and north-western sides of the area examined there is a belt of gneiss country, which has some possibilities as potential auriferous country. As already stated this gneiss is believed to be derived from greenstones and metamorphosed sediments by granitisation. Gneiss country is less favourable for gold deposition than country consisting of greenstones or metamorphosed sediments, in which the main gold deposits of Western Australia occur. It is reported that small quantities of gold have been found at two localities in this belt of gneiss—near New Forest (A7) and near Mt. Dugel (D11). No details regarding the reported finds are available.

Small quantities of gold are reported to have been found at two localities in areas mapped as granite. The first of these localities is 9½ miles east of Noondie homestead and approximately ½ mile north of the Noondie homestead-Noondie woolshed road. The second locality is on Melangata Station, approximately 13 miles north-west of the homestead. At this second locality there is a small patch of basic schist—too small to be mapped on a scale of four miles to an inch.

Iron.

All iron deposits were inspected and sampled. The deposits were not mapped in detail, but their length and average width were obtained by measurement with a 100 feet tape. Their average height above the surrounding country was estimated with an aneroid barometer. From this information estimates of tonnages were prepared. These are not to be regarded as estimates of ore reserves, but are considered to be sufficiently accurate to indicate the amount of ore likely to be available down to the level of the surrounding country. A number of samples were taken from each ore body, and submitted to the Chemical Laboratories for analyses. Details are set out in Tables 3 and 4.

The ore bodies in the vicinity of Tallering Peak and Mt. Hale were found to be quite small and not likely ever to be of importance as sources of iron ore. The deposits in the Weld Range are somewhat larger. It is estimated that 26½ million tons of ore are likely to be available down to the level of the surrounding country from six lenses of ore. More details are to be found in Tables 3 and 4.

Small lenses of hematite were seen at the following localities—six miles north-west of Twin Peaks (map reference B7; sample M77, Fe-65.34 per cent., SiO_2-2.08 per cent., H_2O-1.22 per cent., TiO_2-0.03, P-0.43, S-0.04 per cent.); on the east slope of Mt. Barloweerie (map reference D8; no sample); on an island in the Murchison River near Mt. Taylor (map reference H12; sample M145, Fe-63.13 per cent., SiO_2-4.24, H_2O-2.60, TiO_2-0.02, P-0.20, S-0.08 per cent.; sample M146, from scree, Fe-64.31 per cent., SiO_2-3.22, H_2O-2.51, TiO_2-trace, P-0.24, S-0.02 per cent.). At all these places the lenses of hematite are quite small, and have no value as potential iron ore.

There has been no production of iron from any of these deposits.

Red and Yellow Ochre.

Between 1944 and 1946 six hundred and sixty (660) tons of red ochre valued at £5,536 have been produced from the vicinity of Wilgie Mia (M.Cs. 26 and 27). The red ochre deposit at Wilgie Mia has been known for many years, and prior to 1944 was reserved for aboriginal use. It has been described by Woodward[3].

[3]Woodward, H. P., A Geological Reconnaissance of a Portion of the Murchison Goldfield, Geol. Survey West. Aust., Bull. 57, pp. 74-89, 1914.

Two samples of red ochre were collected by Mr. Johnson—one from Wilgie Mia and the other from Little Wilgie Mia—and submitted to the Chemical Laboratories. Both were found to be "red oxides" of good quality.

A sample of yellow ochre from Wilgie Mia was found to be a "sienna" of poor quality.

Emeralds.

Between 1927 and 1930 emeralds weighing 18,373 carats and valued at £1,609 were obtained from M.L. 79 at Poona. Attention was first directed to the occurrence of emeralds at Poona in 1914[4].

Scheelite.

In 1943 scheelite was produced from Noongal. 2.99 tons of concentrates, valued at £1,050 were obtained. The scheelite was obtained as large crystals from a basic schist. It is associated with some vermiculite.

Beryl.

The only production of beryl has been from the vicinity of Poona in 1944-45, when 24.53 tons, valued at £928, were produced.

Beryl also occurs in the vicinity of Noongal, and has been reported from the vicinity of Warda Warra. There has been no production from either of these places.

Near Noongal both white and green beryl are found. The beryl occurs in pegmatite dykes associated with other minerals. The deposits are small and appear to be of the pod type[5].

A sample taken from a shallow hole one mile south and 4.6 miles east of Warbadoo Rock (E4) contained 12.83 per cent BeO.

Copper.

Between 1906 and 1908 small quantities of copper ore were obtained from Wadgingarra and from the vicinity of Twin Peaks (B7). Both these occurrences have been previously described by the writer[6]. Both are small and of no importance as potential sources of copper ore.

Tin.

1.52 tons of tin concentrates, valued at £118, were produced from Poona in 1909. Additional information regarding Poona is to be found in Bulletin 57[7].

Other Minerals.

Small quantities of the following minerals are found associated with the pegmatite dykes in the vicinity of Noongal (Melville):—magnetite, epidote, bismutite, vermiculite, nontronite, clinozoisite, topaz sericite (variety agolmatolite) feldspar.

There is a talc deposit having a length of 200 feet, a width of 10 feet, in the vicinity of Mt. Taylor (H12). The deposit is associated with a pegmatite dyke. According to local information three to four tons of talc were produced 20 to 30 years ago. The talc is very fractured, and is obtainable only in small pieces. It is unlikely that pieces larger than two inches by one inch by one inch could be obtained. The deposit is situated three-quarters of a mile from Mount Taylor in a gully flowing east, and access is difficult. A sample was submitted to the Government Chemical Laboratories and the following report has been issued:—

> "The sample submitted consisted of a number of pieces of talc heavily stained with limonite and to a lesser degree with hydrous manganese oxides. The talc is somewhat laminated, causing it to split

[4]Woodward, H. P., op. cit., Bull. 57, pp. 59-65.

[5]E. N. Cameron and others, Structural and economic characteristics of New England mica deposits, Econ. Geology, Vol. XL., No. 6, p. 385, 1945.

[6]Hobson, R. A., Copper in the Murchison and Yalgoo Goldfields, Ann. Progress Rept. of Geological Survey for 1940, pp. 11-12, Western Australia. 1941.

[7]Woodward, H. P., op. cit., Bull. 57, pp. 54-59.

readily in one direction. It contains small amounts of fine quartz and opal and traces of chlorite and apatite.

Properties in block form: The sample was unsuitable for heat tests in block form owing to the shape and size of the fragments and their laminated structure.

Properties in powder form: The lumps when broken, grind easily in a mortar with considerable grittiness to pass a 200 mesh screen. The ground powder is greyish white in colour, fairly unctuous to the touch and adheres well to the skin. It is, however, too coloured to be of value except in cases where an off-white colour is not objectionable.''

Water Supply.

Water supplies throughout the area are adequate for the most part for pastoral purposes. The quality of the water varies, frequently within quite small areas. Water of a quality suitable for domestic purposes is rare, and rainwater is generally preferred for these purposes. Water is usually obtained at depths of less than 50 feet. Increased supplies are desired at some localities.

The problem of water supply is one which requires a different type of geological work from that done during the 1946 field season. Investigation of water supplies was not one of the objectives of the present survey, and no water supply work has been done. The problem is important not only to the pastoral industry, but also from a defence aspect. It is one to which attention could be well directed if sufficient staff were available.

SUMMARY AND CONCLUSIONS.

Summing up, it can be said that the extent of greenstone or metamorphised sedimentary country in the area so far examined is very small. The principal gold and other mineral deposits in Western Australia occur in areas of these rocks. No extensive belts of these rocks have been discovered as a result of the present survey. All known belts appear to have been prospected, at least, to some extent. Attention has been directed to a belt of greenstone in the vicinity of Trig. Station K.P., and also in the Dalgaranger-Mt. Charles belt, both of which appear to have some possibilities for additional prospecting. Gold is the principal mineral likely to be produced, but small quantities of other minerals may be produced from time to time as the demand exists. Fairly extensive deposits of iron ore exist in the Weld Range.

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W. JOHNSON,
Geologist.

TABLE 1

CLASSIFICATION OF ROCKS.

Age.	General Description.	Petrographic Information.	Notes.
Recent to Tertiary	Alluvium	... ...	
	Laterite	... ...	Distribution not mapped.
Pre-Cambrian ...	Younger Intrusives	Intermediate intrusives—tonalite porhyries, diorite porphyrites, porphyrites and granophyres Basic intrusives—gabbros, norites, dolerites, basalts and their derivatives	These rocks occur fairly frequently, but their extent is very small. Distribution not mapped.
	Nullagine Series ...	Massive and thinly bedded quartzites, frequently with current bedding	
	Sandplain (Gr/Gn)	... ...	Areas of sandy soil or sandy soil and laterite rubble believed to overlie granite and/or gneiss. NO rock outcrops.
	Gneiss	... ...	Believed to have formed mainly as a result of granitisation of greenstones and sediments.
	Granite	Porphyritic microcline granites, non-porphyritic orthoclase granites, hybrid granites, tonalite and soda granites, gneissic granites	Pegamite dykes and quartz reefs belong here.
	Sedimentary Series	Metamorphosed arenaceous and argillaceous sediments, with very minor quantities of lavas and ultrabasic rocks	
	Greenstone Series ...	Fine to medium grained amphibolites, derived from basic lavas; minor quantities of coarser grained amphibolites derived from basic intrusives; schists; metasediments; minor quantities of metamorphosed ultrabasic rocks	

TABLE 2.

SUMMARY OF INFORMATION REGARDING MINING GROUPS, YALGOO GOLDFIELD
Table compiled by W. JOHNSON, March 1947.

Group.	Total Gold. Fine ozs.	Grade. Dwts. per Ton. (2,240 lbs,)	Period of Production.	Maximum Depth. Feet.	Ore Bodies.	Country Rock.	Reference†	Remarks.
Emerald*	9,783·62	33·2	1897–03, 1905–15	200 ?	Irregular masses of quartz, parallel to strike of country, transverse to dip. Minor ore bodies are quartz veins parallel and transverse to strike and dip of country	Schistose and massive amphibolite	A.R. 1895, pp. 22, 41.	Quartz porphyry associated with the amphibolites of Emerald and Reliance Groups.
Reliance*	552·82	6·7	1899, 1902, 1903, 1906–08, 1916, 1917, 1935–40	100 on underlay of 45°	Principal orebody quartz reef parallel to strike and dip of country but also cuts across strike	Schistose amphibolite, massive amphibolite, and mica schist. Strike 360°, dip 80° E	...	
Wadgingarra South*	18·97	8·2	1897, 1901, 1902	100 vertical	Quartz veins parallel to strike of country and dipping at angles of 35°–70°. Some veins transverse to strike of schistosity	Massive amphibolite, schistose amphibolite, conglomerate. Strike 330°–345°. Dip 70°–80° W.	...	No quartz porphyry within reasonable distance.
Wadgingarra North*	631·66	19·6	1897–04, 1906–08, 1909, 1939	40 vertical, then 60 on underlay 50°	Principal orebodies two types: (1) Silicified shear zones in amphibolite associated with jaspilite parallel to strike and dip of jaspilite; (2) Quartz veins both parallel and transverse to strike of country associated with copper minerals—irregular dips	Type (1) Jaspilite, sheared and massive amphibolite, talc mica schists. Strike 310°. Dip 60°–70° S.W. Type (2) Silicified schistose amphibolite. Strike of schistosity 355°. Dip of schistosity 60° W.	A.R. 1895, p. 43	
Carlaminda ...	1,099·74	10·3	1897–99, 1900 (1897–46 sundry claims undifferentiated)	150 vertical	Principal orebodies are quartz veins parallel to strike and dip of schistosity of country rocks. Some minor orebodies are lode material in schist and some quartz veins transverse to schistosity of amphibolites and mica schists	Schistose amphibolite. Strike of schistosity 360°. Dip 70°–80° E or W. Massive amphibolite, mica schist	A.R. 1895, pp. 22, 42.	Production from sundry claims 600.68 ozs.
Jaspilite*	516·96	12·9	1911, 1915, 1930–38	60 vertical	Principal orebodies lode material in jaspilite, mostly parallel to strike and dip of jaspilite. Minor ore bodies are quartz veins striking in all directions in schist	Jaspilite strike 80°. Dip 70° S. Green mica schist, strike of schistosity 60°, dip vertical	...	

TABLE 2—*continued.*

Group.	Total Gold. Fine ozs.	Grade. Dwts. per Ton. (2,240 lbs.)	Period of Production.	Maximum Depth. Feet.	Ore Bodies.	Country Rock.	Reference†	Remarks.
Melville*	3,778·54	10·0	1897–02, 1912–15 1922–46	100 vertical	Orebodies irregular quartz veins mainly parallel to strike and dip of country, some transverse. Principal ores occur at junction of quartz porphyry and amphibolite	Quartz porphyry, mica schist, massive and schistose amphibolites. Younger dolerites intrusive into quartzose ore bodies. Strike of schistosity 330°–360°. Dip of schistosity 45°–70° W.	A.R. 1895, p. 42	Main productive from open cut in a large irregular quartz vein on G.M.L. 953. Dimensions, average width 20 ft. length 50 ft. depth 30 ft.
Coolgardie Brilliant*	624·10	15·8	1934–38	50...	Orebodies are stringers of quartz or lode material disseminated throughout country rock. No definite strike; dip usually vertical. Lodes not well defined	Quartz porphyry or granite gneiss. Strike of foliation in gneiss N. 40° E.	...	This group occurs in a quartz porphyry and gneiss area isolated from the main Yalgoo green-stone belt.
City of Melbourne*	873·55	8·3	1897, 1937–42 ...	250 on underlay	Principal orebody thin quartz vein, parallel to strike and dip of schistosity	Amphibolite schist. Strike of schistosity N. 20° W. Dip of schistosity 40° W. Associated with quartz porphyry	...	
Yuin	28,107·92	8·2	1897-1909, 1911-16 1926–27, 1935–37 (1897–1946 sundry claims undifferentiated)	350 on underlay of 70°	Principal orebody is a quartz vein parallel to strike and dip of schistosity	Greenstone schist. Strike of schistosity E–W. Dip of schistosity 70° N.	Bull. 59, pp. 140–149	Only one mine. Average stope width 4 ft. Average stope length 280 ft. Worked to 305 ft. on underlay and cut off by granite dyke ?
Trixie*	14·88	9·2	1923	shallow	Quartz vein parallel to schistosity. Associated with azurite and malachite.	Greenstone schist. Strike of schistosity N. 15° E. Dip of schistosity 55° E.	...	...
Kylie*	5,847·16	10·9	1926–27, 1930–35, 1936–38	100+	Lode material in micaceous quartzite striking and dipping parallel to quartzite.	Mica quartz schist, jaspilite, greenstone schist. Strike of jaspilite S. 10° E. dip of jaspilite 50° W.	...	Shaft inaccessible. Open cut dimensions: 100 ft. long; 20 ft. wide; 15 ft.deep on principal ore-body.
Emerald, Reliance	1,022·02	7·8	1897–1946 ...	...	...	...	...	...
Wadgingarra, North and South	559·83	5·2	...	...	...	...	...	...
Jaspilite, Melville, Coolgardie Brilliant, City of Melbourne	3,903·25	9·2	1897–1946 ...	...	...	...	...	...
Trixie, Kylie ...	369·87	7·9	1897–1946 ...	...	...	...	...	...

* This table has been compiled from information supplied by the Statistical Branch, Mines Department, and the groups given in the table do not correspond with those used by the Statistical Branch. Production recorded as from "Sundry Claims" cannot now be allotted to the groups given in the table. Production from "Sundry Claims" is given below.

† A.R. = Annual Progress Report of the Geological Survey, Western Australia. Bull. 59 = Geological Survey of Western Australia, Bulletin No. 59.

TABLE 3.

INFORMATION REGARDING DEPOSITS OF IRON ORE IN PORTIONS OF THE MURCHISON AND YALGOO GOLDFIELDS.

Geology and ore dimensions by W. Johnson, 1946.

For analyses refer to table 4.

Name of Group.	Locality.	Access.	Ref. letter and number.	Ore Bodies. Location.	Average height above surrounding plain. Feet.	Length. Feet.	Average Width. Feet.	Volume. Millions of cubic feet.	Tonnage. Millions of tons. (2240 lbs.)	Summary of Geology.
TALLERING	Tallering Range 30m. in a direction N. 13° E. from Mullewa. Tallering Trig. forms one of S.W. boundary corners of the Yalgoo G.F. Lat. (approx.) 28° 7′ S. Long. (approx.) 115° 38′ E. Map reference A4.	Rail to Mullewa. Main Mullewa Gascoyne Jct. Rd. to "Wandina" Hstd. Station track to Tallering Peak.	T_1	Summit of Tallering Peak approx. 1¼m. N. 30° E. from Tallering Trig.	484	400	103	19·941	2·215	Tallering Range consists of highly folded sandstones, conglomerates quartzites, and associated basic volcanics and intrusives, metamorphosed to varying degrees. Quartzites vary from pure white to highly ferruginous. Iron ore bodies occur as replacements of quartzites parallel to regional strike and dip. Strike N. 50° E. Dip vertical or steep to S.E. Ore bodies grade into highly ferruginous quartzite across and along strike and probably do so in depth.
			T_2	Halfway in a direct line between Tallering Peak and Tallering Trig.	475	150	40	2·85	·32	
			T_3	1 chn. E. of Tallering Trig. Stn. and extending N.E. from there.	670	330	40	8·844	·982	
								Total	3·517	
WELD RANGE	Weld Range in Murchison G.F. Group of ore bodies approx. 35m. in a direction N. 15½° W. from Cue. Lat. (approx.) 26° 56′ S. Long. (approx.) 117° 42′ E. Map reference 19.	Rail to Cue. Cue—Beringeirra — Milly-Milly Mail Road to centre of Weld Range. Station track along N.-S. face of range.	W_1	S.W. end M.C. 20. Contains Wilgie Mia Native Ochre Mine.	400	1900	85	64·6	7·18	Weld Range consists broadly of two parallel lines of jaspilite and quartzite hills 2 to 4 miles apart, with spurs and parallel hills of intermediate to basic intrusives in between. Small bands of jaspilite occur in the intrusives. The series has been metamorphosed but not to a high grade. Strike of jaspilite N. 50° E. Dip of jaspilite vertical or 80° S.E. The trend of the range is parallel to the strike of the jaspilites. The ore consists of massive to specular haematite in places becoming earthy and ochreous. Ore bodies W_1 to W_5 are in the southern line of jaspilite hills and on the same line of strike. The ore bodies are confined to the jaspilite and are of the replacement type.
			W_2	N.E. end M.C. 21, continuation S.W. of W1.	300	800	50	12·0	1·33	
			W_3	N.E. end of M.C. 27.	400	1700	115	78·2	8·68	
			W_4	S.W. end M.C. 27. Little Wilgie Mia Ochre Deposit.	400	700	185	51·8	5·75	
			W_5	1½m. N. 50° E. from N.E. end of M.C. 20	420	900	45	17·01	1·89	
			W_6	Approx. 2m. N. 10° E. of Mt. Lulworth.	400	1300	31	16·12	1·68	
								Total	26·51	

TABLE 3—*continued.*

Name of Group.	Locality.	Access.	Ref letter and number.	Ore Bodies.						Summary of Geology.
				Location.	Average height above surrounding plain. Feet.	Length. Feet.	Average Width. Feet.	Volume. Millions of cubic feet.	Tonnage. Millions of tons. (2240 lbs.)	
MT. HALE	Mt. Hale 85 m. from Meekatharra in a direction N. 65° W. Lat. (approx.) 26° 2′ S. Long. (approx.) 117° 15½′ E. Map reference H12.	Rail to Meekatharra. Mail road to "Judal" Hstd. Stn. track to base of Mt. Hale.	H1	2 chns. S.W. of Trig. Stn. on Mt. Hale.	800	500	31	12·4	1·38	Mt. Hale is composed of drag-folded and metamorphosed ferruginous and pure quartzites intruded by numerous pegmatite dykes and quartz veins. Regional strike of quartzites is N. 40° W. Regional dip of quartzites vertical or steep to S.E. The iron ore body is in the crest of a large dragfold in ferruginous quartzite at the summit of Mt. Hale.

NOTES:

1. Measurement of lengths and widths was made with a 100 ft. tape.

2. Heights were measured by aneroid barometer—relative vertical distance between iron ore outcrops and surrounding plain being the height measured. Barometer heights were checked against elevations of trigonometrical stations where possible.

3. The tonnage given for each ore body is based on the assumption that the ore body continues without change of dimensions down to the level of the surrounding plain. A conversion factor of 9 cubic feet to the ton has been used.

TABLE 4.

RESULTS OF ANALYSES OF SAMPLES TAKEN FROM IRON ORE DEPOSITS REFERRED TO IN TABLE 3.

Sampling by W. Johnson, 1946.

Analyses by Government Chemical Laboratories.

Group. See table 3.	Orebody ref. letter and number See table 3.	Location of Sample.	Sample No.	Results of Analyses.					
				Fe.	SiO_2.	H_2O.	TiO_2.	P.	S.
Tallering	T1	A, 100 feet from N.E. end of orebody	M67	63·27	7·23	1·62	0·01	0·13	0·04
		B, 100 feet from S.W. end of orebody	M68	62·34	8·82	1·39	0·01	0·15	0·05
	T2	At centre of orebody	M69	59·96	12·87	0·94	trace	0·19	0·03
	T3	A, 100 feet from N.E. end of orebody	M70B	68·66	0·43	0·38	0·03	0·09	0·08
		B, 100 feet from S.W. end of orebody	M70A	64·90	4·41	0·96	trace	0·10	0·06
Weld Range	W1	A, 700 feet from east end of orebody	M115	63·69	1·78	5·17	0·02	0·27	0·08
		B, 1,100 feet from east end of orebody	M116	62·72	2·35	5·98	0·02	0·18	0·06
		C, 1,500 feet from east end of orebody	M117	62·02	2·45	5·87	0·04	0·31	0·09
		D, 1,900 feet from east end of orebody	M118	62·59	3·85	2·05	0·02	0·15	0·11
	W2	A, 400 feet from east end of orebody	M119	57·34	4·62	10·63	0·05	0·27	0·07
		B, 800 feet from east end of orebody	M112	57·47	4·58	10·35	0·02	0·09	0·02
	W3	A, 400 feet from east end of orebody	M112	62·58	4·47	3·41	0·03	0·16	0·09
		B, 1,000 feet from east end of orebody	M121	66·30	2·08	1·06	0·03	0·11	0·05
	W4	Centre of orebody	M123	60·73	6·07	2·83	0·10	0·22	0·14
	W5	A, across N.E. end of orebody ...	M139	66·28	2·49	1·00	0·05	0·11	trace
		B, 400 feet from N.E. end of orebody	M140	66·44	1·89	1·17	0·03	0·08	trace
		C, 800 feet from N.E. end of orebody	M141	63·57	4·29	2·22	0·05	0·07	0·02
	W6	A, 400 feet from N.E. end of orebody	M142	56·49	15·68	2·47	trace	0·07	0·05
		B, 800 feet from N.E. end of orebody	M143	64·38	2·11	4·32	trace	0·12	0·02
Mt. Hale	H1	Across centre of orebody	M144	67·77	0·48	0·69	0·02	0·28	trace.

PROGRESS REPORT ON THE RE-SURVEY OF THE COOLGARDIE DISTRICT, COOLGARDIE GOLDFIELD.

By

R. S. Matheson, B.Sc.,

Geological Survey of W.A.

Note by Government Geologist: In G.S.W.A. Bulletin No. 97, which describes the regional geology of the South Yilgarn Goldfield, situated some 120 miles west by south from the Coolgardie District, an account is given of the relation between geological structure and gold occurrence. It was found that gold occurred in favourable stratigraphical horizons accompanied by favourable geological structures. In undertaking the Coolgardie Survey, the field officers were instructed to approach the problem on these lines.

CONTENTS.

CONTENTS—*continued.*

MAPS.

GENERAL INFORMATION.

The area to be surveyed occupies an area of approximately 900 square miles, extending from Bullabulling in the west to Kurrawang in the east and from the northern boundary of the Coolgardie district in the north to Quarnie Rock in the south.

It is proposed to reinvestigate the general and mining geology of this area in greater detail than has been previously attempted, with a view to re-interpreting under the more modern ideas, the mode of ore deposition and its relationship, if any, to the geological structure. This work should be of great assistance both directly and indirectly, to prospecting activity in the district.

The production of gold in the area dates from the time of the discovery of the famous "Bayley's Reef" by Messrs. Bayley and Ford, on 18th September, 1892. The official records show that, to the 31st December, 1946, the area to be resurveyed has produced 1,113,014.11 fine ounces of gold from 2,069,459.01 long tons of ore, while 26,562.13 fine ounces of alluvial and specimen gold has also been recovered.

The district is well served by roads and tracks, and water supply is no serious problem as both the Kalgoorlie and Norseman water supply pipelines pass through the area. Fuel and mining timber is fairly scarce, however, as the area has already been cut over by the Goldfields Firewood and Timber Company.

There is a Mining Registrar at Coolgardie, and also a State battery, where 10 head of stamps and a cyanidation plant are available for public crushings.

Valuable advice and assistance, which is gratefully acknowledged herewith, was received during the field season from the Mining Registrar at Coolgardie, Mining Companies, Mine Managers and local residents. Considerable assistance was also obtained during the year by reference to the work of previous investigators, particularly that of Messrs. T. Blatchford and C. S. Honman.

The detailed investigations of my colleagues, Messrs. H. J. Ward and J. H. Lord, were of great assistance to the general geological work, and their observations have been freely used in the preparation of this report.

The willing co-operation of the Mines Drafting Office, the Government Chemical Laboratories, and Mines Statistical Branch, have greatly aided the investigations.

Portion of the Hampton Plains Estates, namely Location 59 and part of Location 53, which have been alienated from the Crown with the mineral rights, fall within the area to be resurveyed. Conditions for prospecting and mining on these two locations are more stringent than on Crown land.

MINING ACTIVITY.

Gold mining in the district has not yet recovered from the effects of restrictions placed on it as a war-time measure, but there was a marked increase in activity during the field season.

The largest mine operating in the district during the year was the Phoenix Mine at Coolgardie. Tindal's Mine has not yet resumed production (February, 1947).

During the year options were taken by the Western Mining Corporation over the "Barbara" Mine and Bakers' leases, at the Hampton Group, and over the "Bellbird" Mine south of Burbanks, while leases were taken up by the Company at Burbanks. The Company has already exercised its option over the "Barbara" Mine.

The Chattanooka Syndicate was carrying on exploratory work at Zadow's Mine, about two miles west of the 7-mile peg on the Norseman road, and another syndicate was investigating the old "Sydenham" Mine and adjacent leases.

In July, the Baker Bros. made a new find in the Hampton ultrabasic belt about 2 miles south-east of Tindal's Mine. Soon afterwards other discoveries, which are locally known as Frank's Find, Dryden's Find, Moore's Find, Park's and Gordon's Find and May's Find, were made in the same belt of country. The new find of the Baker Bros. was a great incentive for further prospecting in the district.

Towards the latter part of the year the Hampton Plains Company appointed a mining engineer, and commenced operations on its own account on holdings at the Hampton Group on Location 59. It is understood that there is likely to be an expansion of their prospecting activities.

Due to the shortage of crushing ore, the Coolgardie State Battery was only operating for broken periods during the year, but continuous crushing will be resumed when warranted.

Mining was in progress at the Londonderry felspar quarry throughout the year.

FIELD WORK.

The district was visited during January, 1946, by the writer and Mr. H. J. Ward for the purpose of making a geological map of the Hampton Group, but it was not until the beginning of April that the general resurvey was commenced.

Initially, three geologists, namely the writer and Messrs. H. J. Ward and J. H. Lord, were included in the field party. The writer, who was officer in charge of field work, was responsible for the general geological investigations and for the supervision of the work of the other two geologists, whose efforts were to be concentrated on the detailed surface and underground investigations at the various mining groups. Owing to increased commitments of the Geological Survey, it became necessary, early in May, to withdraw Geologist Lord from the Coolgardie district for work elsewhere, and as a result, most of the mining group investigations were carried out by Geologist Ward. Field work for the season was discontinued early in December.

The general geological investigations involve remapping the area on a scale of 20 chains to 1 inch, and this has been carried out to date by tacheometer and staff, compass and chain, and car traverses, the surveying methods varying according to conditions. The use of aerial photographs of the district, kindly made available by the Western Mining Corporation, has facilitated the work. At the commencement of the season, work was concentrated on establishing a geological section of the country for about 3 miles eastwards from Coolgardie, in order to lay down a control for the group mapping and to determine the most favourable horizons for structural mapping. In addition to the above, prospecting activity in the area was assisted by making preliminary investigations of holdings, by giving verbal advice and assistance, by publishing details of favourable areas for prospecting through the Press, and by posting a progressive structural geological map, which was brought up to date monthly, at the Mining Registrar's Office.

The mining group investigations involve the preparation, by the use of a plane table, telescopic adilade and staff, of 5 chain to 1 inch geological maps around the various mining groups, and also the preparation of underground geological plans and sections. Where mine plans are unavailable, compass and tape surveys of the mine workings are carried out prior to geological mapping.

For the benefit of the mining public, it is perhaps advisable to point out that the scope of the investigations is such that the party is limited to recommending likely areas for prospecting, and does not actively engage in prospecting.

During the progress of both the general and group investigations specimens for analyses, and mineral petrological determinations were collected.

GEOLOGY.

Classification of the Rock Types.

The classification given below should not be regarded as the final classification of the rocks of the district, as amendments to it will probably be made before the resurvey is completed.

Age.	Series.	Description.	Remarks.
Recent ...	...	Soils	Various Types.
Tertiary to Recent	...	Alluvial and Lake Deposits	These deposits may be younger or older than the laterite deposits, and possibly deposits of both ages occur.
Tertiary (?) ...	...	Ferruginous Laterite and "Cement" Deposits	The laterites of the State are generally accepted as being of Tertiary age.

PLATE IV

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

GEOLOGICAL SKETCH MAP
— OF —
— PORTION OF THE —
YALGOO AND MURCHISON GOLDFIELDS

Scale: 10 miles to an inch

10 5 0 10 20 30

Compiled from field maps, scale 1" = 4 miles, by W. Johnson, Dec., 1946.
Geology by R.A. Hobson and W. Johnson, June - Nov, 1946

LEGEND

RECENT

Alluvium — Gn

PRE-CAMBRIAN

Horizontal quartzites, Nullagine Series — N

Granite. Includes small areas of sandplain and gneiss. — Gr

Gneiss. Mainly granitised greenstones or sediments. Includes frequent small ungranitised patches of greenstone or sediments. May include some granite or sandplain. — Gn

Sandplain. Sandy soil, laterite rubble — Gr/Gn

Sediments, steeply inclined and metamorphosed. Includes mica schists, phyllites and quartzites with some sandstones, conglomerates, interbedded basic lavas and intrusives. — S

Greenstone i.e. basic lavas with intrusive basic and acid rocks, pyroclastics and minor quantities of sedimentary rocks. — G

REFERENCE TO SIGNS

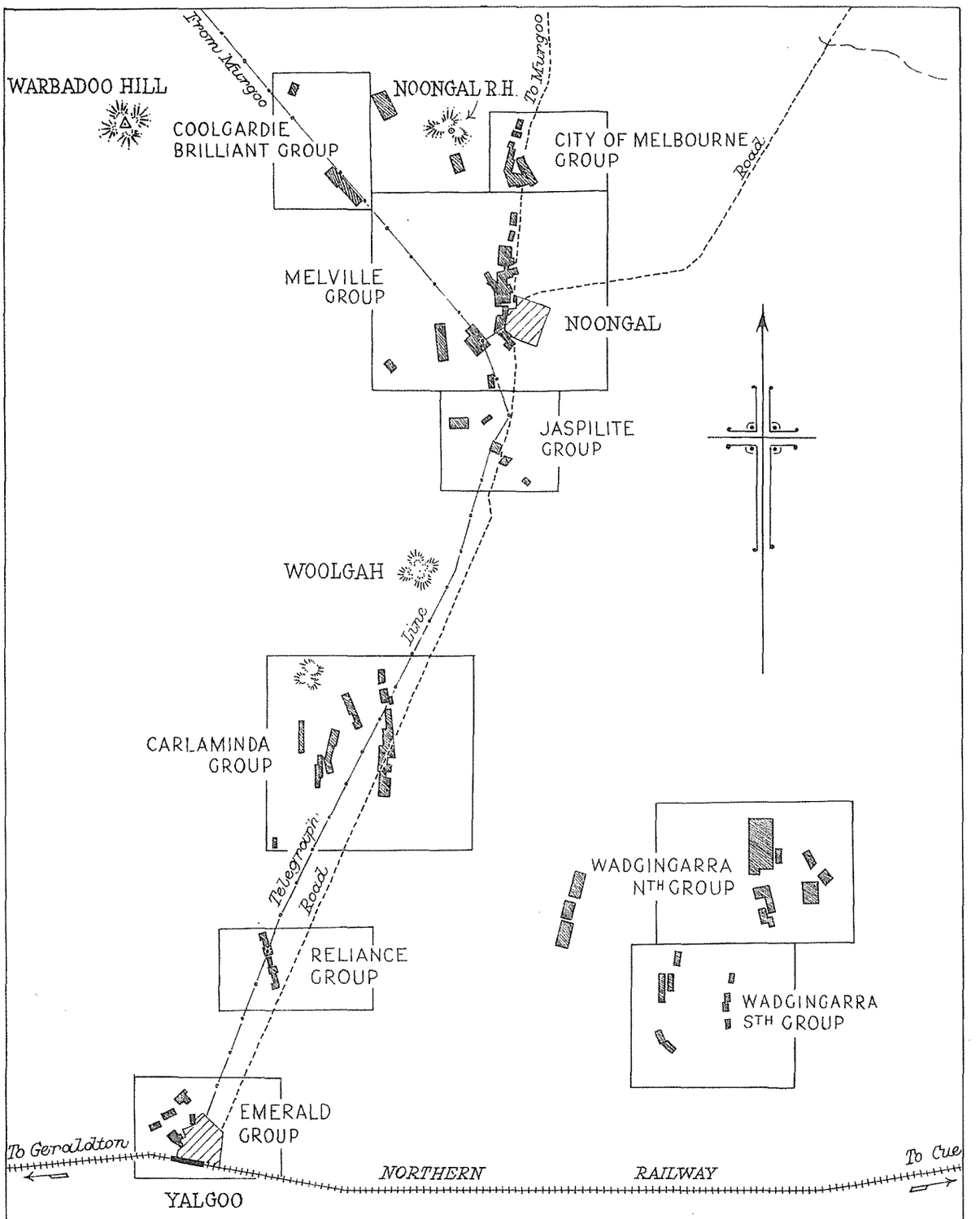
Approximate geological boundaries ---------
Main roads ---------
Railway +++++++++
Fence —"—"—
Hills with trig stations Δ ERIDA
Hills with cairns (c) WALLOO
Sheep station homestead ▪ "EDAH"

MINERAL LOCALITIES

Designated thus

Au. — Gold
Fe. — Iron
Cu. — Copper
Sn. — Tin
Be. — Beryl
Bi. — Bismuth
Wo. — Scheelite

PLATE Nº V



GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

MAP SHOWING MINING GROUPS
IN THE
VICINITY OF YALGOO AND NOONGAL (*MELVILLE*)

Scale: 2 miles to an inch

Age.	Series.	Description.	Remarks.
		POST-ALASKITE MOVEMENTS.	
Pre-Cambrian	...	Quartz veins, alaskite dykes, and probably the mineral-bearing pegmatites of the Londonderry area and elsewhere.	This may possibly represent a second age of granitic intrusion or a regeneration of the granitic magma responsible for auriferous ore deposition.
		POST-GOLD-FAULTING.	
Pre-Cambrian	...	Intrusive biotite granite and biotite gneiss, associated with which are quartz veins and (?) pegmatite dykes. Auriferous ore deposition is associated with this period of intrusion.	Ore deposition is controlled by the regional folding and is also known to occur in places in post-porphyry shears hence it must be younger than both.
		REGIONAL FOLDING, SHEARING AND JOINTING.	
Pre-Cambrian	...	The porphyry-porphyrite series of acid intrusive sills and dykes.	The rocks are folded, sheared and jointed and are therefore older than the regional folding. The source magma of these rocks is unknown but was presumably granitic.
		PRE-PORPHYRY MOVEMENTS.	
Pre-Cambrian	Sedimentary Series. [(?) Black Flag Series.]	Metamorphosed, interbedded erosion sediments consisting of slates, phyllites, mica schists, grits and quartzites, with some greenstone bands.	The series is intruded by the porphyry-porphyrite series and by granitic rocks, and appears to conformably overlie the Greenstone Series.
Pre-Cambrian	Greenstone Series. [(?) Kalgoorlie Series of Older Greenstones.]	Metamorphosed, alternating, conformable belts of basic lavas and allied rocks and ultrabasics, interbedded with which is a belt of amphibolite and thin bands of slate and mica schist	The placement of the amphibolite in this series is in accordance with available field evidence, but petrological work suggests that it may eventually be found to be younger in age, and belong to a Quartz-Dolerite period of intrusion.

DESCRIPTION OF THE ROCK TYPES.

Greenstone Series.

This series consists of metamorphosed, alternating, apparently conformable belts of basic lavas and allied rocks, and ultrabasics, interbedded with which is a belt of amphibolite and thin bands of erosion sediments consisting of slates and mica schists. The series is folded, sheared and jointed, and intruded by the porphyry-porphyrite series and by the granite and allied rocks.

Basic Lavas and Allied Rocks.—Four main belts of these rocks have been mapped, and they consist of fine to medium grained basic lavas, pillow lavas, amygdaloidal lavas, porphyritic lavas, volcanic breccias, volcanic agglomerates and possibly tuffs. They are hard, dark-greenish coloured rocks, which show only a rude schistosity. These rocks have been fairly resistant to erosion and frequently form the hills in the area. The lavas generally have a dark brown coating on their weathered surface, and they yield a dull reddish soil which frequently contains calcareous travertine. Considerable variations in the character of the lavas occur within each of the four main belts, and thin bands of slate, mica schists and/or volcanic agglomerate are generally present, indicating that the belts are made up of successive flows. Local coarse grained patches and layers, which may possibly result from recrystallisation, occur in places in the fine and medium grained lavas in proximity to shear zones.

A typical suite of specimens representing the basic lavas and allied rocks had been collected, with a view to making petrological determinations of the various types. At this juncture, however, the volcanic structures are sufficient to establish the origin of these rocks.

Ultrabasics.—Five belts of ultrabasic rocks, which can be conveniently referred to as the Mt. Robinson, the Bonnievale, the Hampton, the Tindal's and the Lord Bobs belts, were mapped in the area during the 1946 field season.

The ultrabasic rocks consist of fine to coarse grained actinolite, actinolite-tremolite and anthophyllite rocks and schists, fuchsite schists and serpentine rocks, with local variations to talc schists, chloritic schists and hydro-biotite schists in the vicinity of shear zones. Schists containing magnetite, and martite pseudomorphs after magnetite, are met with in places. Decomposition products in the form of magnesite, jaspery ironstone and anthophyllite boulders, and cellular opaline quartz rubble are scattered over the belts, and are of importance in determining the presence of ultrabasic rocks in the soil covered areas. Patches of coarse gained hornblendite (e.g., specimen C. 35), which are believed to be related to the ultrabasic rocks, occur at scattered localities in the belts. Narrow unmapped bands of basic lava also occur in the ultrabasic belts in some places. The ultrabasics are much softer rocks than the other components of the Greenstone Series, and as a result of differential erosion they are generally found occupying the low-lying country between the ranges of hills formed by either the basic lavas or the amphibolite.

From field evidence, and from a few petrological determinations kindly made by Dr. R. T. Prider, of the University of Western Australia, there is little doubt that the rocks of these belts are of ultrabasic

composition, but it appears that much more petrological work will be necessary before their mode of origin can be definitely established.

The ultrabasic rocks occur as conformable belts in the Greenstone Series, and the writer favours the view that the various types have resulted from the regional metamorphism of sills or flows, originally consisting of peridotites and pyroxenites. The regional metamorphism is believed to have taken place under conditions in accordance with those described by Harker*, and the scattered patches of serpentine and hornblendite which occur in the belts are believed to be the less metamorphosed remnants of the original peridotites and pyroxenites respectively. It is of interest to note the serpentine and hornblendite patches have not been found in the ultrabasic belts near the crossfold axes where the regional metamorphism may be expected to have reached its greatest intensity. This view differs from previously accepted ideas in that the serpentine and hornblendite are not regarded as representing local intrusions. Due to their conformability with the remainder of the Greenstone Series, and their consistent association with the basic lavas and allied rocks, the writer is inclined to doubt even if the ultrabasic belts themselves are of intrusive character, and to regard them as volcanic rocks of ultrabasic composition.

Amphibolite.—The amphibolite occurs as a conformable belt in the Greenstone Series. Two fairly distinct types, which can be conveniently referred to as the "Three Mile Hill" and "Mottled" types, are included in the belt as shown on the accompanying map.

The "Three Mile Hill" type appears to be more or less confined to the stratigraphical hanging wall of the belt. It is a medium to coarse grained equigranular, blackish rock, consisting chiefly of hornblende with minor amounts of felspar and quartz. It is generally blocky to rudely schistose, but becomes highly schisted in the vicinity of shear zones.

The "Mottled" type, which occurs along the stratigraphical footwall of the belt, is a medium to coarse grained equigranular rock, generally composed of dark greenish hornblende and felspar occurring in approximately equal proportions. In some varieties, however, the dark greenish hornblende predominates, and in others it is arranged in knots giving a porphyritic appearance to the rock. This type of amphibolite is generally blocky or only rudely schistose.

The amphibolites are hard rocks and their resistance to erosion has caused them to form many of the prominent hills in the area. The bare nature of the hills and the presence of brick red soil is often a guide, from a distance, to the presence of amphibolite.

The amphibolite extends continuously in a north-westerly direction from near the Hampton Group to the vicinity of Bonnievale, and is also well exposed in the Grosmont area. Near Calooli, at Zadow's Find and at the Queenslander Group, amphibolite schists occur, which, judging from their stratigraphical position and general appearance, could be the sheared equivalents of the amphibolite. Further investigations are necessary, however, for this to be definitely established.

A few specimens of amphibolite, mainly representative of the "Three Mile Hill" type, were petrologically examined by Dr. R. T. Prider, and determined as "granulitic, doleritic to gabbroidal epidiorites derived from an intrusive gabbroidal magma, which probably suffered some movement during the final phases of consolidation." He is of the opinion that they are definitely not part of the Older Greenstone Series, and "may belong to the Younger Greenstone Series or a still younger group of intrusives."

These observations are presumably in agreement with the petrological classification of the Younger Greenstones as established at Kalgoorlie, but the writer doubts whether sufficient detailed geological mapping has yet been carried out in that district to confirm by their field distribution the intrusive origin of the quartz-dolerite greenstone and its so-called associates, and whether, if this was done, some of the associates would not prove to be recrystallised volcanic rocks.

It is also difficult to reconcile Dr. Prider's views with available field evidence and, until unquestionable field evidence of intrusive origin is obtained, or a more extensive suite of the amphibolite has been petrologically examined, the writer is not prepared to remove the amphibolite from the Older Greenstone Series.

The distribution of the amphibolite belt can be seen on the accompanying map (Plate No. VI). It is conformable with the other components of the Greenstone Series and has also been regionally folded. While the coarse crystalinity of the rocks certainly suggests that it is an intrusive, the absence of intrusive junctions, chilled margins and evidence of contact metamorphism give no support to this origin. The belt is practically everywhere bounded on both sides by narrow beds of slate and, on the old "Sydenham" and adjacent leases, there is some suggestion of internal folding in the amphibolite, both of which are inconsistent with an intrusive origin. From available field evidence, the writer is inclined to regard the amphibolite as a recrystallised volcanic rock.

Erosion Sediments.—Narrow beds of metamorphosed erosion sediments, consisting of grey slates, which are sometimes graphitic and/or mica schists, occur at practically all the junctions of formations in the Greenstone Series, and are also frequently found in the basic lava belts at the junctions between successive flows.

With the exception of a few small scattered lenses, jaspilite has not been found in the district, and the slate beds have been used for the purpose of structural geological mapping.

Sedimentary Series.

This series has only been mapped to date on the Norseman Road and for a few miles to the north of it, but from additional reconnaissances in this area and also to the north-east of Mt. Robinson, it appears that a fairly wide belt of metamorphosed erosion sediments, which conformably overlies the Greenstone series, extends between these two places. It is likely that its distribution will follow closely the limits assigned to it by Homan† in Bulletin 56.

The series consists of interbedded slates, phyllites, mica schists, grits and quartzites, with occasional greenstone bands. It is folded, sheared, and jointed, and is intruded by the porphyry-porphyrite series and by the granite and allied rocks.

It is believed that this Sedimentary Series corresponds with the Black Flag Series, which conformably overlies the Older Greenstone Series in the Kalgoorlie district.

Porphyry-Porphyrite Series.

The Porphyry-Porphyrite Series consists of acid intrusive sills and dykes, which vary individually, and also within themselves, from felsitic to porphyritic in texture. The series is sheared and jointed, and both regionally and locally folded. The physical character of the series, taken in conjunction with the fact that pegmatites have been noted cutting through porphyry dykes in a few places (e.g., on G.M.L. 1619 between Burbanks and Londonderry), indicates that the series is of an earlier age than the pegmatite dykes, alaskite dykes and quartz veins of the district.

The intrusion of the Porphyry-Porphyrite Series has taken place most frequently close to formation junctions, where they are often closely associated with slate beds, and at intervals in the ultrabasic belts, which may possibly represent junctions between different types of ultrabasic rocks. Along these structurally weak zones the porphyries sometimes occur as single sills, but more generally as groups of sills. The intrusive nature of the series is established by the fact that some of the sills branch, and in places porphyries occur which are transverse to the general strike and are obviously dykes (e.g., on G.M.L. 2428 north of Coolgardie).

* Harker, A., "Metamorphism," 1932, pp. 274-277, 304-306.

†Homan, C. S., G.S.W.A. Bull. No. 56, Plate No. 1.

The normal type of porphyry is granitic in composition, the essential constituents being albite felspar, quartz and a little muscovite and biotite mica, with ilmenite occurring as a common accessory. When the porphyritic texture is developed, the phenocrysts consist of quartz and/or felspar. From traversing porphyries over many miles along their strike, fairly conclusive evidence has been obtained that variations in their general appearance and composition occur due to local assimilation and/or replacement of wall rocks. Where porphyries follow slate beds the slate bed is sometimes absent over short sections, and the porphyry becomes cherty and assumes a dull bluish-grey colour. When the ultrabasics are the host rocks of the porphyries, the local hybrid varieties of the porphyry contain abundant actinolite and possibly other extraneous minerals. Work to date indicates that there is only one series of porphyry-porphyrite intrusions in the area, which are probably consanguinous with the Albite-Porphyry Series of the Kalgoorlie district.

The results so far obtained do not support previous views that ore deposition is an end phase injection of the porphyry period of intrusion, and it is believed that the frequent association of ore deposition with porphyries is only a structural, not a genetic relationship. It is contended that while the Porphyry-Porphyrite Series is pre-folding, ore deposition must be post-folding as it is largely controlled by the folded structure, and hence is more likely associated with the post-folding period of granitic intrusion. More direct evidence of ore deposition being post-porphyry in age, which is given later in this report, has been obtained from some of the mines in the district, and also from mines at Kalgoorlie.

Granite and Allied Rocks.

As work during the 1946 field season was mainly concerned on the Greenstone and Sedimentary Series, the main granitic areas have so far received little attention. Isolated granite "rocks" have been examined, however, which consist chiefly of medium-grained, equigranular biotite granite, and occasionally of porphyritic biotite granite. These rocks are intruded by barren pegmatite dykes.

The main granitic areas meet the Greenstone and Sedimentary Series with intrusive junctions, and are obviously post-folding in age. Massive granite "rocks" occur at the junctions in some places, but, in others, gneiss of granitic composition occurs which may represent granitised rocks.

The apophyses from the granitic magma occurring in the pre-Cambrian succession consist of barren pegmatite dykes, mineral-bearing pegmatite dykes, post-gold alaskite dykes, auriferous quartz veins and barren quartz veins, some of the latter being younger in age than the post-gold faulting. To be consistent with this field evidence it must be assumed that there were either two periods of granitic intrusion, or there was a regeneration of the original granitic magma. The auriferous quartz veins, and some of the barren quartz veins and barren pegmatite dykes are believed to have been associated with the first period of intrusion. The evidence for placing the mineral-bearing pegmatites, such as those at Londonderry, in the second period of intrusion, is based on the fact that they are restricted to only certain parts of the area, which bear no relationship to the distribution of the auriferous deposits. There is no available evidence as yet to suggest the presence in the area of a second period of auriferous ore deposition.

Ferruginous Laterite and "Cement" Deposits.

Patches of ferruginous laterite, which occur as hard cappings on hills and rises, are scattered over the area, and they appear to be most ferruginous when they are overlying greenstones. They are considered to be remnants of an original laterite plateau.

The laterites of the State are generally regarded as being of Tertiary age, and for this reason they have been classified as such. No attempt has yet been made to determine the relative ages of the laterite and other superficial deposits. It is assumed that the ferruginous laterite has been formed as a fossil B horizon in an old soil profile as described by Prescott (Ref. p. 188).

The gritty cement deposits occurring over parts of the granite country, and the concretionary travertine deposits on some of the greenstone country, are believed to have had a similar origin, but were formed in soils having a different composition.

Alluvial and Lake Deposits.

Much gold has already been won from alluvial ground in the Coolgardie district, and consequently these deposits warrant a fair amount of attention, which they have not received so far during the present survey. However, some observations have been made which are worthy of recording.

Except in the immediate vicinity of the hills, most of the drainage channels in the area are filled with alluvial deposits, and these deposits probably also fill many of the depressions. The presence of beds of wash in some of the deposits in the old drainage channels (e.g. on G.M.Ls. 356 and 372 at the Hampton Group) leaves no doubt of their alluvial origin. The old drainage channels trend towards the lakes, which are themselves filled with deposits, presumably of alluvial origin. Increased run off, resulting from the cutting out of the timber in the area over the last 50 years, is causing recent erosion of the alluvial deposits, and in many places deep stream channels can be seen cutting back into the alluvial deposits in the old drainage channels. It appears likely that both the alluvial deposits and at least some of the lake deposits, were laid down during a previous cycle of erosion which eventually reached a stagnation stage in comparatively recent times. This previous cycle of erosion is believed to be that responsible for the denudation of the original laterite plateau.

In Rollo's shaft, which was sunk in the alluvial flat south-east of the Coolgardie State Battery in the early days of the field, a thickness of 400 feet of alluvial deposits is reported (Ref. p. 189) to have been encountered. The lower beds in this section show marked difference in character from the other alluvial deposits in the area, and may represent a second, earlier age of alluvial deposits. The first alluvial deposits may possibly be contemporaneous with, or slightly earlier in age, than the period of lateritisation.

Soils.

The hill slopes bordering the alluvial flats are frequently soil covered, and the soils often show differences in appearance, physical character and composition, which vary according to the nature of the underlying rocks. These differences can be used as a guide for mapping, but it has been found that the rock fragments and their decomposition products occurring in the soils, have been more useful in this respect.

GEOLOGICAL STRUCTURE.

From the accompanying progressive structural geological map (Plate No. VI), it will be seen that the pre-Cambrian succession of greenstone and sedimentary rocks has been regionally folded. The resulting structure is in the form of an elongated dome, with steeply dipping limbs and a steep pitch at the north end. The southern end of the structure has not yet been mapped, but from the known distribution of the greenstone series in this area (Ref. p. 189), there is a suggestion that it will terminate as a long attenuated fold near the Nepean Group.

Granite and allied rocks occupy the core of the dome, and have also invaded and partly absorbed the western limb. The eastern limb is well preserved, however, and reference to Honman's plan in Bulletin 56 (Ref. p. 190), in addition to the accompanying plan, shows a wide section of it extending eastwards from Coolgardie for about 10 miles. Taking into account Gustafson's and Miller's observations at Kalgoorlie†, it is highly probable that this eastern limb of

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*Prescott, J. A., C.R.I.R. Bull. No. 52, pp. 45-51.
*Blatchford, T., G.S.W.A. Bull. No. 3, pp. 21-24.
*Blatchford, T., G.S.W.A. Bull. No. 53, Plate No. 1.
*Honman, C. S., G.S.W.A. Bull. No. 56, Plate No. 1.
†Gustafson, J. K., and Miller, F. S., Proc. Aust. I.M.M., N.S., No. 106, 1937, pp. 93-125.

the Coolgardie structure represents the reappearance of the Older Greenstone Series of Kalgoorlie, after it has passed beneath the Black Flag and Kurrawang Series in the Kurrawang Syncline. As has already been stated, amphibolite, which may possibly be a representative of the Younger Greenstone Series of Kalgoorlie, occurs in the Greenstone Series at Coolgardie.

Regional folding has occurred on two separate axis, one of which strikes in an approximately east-north-east by south-south-west direction. The latter is being referred to as crossfolding. There is no available evidence of the relative ages of these two types of folding, but the writer favours the view that crossfolding closely followed the other period of folding.

The presence in the ultrabasic belts of much internal folding, and a more highly developed schistosity than in the other formations, indicates that they acted as the incompetent rocks during regional folding. It is probably for this reason that they have been the most favourable rocks for ore deposition in the district.

Only one crossfold, namely, the Tindal's crossfold, has been established, which is anticlinal and has a steep pitch to the east-north-east. The axis of this crossfold appears to extend south-south-westwards through Grosmont to Gibraltar, and east-north-eastwards probably to the south of Kalgoorlie in the direction of Boorara. It is of economic interest to note that there is little evidence of crossfolding in the lowest formation of the Greenstone Series on the Tindals crossfold, and folding of the formations becomes progressively more intense towards the top of the greenstone section. By reference to the accompanying map it will be seen that where the Hampton ultrabasic belt is encountered in the section, two folds have developed on the axis instead of one.

There is probably a synclinal crossfold of the same order in the vicinity of Bonnievale, and another of the same type will very likely be found at the south end of the Coolgardie structure. Crossfolds of a lower order may be responsible for the flexuring of the formations between the major crossfolds.

From the classification given in the early part of this report, it will be seen that evidence has been obtained of the occurrence of at least four periods of movement in the district.

The first period of movement is that which caused the shearing, at formation junctions and elsewhere, to allow the entry of the porphyry-porphyrite series of intrusives. It may possibly have occurred in the early stages of regional folding, but definitely before the cessation of regional folding as the porphyry-porphyrite series is itself folded, sheared and jointed.

Regional folding, accompanied by local folding, shearing, jointing and readjustments along the formation junctions, followed the pre-porphyry movements. The openings for auriferous ore deposition were formed during this second period of movement.

The presence of post-gold faults in the district (e.g. at the Phoenix Goldmine, Coolgardie), and of alaskite dykes in shears cutting through ore bodies (e.g. at the Barbara Goldmine, Hampton Group), indicates that further readjustments followed gold deposition.

The faulting of an alaskite dyke in the Barbara Goldmine indicates a fourth period of movement.

There are only two important points regarding the local structures, which deserve special mention at this juncture, and they are that the local folding, shearing, and jointing is generally more intense in the vicinity of the Tindals crossfold axis than elsewhere and that a steep cross jointing, which may represent the fracture cleavage of the crossfolding, is frequently developed in the porphyries in this structure.

In mapping the geological structure, the structure outline plan around Coolgardie, drawn from aerial photographs by Dr. K. R. Miles in 1941, was very useful.

ORE DEPOSITION.

The following types of ore deposits have already been noted in the district:—

(a) Quartz reefs with or without lode material in greenstone country.

(b) Quartz reefs with or without lode material in sedimentary bands in the Greenstone Series.

(c) Quartz reefs with or without lode material in porphyry dykes (e.g. at the Phoenix Goldmine, Coolgardie).

(d) Stockwork types of deposits consisting of lode material, and narrow quartz veins with varying attitudes, which are confined to the amphibolite belt.

(e) Schistose greenstone lode material with hard albitised and silicified bands (e.g. at the Barbara Goldmine, Hampton Group).

(f) Silicified lodes occurring in special structural positions near porphyry dykes (e.g. at the old Bellbird Goldmine, south of Burbanks).

(g) Porphyry lode material with quartz veinlets (e.g. at the Tindals Goldmine).

(h) Hybrid silicified porphyry lodes (e.g., the "Brown Lode" at the Surprise G.M., Hampton Group);

(i) Deposits of alluvial and/or eluvial gold about which little information has yet been obtained.

The most favourable host rocks for ore deposition have been the ultrabasics, and most of the bigger mines in the area are situated in rocks of this type. The relative favourability of the different ultrabasic belts appears to be governed to some extent by the facilities offered for their easy accessibility by ore solutions emanating from the granitic magma.

In addition to favourable host rocks, it has been established that there are also favourable horizons for ore deposition, along which the majority of the ore bodies occur at scattered intervals. These favourable horizons consist of formation junctions, junctions between successive flows in the lava belts, and the scattered groups of porphyry sills in the ultrabasic belts. Shearing apparently occurred along these lines of weakness during the period of regional folding.

Auriferous deposits occur at scattered intervals along these favourable horizons, but they are in greater abundance and generally most important, in the vicinity of the major crossfolds and the minor flexures occurring between them, which are probably also related to the crossfolding. There is good reason to believe that the localisation of ore deposition is controlled by crossfolding.

Evidence to support the belief that ore deposition in the Coolgardie district is post-porphyry in age, is as yet inconclusive, but taken in conjunction with evidence obtained at Kalgoorlie, there is little doubt that this is correct. The frequent association of ore bodies and porphyries in the Coolgardie district is thought to be only a structural, not a genetic, relationship.

It is argued that, in the Coolgardie district the physical character and distribution of the porphyries indicates that they have been included in the regional folding, and are therefore of an earlier age than ore deposition, which is controlled by the regional folding. Supporting, though also inconclusive, evidence has been obtained in several of the mines in the area (e.g., in the Lady Mary G.M., Hampton Group), where the ore bodies occur in shears, which do not follow faithfully the folded structure of the porphyry and are undoubtedly later in age.

Through the courtesy of the managements of the Lake View and Star and South Kalgurli Mines at Kalgoorlie, the writer was able to inspect a few, and obtain other examples of, ore bodies occurring in faults displacing porphyry dykes, which appears to be conclusive evidence of ore deposition being later in age and in no way associated with porphyry-porphyrite period of intrusion. The examples of this relationship between the ore bodies and the porphyries, which have been noted, are as follows:—

(a) The Lake View East lode, which can be seen in a fault displacing an albite porphyry dyke, at the 1,000 feet level in the Lake View Mine.

(b) The No. 3 Tetley Lode, which can be seen in a fault displacing an albite porphyry dyke, at the 1,100 feet level in the Associated Mine;

(c) The No. 1 Cross Lode, which can be seen in a fault displacing albite porphyry and hornblende porphyrite dykes, at the 1,500, 1,600, 1,700, 1,800 and 1,920 foot levels in the South Kalgurli Mine.

Insufficient work has yet been done on the mines to generalise on the local control of ore shoots within the different types of ore bodies. The control at a few centres, however, has been established by my colleague, Mr. H. J. Ward.

At the Hampton Group, ore deposition has occurred in the greenstone lodes as discontinuous shoots, in strong but complicated shear zones. The ore shoots are generally lenticular, and when they terminate along the strike and down the dip, it is necessary to break through either the hanging wall shear or footwall shear to find the next shoot. It is most common to find the shoots stepping south into the footwall when driving east, and north into the hanging wall when sinking. It is expected that this will also be the control of the shoots at Baker's New Find.

From the writer's observations it also appears likely that the local folding of the porphyries has sometimes helped to concentrate the auriferous solutions. The "Brown Lode" at the Surprise Goldmine is thought to have had this control, and other examples occur at the Tindal's and Bellbird Goldmines.

The fact that the ore deposits have been richer near the surface than at depth, the occurrence of enrichments at water level, and the frequent occurrence of paint gold, and sometimes crystalline gold, in the ore bodies in the oxidised zone, leave little doubt that they have been subjected to the processes of secondary enrichment.

RESULTS OF RESURVEY.

During the 1946 field season, the general geology was mapped over an area of approximately 200 square miles extending from Bonnievale to Londonderry, and group maps were prepared and underground investigations carried out at the Hampton, Bayley's and Burbanks Groups and at Baker's New Find.

The greenstone section, the geological structure, and the order of events in the geological history have been fairly satisfactorily worked out in the area already mapped, and it has been established that there are favourable horizons for gold deposition, in which the localisation of the best ore bodies appears to be controlled by crossfolding. This knowledge has led to the discovery of several new finds, and renewed activity at some of the old ones, as well as a better understanding of the manner of ore occurrence at many of the older mines.

Regarding Baker's, Frank's, Dryden's, Moore's, Park and Gordon's and May's New Finds, it is of interest to point out these discoveries were all made in an area previously recommended for prospecting by the writer. This recommendation was based on geological evidence of the occurrence of a partially obscured fold, where conditions for ore deposition were favourable, immediately to the south, and in the same stratigraphical belt and crossfold structure, as the Hampton Group. The official records show that crushings received from Baker's and Frank's Finds to 31st December, 1946, have yielded 406.38 fine ounces of gold from 443.25 long tons of ore.

The detailed work at the mining groups has assisted mining companies and small mine owners in their exploratory and development work, and also in solving many of their local geological problems.

Two areas on location 59, which had previously been recommended for prospecting on geological grounds, were geophysically surveyed at the latter part of the year by a Commonwealth party, with a view to reducing the favourable areas for prospecting to smaller limits. The survey of an area east-north-east of the Hampton Group, which was examined first, produced unsatisfactory results, but the trial traverses of the second area, which includes the alluvial flat at the Hampton Group, gave every indication of yielding valuable information.

FUTURE INVESTIGATIONS.

It is proposed to carry out the following investigation before the completion of the resurvey:—

1. Further geological mapping and interpretation of the general and mining geology of the area.

2. Determinations of the mineral and chemical composition of the various ores.

3. Petrological and chemical examinations of typical suites of rocks from the area.

4. A study of the problem of secondary enrichment, aided by mineragraphic examinations of sulphide ores.

5. Determinations of unusual minerals.

6. Geological examinations of mineral deposits other than gold.

7. Additional geophysical surveys in areas recommended for prospecting.

PROSPECTING RECOMMENDATIONS.

Work to date indicates that there are opportunities for renewed activity at some of the old mining centres in the area, and that opportunities for new discoveries are practically confined to the low-lying, extensively soil covered and alluviated areas. The soil covered areas respond to loaming methods of prospecting, but for the alluviated areas it appears that drilling, preferably preceded by geophysical surveying, is required.

As has been previously described, the most favourable places for ore deposition occur in the vicinity of crossfold axes, at formation junctions, and close to lines of porphyry, which occur at intervals in the ultrabasic belts. The ultrabasic rocks in particular warrant attention, as they have been the most favourable host rocks in the area.

The following areas, some of which have already been announced through the press or posted at the Mining Registrar's Office, Coolgardie, are recommended for prospecting:

1. A strip of country about 1 mile wide, which embraces the fold containing the Hampton Group, should be prospected in an east north east direction for at least 6 miles. The strip of country is along the supposed continuation of the axis of the Tindal's crossfold and is extensively soil covered and alluviated. Prospecting should be concentrated around the approximate intersections with the strip, of the amphibolite belt, and the Bonnievale and Mt. Robinson ultrabasic belts, which have been auriferous farther north. The Sedimentary Series, which is intruded by granite*, also warrants prospecting in the vicinity of the crossfold.

Crossfolding on the Tindal's axis, represents folding of a fairly high order and consequently it may persist as far as Kalgoorlie.

2. Further prospecting is warranted in the fold containing Baker's New Find, particularly towards the south eastern apex and in higher stratigraphical formations.

3. There is scope for further prospecting at the Hampton Group, in the following places:

(a) In the incompletely explored soil-covered parts of the ultrabasic belt;

(b) Below the alluvial flat for possible extensions of the favourable auriferous horizons being developed on the "Surprise" and "Lady Mary" Goldmines;

(c) Within the alluvial ground itself on the downstream side of these possible lode extensions;

(d) Below the soil-covered country in the vicinity of the south western boundary of G.M.L. 401,

*G.S.W.A. Bull. No. 56, Plate No. 1.

where a band of graphitic slate with porphyry should intersect the Tindal's crossfold axis. This band of slate outcrops on both sides of the crossfold, and the presence of scattered workings show that it has been auriferous.

4. Prospecting is warranted in a strip of country about one mile wide extending north east for 4 to 5 miles from the fold in the Bonnievale ultrabasic belt to the south west of the 4-mile peg on the Kunanalling road. This recommendation is based on the fact that mining has been carried out around this fold in most of the stratigraphically lower formations, and other favourable horizons for ore deposition, which have so far been neglected, may occur in the same structure higher in the section.

5. Based on the same grounds as recommendation 4, prospecting is also warranted over a strip of country about 1 mile wide, extending for 4 to 5 miles east north east of the anticlinal fold in the Bonnievale ultrabasic belt, which occurs immediately to the south of Bonnievale.

6. Prospecting is also warranted in two places within this Bonnievale structure—

(a) Near both the hanging wall and footwall sides of the sharply folded section of the amphibolite;

(b) In the soil-covered country occurring between the basic lavas and the granitic rocks in the lower part of the fold, where a small obscured section of the Hampton ultrabasic belt may possibly be tucked in.

7. Prospecting is also warranted in the folded section of the amphibolite, occurring in the Grosmont area, occurring about ½ mile south west of the 4-mile peg on the south west boundary of Timber Reserve 19211.

8. The western margin of the Hampton ultrabasic belt forms the south-eastern edge of the outcropping section of the greenstone country, as far south-west as Londonderry, and it has not been subjected to much prospecting. There are two places between Baker's New Find and Londonderry, where local folds occur at the junction of the belt and prospecting is warranted—

(a) The section of the Hampton belt enclosed by lines drawn in east north east and south east directions through Burbank's siding. In this section the western boundary of the belt is about ¾ mile east of the siding;

(b) The section of the belt extending about ¾ mile north easterly from a line drawn east south east through the south peg of old G.M.L. 1619 on the Burbanks-Londonderry road.

9. The soil-covered section of the Tindal's ultrabasic belt at the south-west end of the Burbanks Rifle Range warrants prospecting. There is a local swing in the belt in this vicinity.

10. The whole of the Lord Bobs ultrabasic belt occurring to the south of a line drawn west from the 4-mile peg on the Burbanks road warrants prospecting, particularly at its folded southern extremity.

11. There is scope for prospecting to the south-west in the belt of ultrabasic rocks, which intersects the Norseman road between the 12 and 13 mile pegs. Reconnaissances have indicated there is a possible swing in the belt in this direction. It is thought that this belt of country represents the southern extension of the Mt. Robinson ultrabasic belt.

12. There are indications of the presence of a major synclinal crossfold near Bonnievale, and, if it is assumed that the axis is parallel to the Tindal's crossfold axis, its south-western extension would intersect the Bullabulling-Jaurdi Hills greenstone belt a few miles north of Bullabulling. Based on these structural grounds, and on the reported difficult nature of the country to the north of Bullabulling, the area is recommended in a very general way for prospecting.

13. From the accompanying plan it will be seen that there is likely to be a swing in the Calooli greenstone belt near the Great Eastern Railway, provided that it has not been absorbed by the granite. If the greenstones persist in this area, and future mapping will prove this, prospecting is warranted.

REPORT ON THE "SECOND TRY" G.M.L. 1530, LADY MARY GROUP, NORSEMAN, DUNDAS GOLDFIELD.

Approx. Lat. 30° 12'—Approx. Long. 121° 50'.

By H. J. Ward, B.Sc., Geological Survey of W.A.

Locality.

The "Second Try" G.M.L. 1530, Lady Mary Group, Dundas Goldfield, is situated 4.4 miles on a bearing of S. 23° E. of Norseman G.P.O.

The "Second Try" is part of what is known as the Lady Mary Deep Lead. The Lead is situated on the south-eastern bank of the Lady Mary Creek where it leaves the quartz ironstone ridges and passes on to the low-lying ground.

Purpose of the Survey.

The purpose of the geological investigation was—

(a) to determine if a definite gutter could be found;

(b) to determine the origin of the "lead.";

(c) to give advice as to the future development of the "lead."

Method of the Survey.

The survey was conducted in two parts—

(a) A map of the lease (Plate VIII) was drawn on a scale of 50 feet to the inch. This map shows the surface topography and geology together with the underground workings and subsurface topography. For convenience the shafts on the lease were numbered consecutively from 1 to 22 inclusive.

(b) A map (Plate VII) showing the topography and geology of the country surrounding the lease was prepared on a scale of 5 chains to the inch. The area covered was approximately 1.15 square miles.

The magnetic variation ranged from 0° to 20° E. It was not always possible to check the variation and in such cases the strike was estimated.

Means of Access.

Access to the lease is by road. For anyone new to the district it would be best to use the old surveyed Norseman-Dundas road, which passes within a quarter of a mile of the lease. Entrance to the lease from this road can be made by using a track which follows the Lady Mary Gully eastwards.

Mining Activity.

The "Second Try" G.M.L. 1530 is part of what is known as the Lady Mary Deep Lead. This Deep Lead was discovered about the year 1900 and has been worked intermittently as separate alluvial claims and prospecting areas. It was in 1938 that part of the area was taken out as a gold mining lease. There have been 53 shafts sunk on the Deep Lead over a length of about 40 chains. The shafts are more numerous at the south-eastern extremity but unfortunately it was not possible to enter the workings outside the "Second Try." Of the 22 shafts on the lease only 11 are accessible.

In the underground workings the ground has been stoped to an approximate height of four feet above the bedrock. A large amount of stoped ground has been filled with mulloch. It is thought that the ground between shafts Nos. 12, 13, and 14 has been worked but now filled in.

Water.

The well water in the district is mostly either brackish or salt. At present drinking water is obtained from the Lady Mary Gold Mine where there is a fresh water tank. There is a well containing good drinking water situated approximately a third of a mile west of the lease in the Lady Mary Gully. Water for mining purposes is pumped from the Lady Mary Gold Mine.

Mining Timber.

In the district there is an abundance of salmon gum and gimlet which can be used for timbering.

PLATE No VI

MT BURGESS E.75

Road to Tourist Hills

10M

Track to Dunnerville

Road to Kanowalling

BONNIE VALE

HK.2.

MUNGARI

Main Road to Kalgoorlie

BONNIE VALE BELT

"Curiosity" gold mine

Anmidale gold mine

Alfreds gold mine

"Sydenham" gold mine

5M

"Dunallens" gold mine

"Three mile well" workings.

COOLGARDIE KALGOORLIE RAILWAY

MT ROBINSON

MT ROBINSON BELT

"Bayley's gold mine

COOLGARDIE

70°

Barbara gold mine

Surprise gold mine

HAMPTON TOWN

Banham gold mine

Lady Loch gold mine

Tindals gold mine

TINDALS BELT

From Perth

SOUTHERN CROSS

CALOOLI STN

COOLGARDIE RAILWAY

Gears find

COMET HILL

LORD BOBS BELT

Lord Bobs gold mine

Burbanks gold mine

BURBANKS

HAMPTON COOLGARDIE RAILWAY

Baker's find

Frank's find

Mays find

Moores Find

Jadows gold mine

Queenslander gold mine

HAMPTON

LOC.59

Greenstone

HAMPTON

LOC.53

10M

Track

CHEAPSIDE

GROSMONT

From Gnarlbine

Londonderry gold mine

LONDONDERRY

Road

ESPERANCE

Londonderry Felspar quarry

MT ROBINSON BELT ?

Road

15M

Norseman

KUNANALLING DISTRICT GOLDFIELD BDY.

COOLGARDIE

KALGOORLIE

EAST COOLGARDIE G.F.

BONNIE VALE

COOLGARDIE

BULLA BULLING

BURBANKS

LONDONDERRY

51/80 50/80 49/80 39/80 39/80 40/80

Area surveyed

Area to be surveyed

Lands litho. sheet boundary and no 50/80

— LOCALITY MAP —

Scale: 10 Miles = 1 inch

— LEGEND —

Soil covered areas — The nature of the underlying rocks cannot be inferred with any degree of certainty

PRE-CAMBRIAN

SEDIMENTARY SERIES (Probably corresponds with Black Flag Series)

Metamorphosed sediments — Consisting of slates phyllites mica schists quartzites and thin bands of greenstone apparently overlying the greenstone series

GREENSTONE SERIES (Probably corresponds with Kalgoorlie Series)

Metamorphosed Ultrabasic rocks — Fine to coarse grained actinolite schists, actinolite tremolite schists and anthophyllite and serpentine rocks, with local variations to talc, chloritic, and biotite schists. Decomposition produces in the form of magnesite and jasperoy ironstone boulders and cellular opaline quartz rubble are scattered over these belts.

Metamorphosed Basic lavas and Allied rocks — Fine to medium grained basic lavas amygdaloidal and pillow lavas, volcanic breccias and agglomerates and probably tuffs

Amphibolite (Metagabbro) — Medium to coarse grained hornblende and hornblende-felspar rocks. At present their origin is doubtful.

Granite, gneiss and allied rocks

— REFERENCE —

Boundaries assumed ---?---?---

Boundaries approximate ————

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

PROGRESSIVE STRUCTURAL GEOLOGICAL MAP OF THE COOLGARDIE DISTRICT — COOLGARDIE GOLDFIELD —

SHOWING

AREA MAPPED DURING 1946 FIELD SEASON

— Scale: 80 Chains = 1 Inch —

80 60 40 20 0 80 160 240

Geology by R.S. Matheson. April to December 1946

Crushing Facilities and Ore Treatment.

There is a ball mill and cyanidation plant erected and in good working order.

The pug had formerly been treated by puddling, but owing to the loss of fine gold in the overflow this method is unsatisfactory.

The Kalgoorlie School of Mines Report No. 148, 1938, outlines a successful method of treatment. The conclusion reached is that the pug "is readily amenable to treatment by amalgamation and cyanidation by percolation at 30 mesh. Finer grinding does not appreciably increase the gold extraction."

Production.

The following figures show the amount of gold obtained from December, 1938. Previous to this date there are no returns available.

Period	Dollied & specimens Fine ozs.	Ore treated (Tons =2240 lbs.)	Gold therefrom Fine ozs.	Total Fine ozs.	Silver Fine ozs.
Dec. 1938	...	21·75	6·18	6·18	...
1939	...	640·0	19·92	19·92	...
1940	4·37	66·0	11·62	15·99	·09
1941	...	17·0	14·81	14·81	·81
1942	...	23·0	18·67	18·67	7·90
1944	...	625·0	302·57	302·57	42·01
1945	...	720·0	470·16	470·16	50·49

When the lead was first worked only the coarse gold was sought for owing to the inability to separate the fine gold from the pug. It is reported that most of the coarse gold was associated with the large quartz boulders.

The General Geology and Physiography of the Area Surrounding G.M.L. 1530.

Owing to the nature of the survey a quick geological reconnaissance was made of the area surrounding the "Second Try" in order to obtain information relating to the origin of the Deep Lead.

Physiography.

The western side of the area is bounded by quartz ironstone ridges which rise 100 feet to 150 feet above the general level of the lease. These ridges slope away to the east, at first rapidly, and about the eastern edge of the lease the change in surface gradient is very gradual.

The drainage is to the east into Lake Dundas which is approximately a mile away from the lease. There are three main creeks in this area, in the north Raggedy's, in the centre the Lady Mary, in the south Barry's. There are some smaller creeks but all have become choked on entering the lower ground.

Geology: Covered as much of the field is with superficial deposits, most of the structural features are obscured. On the higher ground lying to the west and north-west the out-cropping rocks are metamorphised sediments (sandstones and a thin conglomerate band), banded quartz ironstones with interbedded greenstones of two types:—

(a) coarse grained amphibolite.

(b) fine grained schistose amphibolite.

The regional strike is to the north whilst the dip varies from 45° W. in the metamorphosed sediments to 80° W. in the quartz ironstones. From the field evidence the beds are on the western limb of a north pitching anticline. Faulting is suspected, especially in the north-eastern part of the area where there is an outcrop of quartz ironstone beds with coarse grained amphibolite. It might be noted that the fault shown by W. D. Campbell (G.S.W.A. Bulletin 21, Geological and Topographical Map of Norseman), crossing Raggedy Gully in a north-west-southeast direction, lies just outside the area examined. Possibly these beds can be correlated with the Greenstone Series of the Yilgarn System.

Lying on top of the quartz ironstones and metamorphosed sediments is ferruginous laterite. Except for two isolated knobs this ferruginous laterite occurs at approximately the same level.

There are also scattered deposits of a calcareous residue or travertine.

The rest of the area is soil covered with greenstone and quartz ironstone boulders resting on the soil surface. It is possible that much of the area shown as "soil covered" is really alluvium. For instance, near the eastern boundary of the area examined, just off the road to the "Pennyshaw" Gold Mine two shafts have been sunk nearly side by side—one is approximately 20 feet deep and is in alluvium whilst the one adjacent is approximately 30 feet deep and has bottomed on metamorphosed sediments.

The Deep Lead on G.M.L. 1530.

Except for a laterite knob in the north-western corner of the lease, the surface is soil covered with greenstone, ironstone and quartz boulders and rubble. The Lady Mary Creek enters the lease 280 feet from the northern lease peg and leaves it about 450 feet from the south-eastern lease peg.

Examination of the accessible shafts shows that each shaft has been sunk through a layer of soil and grit, a boulder bed, approximately 40 feet of clay or "pug" and a layer of wash.

The Bedrock: The bedrock consists of extremely weathered greenstones and metamorphosed sediments. It is reported that the extent of decomposition exists for 30 feet below the present bottom of shaft No. 16.

The Wash: The wash consists of quartz, quartzite and quartz ironstone boulders and pebbles. It was at first thought that there were no greenstone pebbles in the wash but a few pebbles of decomposed greenstone were located. The boulders and pebbles are embedded in a matrix of blue clay termed "pug." The pug also has patches of ilmenite sands. The quartz ironstone boulders are not very plentiful—the maximum size reached is approximately 4 inches by ½ inch. Boulders of quartz and quartzite are predominant in the wash. Quartzite boulders do not attain such large dimensions as those of quartz which are so often well over 2 feet by 2 feet. In the west drive from this shaft and about 30 feet from No. 6 shaft there is a quartz reef four feet in width with a N. 64° W. strike and a 45° dip to the south-east. This reef could account for all the large boulders occurring to the eastwards but there is no evidence to explain the presence of large boulders occurring in the workings between No. 1 and No. 2 shafts. Hence it is assumed that these boulders have been derived from quartz reefs which are now buried.

The boulder size diminishes as one proceeds eastward from No. 7 shaft although there is still an abundance of quartz and quartzite boulders. In No. 13 shaft the wash consists of quartz, quartzite and quartz ironstone pebbles. In this shaft there are three separate layers of wash. The uppermost wash is 4 feet above the middle wash and the bottom of wash are one foot apart but going eastward 20 feet from the shaft these two washes are 3 feet apart.

The Blue Clay or Pug: It has not been possible to determine whether there are different layers of pug as iron bearing solutions have penetrated from the surface to the bedrock and have obliterated any signs of stratification that might have been present. There appears to be a change in colour from light blue grey to blue grey. Slickenslided "walls" are present in the pug and wash owing to slumping. These "walls" generally occur where there is a change in the contour of the bedrock.

Origin of the Lead.

Owing to the relative inaccessibility of the workings and lack of development work only a part of the subsurface

topography could be contoured. These underground contours show that between Nos. 1 and 2 shafts there is a distinct channel with a south-easterly trend whilst in the area included by shafts Nos. 9, 10, 12, 16, and 17 there is evidence of a channel changing from an easterly to a north-easterly direction. It is to be noted that the level of the bedrock between shafts Nos. 1 and 2 is approximately the same as that in shaft No. 7, which is about 700 feet to the east of Nos. 1 and 2 shafts. Thus it is suspected that a basin like depression exists around shafts Nos. 1 and 2.

The metasediments and greenstones, shown on the regional map to the north of the "Second Try," are the rocks that have provided the quartzite boulders some of the quartz boulders and the blue clay. It is thought that as the greenstones are fine grained and schistose and if the direction of flow was along the strike then the tendency would be for the greenstone to break up into fine particles and not to form boulders—thus explaining the rarity of greenstone boulders in the wash. The quartz ironstone boulders may have been derived from outcrops now obscured—if not, then it is evidence that erosion did not extend far to the west. As the metamorphosed sediments included a sheared conglomerate band, it is thought that some of the more rounded pebbles in the wash may have been derived from this source. The derivation of the large quartz boulders has already been mentioned.

The following facts point to a short erosive period followed by quiet conditions of sedimentation:—

(a) The large quartz boulders have not travelled far.

(b) The wash in most places averages only three feet, and sometimes is non-existent.

(c) The relative thickness of the pug (40 feet) compared with the thickness of the wash (three feet).

If the lead was formed by a river then neither banks of such a river has yet been located, and the banks must be at least 400 feet apart in this area.

On the north bank of the Lady Mary Creek, before it enters the lease, there are two shafts, sunk on a flat, which are reported to have bottomed on undecomposed greenstone at an approximate depth of 20 feet. The fact that the bedrock is not decomposed, as in the Deep Lead, suggests that it was not exposed to the same erosional processes. The bedrock on the flat is at an approximate R.L. of 1,000 feet whilst in No. 1 shaft the bedrock has an R.L. of 961 feet. These two reduced levels are about 800 feet apart, giving a gradient of one in twenty.

This gives a sloping bank towards the Lead but it is thought that such is not the case and in reality that there is a much steeper fall nearer the creek, but at present obscured.

The laterite knob in the northern corner of the lease is thought to be a remnant of the blue clay which has been indurated and ferruginised by iron bearing solution. The same opinion has been formed of the laterite knob about 12 chains east of the south-eastern lease peg of The Second Try.

The boulder bed which is in every shaft only a few feet from the surface has been probably formed by the Lady Mark Creek which has moved eastward and is now cutting into the laterite knob in the northern corner of the lease. The boulders in this bed consist of quartz, coarse and fine-grained greenstone, and quartz ironstone.

The nature of the pug and the width of the lead are thought to indicate a lacustrine origin for the deposit.

The Gold.

The gold occurs in three different forms—

(a) well rounded gold;

(b) rough, uneven gold;

(c) "paint" gold.

It is reported that both (a) and (b) have been found in large nuggets adjacent to each other. The largest nugget reported from the field weighed 20 oz. However the mode of occurrence of a sufficient number of examples was not seen in order to explain the cause.

The "paint" gold has been deposited in thin flakes on the pug, by circulating solutions.

The locality from which the gold has been derived is thought to be in the vicinity of Cash's Find G.M.L. 1231. Over three thousand ounces of gold have been taken from this find which is about 930 feet on a N. 90° E. bearing from the northern lease peg of G.M.L. 1530. The gold has occurred associated with a quartz reef striking N. 50° E. through metamorphosed sedimentary rocks.

Recommendation.

The owner was advised to follow the eastern continuation of the centre of the channel which lies between shafts Nos. 1 and 2. If the supposed basin structure is present the importance of continuing over the edge of the basin was stressed.

A prospecting drilling programme in the virgin ground between shafts Nos. 1 and 2 was also advised.

HAMPTON GROUP—COOLGARDIE DISTRICT.

By H. J. Ward, B.Sc., Geological Survey of W.A.

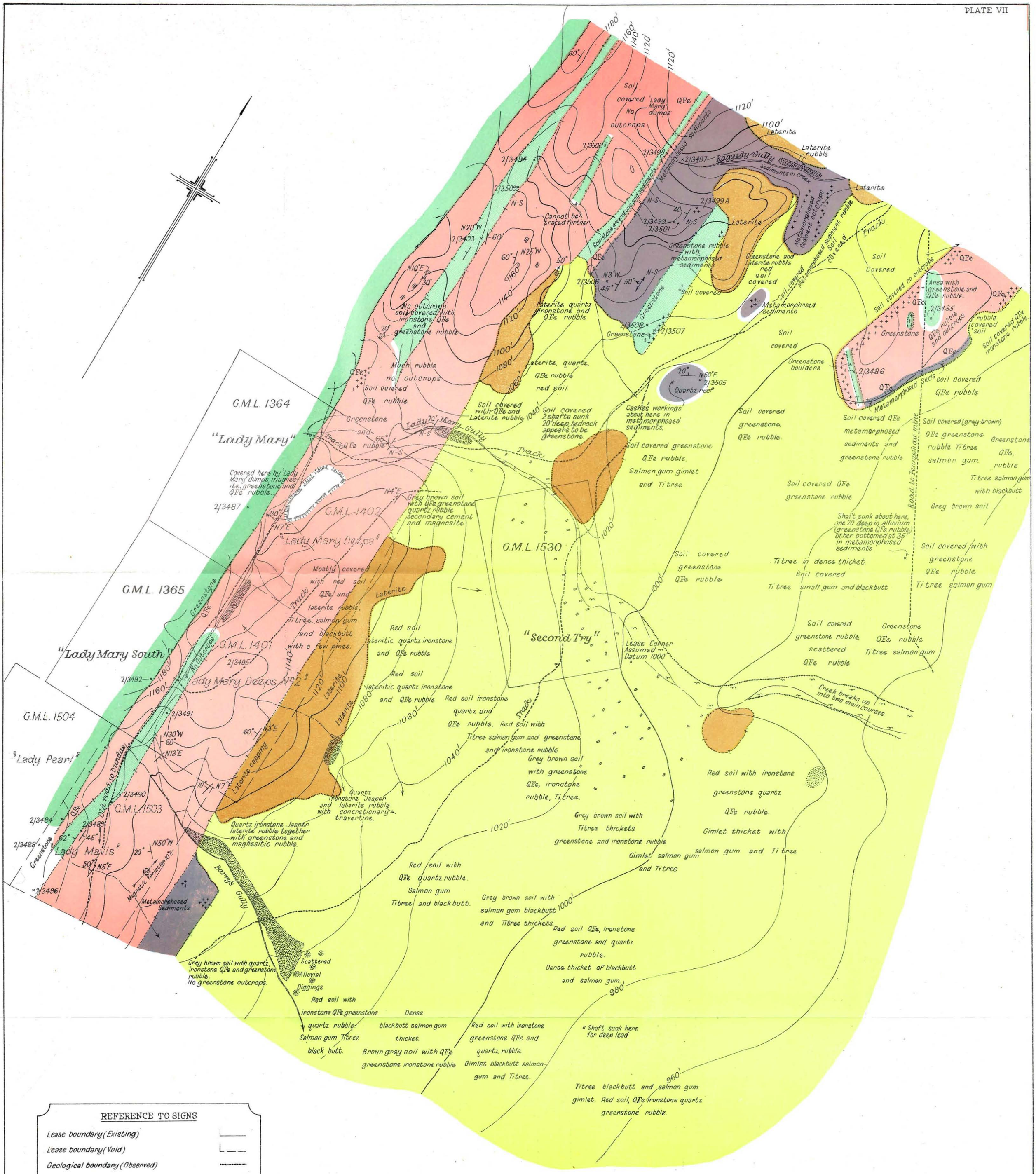
CONTENTS.

PLATES.

GENERAL INFORMATION.

The group is situated on Location 59, Hampton Gold Mining Areas Ltd., approximately five miles south-east of Coolgardie. A 10 chains to the inch map (Plate IX) was prepared in January, 1946, and it shows that well over 100 leases have been pegged.

The main road from Coolgardie to Norseman passes to the west of this group. At a point approximately 4.4 miles south of Coolgardie a branch road about 2½



REFERENCE TO SIGNS

- Lease boundary (Existing)
- Lease boundary (Void)
- Geological boundary (Observed)
- Geological boundary doubtful or assumed
- Outcrop with no observed strike or dip
- Strike and dip of bedding — N25°E, 50°
- Strike and dip of schistosity — N-E, 50°
- Dragfold with direction and amount of plunge — 50°
- Synclinal trough — 20°
- Dumps
- Costean
- Alluvial diggings
- Roads or tracks.
- Water courses
- Contours — 1000'
- Shafts
- Locality and number of specimen. — ×2/3501

LEGEND

- Greenstones — Course grained
- Greenstones — Fine grained schistose interbedded with sediments
- Sediments
- Banded quartz ironstone — QFe
- Alluvium
- Soil covered
- Laterite

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

GEOLOGICAL AND TOPOGRAPHICAL MAP OF AREA SURROUNDING "SECOND TRY" G.M.L. 1530 DUNDAS GOLDFIELD

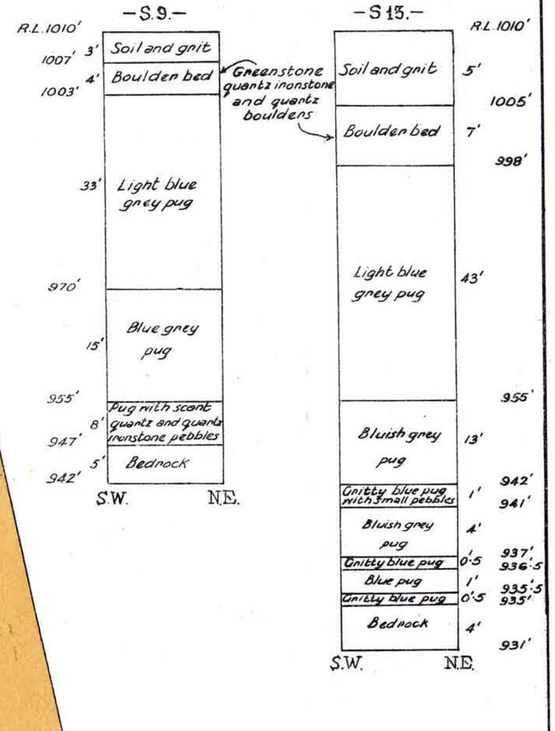
Scale of Chains

5 4 3 2 1 0 5 10 15

Topography by Plane table & Telescopic alidade. Geology by pace and compass traverse by H.J. Ward. February 1946.

PLATE VIII

— COLUMNAR SECTION —
OF
SHAFTS Nos. 9 and 13
"SECOND TRY" G.M.L. 1530



— LEGEND —
— RECENT —
Soil
Alluvium
Laterite

— REFERENCE TO SIGNS —
Observed geological boundaries
Water course
Shafts accessible
" inaccessible
Surface contours — 1020 —
Bedrock contours — 960 —
Doubtful subsurface contours —?— 960 —?—
Underground workings
Stoped areas

Assumed datum 1000 ft. S.E. lease peg G.M.L. 1530.
Shafts located by intersection with telescopic alidade and planetable.
Surface contours obtained with telescopic alidade and planetable.
Subsurface workings and topographical survey with venschoyle compass and tape. By H.J. Ward. Feb. 1946.

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

SURFACE AND SUBSURFACE MAP
— OF —
"SECOND TRY" G.M.L. 1530
— DUNDAS GOLDFIELD —
— Scale: 50 feet to an inch —

miles long has been constructed into the group. This branch road passes the Barbara G.M.L. 330 and continues to the Surprise G.M.L. 316, where it terminates. Access to other leases is by means of bush tracks.

Water is obtainable from a standpipe on the Coolgardie-Norseman water supply line which passes through the group. At the time of writing (January, 1946) the Western Mining Corporation had the right to retail the water from this standpipe. Water is also carted from Coolgardie, where the price is sixpence for fifty gallons.

Suitable mining timber is not plentiful in the area.

All ore has to be carted to the State Battery at Coolgardie.

At Coolgardie there are stores, two hotels, post office and a Mining Registrar.

Up to 31st December, 1946, 24,808.39 tons of ore had yielded 17,420.94 fine oz. of gold.

GENERAL GEOLOGY.

The group is situated in an area of metamorphosed inter-bedded basic lavas ultrabasic rocks and schists, amphibolites and erosion sediments, the general distribution of which can be seen on Plate IX. The whole series has been intruded by porphyries and alsakite dykes.

Regional mapping* has shown that the group is situated on the eastern extension of the Tindals cross-fold axis which passes approximately through G.M.L. 316.

Basic Lavas.

The basic lavas consist of rudely sheared dark green rocks, fine grained in texture.

In the area mapped the basic lavas overlie the ultrabasics. The contact of the basic lavas with the ultrabasics changes direction from approximately N. 70° W. to N. 10° W. on G.M.L. 320 and then swings further round to the east so that on G.M.L. 377 the boundary is approximately N. 60° E.

Later mapping has shown that the outcrops in the south-eastern corner of the map (Plate IX) which were at first regarded as doubtful basic lavas, are definitely part of these overlying basic lavas.

The basic lavas on this locality have not favoured ore deposition as in no instance has there been any payable finds.

Amphibolites.

In earlier mapping these rocks were not separated from the basic lavas, but now they have been found to be part of a belt of rocks which overlie the basic lavas.

These amphibolites occupy the north and north-eastern portion of the area mapped. They are separated from the basic lavas by a thin band of erosion sediments. The amphibolites are dark green coloured rocks, varying from fine to coarse grain. They are rudely sheared rocks which have been intruded by porphyry. On G.M.L. 403 there is a thin band of sediments which appears to occur at the contact of two types of amphibolites, but this has not yet been conclusively established by mapping.

Ultrabasics.

The ultrabasics consist chiefly of fine to coarse grained actinolitic schists, serpentine rocks, and fine to coarse grained rudely sheared actinolitic rocks. There are local variations to talc schist, chlorite schists, and micaceous schists. The colour of the ultrabasics varies from the light straw yellow colour in the weathered state to the dark green of the unweathered state.

Decomposition products of cellular quartz, opaline quartz and ironstone, and magnesite are frequently found overlying the ultrabasic rocks.

The strike of the schistosity of the ultrabasic schists changes from N. 70° W. to N. 35° W. and the dip varies from 70° N. to 70° E. with changing strike.

Erosion Sediments.

Erosion sediments occur as white to grey graphitic and micaceous phyllites. A thin band of graphitic schists occur at the junction of the emphibolites and the basic lavas, and in the south-eastern corner of the area a micaceous quartzite occurs in the lavas. These thin bands are thought to separate successive lava flows. They outcrop discontinuously but nevertheless they are of great value in structural mapping.

Porphyry-Porphyrite Series.

The porphyries are hard, light-coloured rocks consisting chiefly of quartz and ablite. They have been sheared, jointed, and locally folded. They are thus regarded as prefolding intrusives and not genetically related to ore deposition*. Rocks of this series have intruded the basic lavas, the ultrabasics and the amphibolites. The occurrence of hybrid porphyries and offshoots from the main porphyry bodies supports the conclusion that members of this series are concordant igneous intrusions. Examples of hybridisation of the porphyries occur on G.M.L. 355 and also in the 68 feet level of the Brown Lode on G.M.L. 316.

Alaskite Dykes.

The alaskite dykes, occurring as light-coloured felspathic rocks, intersect the ore bodies and, therefore, are post gold intrusives.

On the 83 ft. level of the north lode on the "Barbara" G.M.L. 330 the alaskite dykes have undergone minor displacement. Furthermore, between the 45 feet level and the 83 feet level there is an alaskite dyke which has a regular course. This dyke in the No. 3 shaft exhibits a slight drag fold which is reproduced in plan on the 83 feet level. However, there is no other evidence in the area of folding of the alaskites.

Laterite.

Ferruginous laterite is found as a capping in two localities. On G.M.L. 364 there is only a small amount of laterite but a more extensive capping occurs on G.M.L.'s 331, 326, and 408.

Alluvium.

The alluvium which covers a large portion of the ultrabasic belt, commences in the north-west of the area and widens out towards the east, in which direction the lake system lies.

A shaft has been put down on G.M.L. 356 for a vertical depth of 20 feet. This shaft contains 10 feet of alluvium and six feet of wash. On G.M.L. 372 another shaft contains 8 feet of alluvium and 4 feet of wash. The wash was found to consist of greenstone, quartz and porphyry pebbles and boulders.

The possible occurrence of payable gold pockets in the wash should not be overlooked.

THE MINES.

The whole area—about six square miles—was pegged out by January, 1946. To date (December, 1946) the Western Mining Corporation, Ltd., is the most active concern, having control over the following leases: G.M.L.'s 330, 337, 318, 320, 326, 328, 315, 316, 319, 321, 322, 324, 331, 332, 335, 336, 346, all of which are under option except G.M.L.'s 330 and 351, purchased by the company from Messrs. Cash and Scahill. After purchasing these two leases Western Mining Corporation, Ltd., suspended operations on them in order to concentrate on exploratory work on the leases which were then under option.

Hampton Gold Mining Areas, Ltd., are also engaged in exploratory work on G.M.L.'s 334 and 348. Latest information received indicates that the eastward extension of the "South Lode," on the Barbara G.M.L. 330, has been located on G.M.L. 334.

*Matheson, R. S., G.S.W.A. Ann. Report, 1946, Plate VI.

*See also Matheson, R. S., G.S.W.A. Ann. Rept. 1946, p. 76.

Earlier in the year the "Barbara" G.M.L. 330, "Surprise" G.M.L. 316, "Lady Mary" G.M.L. 319 were under option to Goldfields Australian Development Ltd., whom the writer wishes to thank for supplying plans and bore information. He would also like to take this opportunity to acknowledge the invaluable help he received from Mr. T. Allen during the inspection of the "Barbara" G.M.L. 330. When Western Mining Corporation Ltd. took over the above leases, every assistance was given to the writer during his inspection.

"Barbara" G.M.L. 330.

This lease is situated about 50 chains along the branch road into the group. At the time of inspection (May, 1946) two lodes were being worked and they are described hereunder. Up to 31st December, 1946, 2,157.75 tons of ore were crushed for a yield of 1,655.63 fine ozs. of gold.

North Lode.

Three shafts, called Nos. 1, 2, and 3 shafts, have been sunk on this lode, which is in ultrabasic rocks. No. 3 shaft is about 618 feet on a 351 degree bearing from the south-east corner peg of the lease. It is 140 feet east south-east of No. 1 shaft and 45 feet east south-east of No. 2 shaft.

Of the three shafts, No. 1 shaft was the deepest, having a vertical depth of 198 feet, whilst Nos. 2 and 3 shafts were only 83 feet in vertical depth. There were two accessible levels at 83 feet and 198 feet; a level at 45 feet was only partially accessible. On the 83 feet level there was approximately 200 feet of driving which began at the No. 1 shaft and extended about 50 feet east of No. 3 shaft. On the 198 feet level there was 140 feet of driving and about 40 feet of crosscutting. The driving on the 198 feet level extended from 50 feet west to 90 feet east of the No. 1 shaft.

The back of the 83 feet level has been stoped to within 30 feet of No. 1 shaft, at which point the stope slopes backwards to the 45 feet level at approximately 43 degrees.

Access to the workings at the time of inspection was gained by No. 3 shaft. From No. 3 shaft it was possible to reach the 198 feet level by way of No. 1 shaft.

On the 83 feet level the gold values averaged 15 dwts. for a length of 133 feet and a mean width of 4 feet. The pitch of the lode between the surface and the 83 feet level appears to be 45° to the north-west and the dip of the lode is 85° to north-east. On this level there are two alaskite dykes, one of which is about 20 feet east of No. 1 shaft and the other of which is about 30 feet east of No. 3 shaft. The dykes have undergone minor displacements.*

In No. 1 shaft between the 83 feet level and 198 feet level it was possible to map a hard band of rock, which consists of felted crystals of *tremolite* and *actinolite* with interstitial brown *biotite* (Lab. No. 4397). There was also some *niccolite* and *gold*. On the 198 feet level this "hard band" extended horizontally from 40 feet west to about 60 feet east of No. 1 shaft. The "hard band" is six feet wide at the shaft but narrows down to approximately two feet in both directions. At both ends driving has departed from the strike of this "hard band."

The gold values were found to be highest in the "hard band."

South Lode.

Access to this line of workings was gained by a shaft (No. 5 shaft), which is 126 feet on a bearing of approximately 200 degrees from the south-east corner peg of the lease.

There was one level at a vertical depth of 58 feet from the surface. There were about 240 feet of driving and 50 feet of crosscutting.

This lode is in ultrabasics on the footwall side of a porphyry which dips steeply to the north-west and has an approximate west north-west strike swinging to east north-east. The porphyry, which is weathered on this level, shows evidence of folding at the eastern end of the drive. At the contact of the porphyry and ultrabasic rocks there is a thin band of dark green ultrabasic schist. There is no available evidence as to the exact thickness of the porphyry. A borehole into the hanging wall of the drive proves it to be at least 40 feet thick.

There are gold values along the contact of the two rock types, but the best values occur where the footwall shear approaches the hanging wall shear, which is from 25 feet to 70 feet going north-westerly from the shaft. About 70 feet north-west of the shaft the values start to change from the hanging wall and pass across to the footwall. As a result of this a crosscut was put out in a south-westerly direction, approximately 105 feet north-west of the shaft. After a cut was taken out the footwall shear was located and this was found to be the new hanging wall to the lode. This hanging wall was driven along for a distance of approximately 60 feet. At the time of inspection the drive was inaccessible.

A winze was being sunk at the corner of the crosscut and the new drive. It had reached a depth of 100 feet and was still in ultrabasic rocks. The values were still adhering to the new hanging wall. It is reported that about 60 feet below the level the values in this shear terminated and were located in a shear three feet north of the new hanging wall shear. The values continued downwards on this shear. The winze has an inclination of 88° to the north.

The presence of sulphides is reported at 62 feet below the level. Specimens taken from the winze at 100 feet below the level were found to contain *pyrite* and *dolomite* (Lab. Nos. 4980, 4398).

Water level occurs about 143 feet below the surface and the winze was reported to be making 2,000 gallons of water per day.

Recommendations.

North Lode.—To date work done gives the impression that the ore body is pitching to the north-west at 45 degrees between the surface and 83 feet level with a steepening of pitch between the 83 feet and the 198 feet levels.

On the 198 feet level highest values have been obtained in the "hard band." When the band narrowed down in the face the direction of the drive was changed to the south-east at the eastern end and to the south-west at the western end. It is thought that the "hard band" might widen out again with a consequent increase in stoping values, so driving along this band should be persisted with. At the eastern extremity of the drive the alaskite dyke, which is near No. 1 shaft on the 83 feet level, should appear in the face when a further 50 feet of additional driving has been done (viz., at 130 feet from shaft). This is providing there has been no change in dip of the alaskite between the two levels.

Should continued driving fail to reveal a continuation of the ore body lateral prospecting, firstly to the south and east, is advised.

South Lode.—Work to date has shown that the gold values have a tendency to move to the south-west in plan, but in section step northwards into the hanging wall.

If values terminate with continued driving, lateral prospecting, firstly to the south and west, is advisable.

G.M.L. 334.

This lease is adjacent to the eastern boundary of the "Barbara" G.M.L. 330. At the time of inspection (November, 1946), it was being worked by Hampton Gold Mining Areas Ltd.

There were six shafts on the lease, all of which, excepting No. 3 shaft, had been sunk in ultrabasic rocks. Shafts Nos. 2, 4, and 6, all over 50 feet in depth, were sunk in about the same straight line. No. 2 shaft is about 300 feet on an approximate bearing of 67° 30′ from the south-western corner peg of the lease. No. 6

* Vide Alaskite Dykes, p. 81.

shaft is 205 feet on a 100 degree bearing from No. 2 shaft. No. 4 shaft is situated approximately halfway between these two shafts.

Crosscutting to the south from the bottom of these shafts has been carried out. A crosscut to the south from the bottom of No. 2 shaft revealed a shear 20 feet from the shaft striking approximately N. 70° W. and dipping vertically. Driving, 20 feet to the west and 12 feet to the east, along the shear has been done.

No. 3 shaft, situated 365 feet on a bearing of 64 degrees from the south-west corner peg of the lease, had a vertical depth of 35 feet. It has been sunk in weathered porphyry, which is a continuation of the porphyry on the "Barbara" lease. At the bottom of the shaft a crosscut has been put cut in a south-westerly direction for a total length of 28 feet. The crosscut is in weathered porphyry for the first 18 feet. A drill hole, to the north, at the foot of the shaft is reported to have passed from porphyry into ultrabasics at a distance of 18 feet.

At the time of inspection sufficient crosscutting from Nos. 4 and 6 shafts had not been done to determine whether the shear encountered in the south crosscut from No. 2 shaft continued eastwards. However, it is since reported that an ore body similar in nature to the *South Lode* on "Barbara" G.M.L. 330, has been located along a shear, which is probably the eastern continuation of that south of No. 2 shaft.

G.M.L. 348.

This lease was inspected in November, 1946. Numerous potholes and shafts have been sunk on the lease. Early in the year (January, 1946) it was worked by Goldfields Australian Development, but apparently results were not sufficiently convincing to warrant further work.

Hampton Gold Mining Areas Ltd., commenced work on the lease in the latter part of the year. At the time of inspection, a shaft had been sunk 453 feet on a 299 degree bearing from the north-east corner peg of the lease. At a vertical depth of 34 feet a crosscut to the north, 24 feet in length, and a crosscut to the south, 31 feet in length, had been put out.

The main shaft sunk by Goldfields Australian Development lies approximately 140 feet to the north-east of a porphyry which has a N. 70° W. strike. To locate this porphyry from the south crosscut from the shaft sunk by Hampton Gold Mining Areas Ltd., would necessitate about another 60 feet of crosscutting.

"Surprise" G.M.L. 316.

This lease, on which gold was found in 1939 by the Baker Brothers, was inspected in November, 1946. At the present time (January, 1947) it is under option to Western Mining Corporation Ltd. It is situated approximately 115 chains on a 40 degree bearing from the 5-mile peg on the Coolgardie-Norseman road.

The surface geology is obscured and revealed by the numerous costeans and shafts on the lease. Work to date has been confined to what are known as the Brown Lode and the Blue Lode. Up to 31st December, 1946, 3,476.94 fine oz. of gold were obtained from 7,270 tons.

Brown Lode.

The Brown Lode workings are situated 394 feet on a bearing of 40 degrees from the south-west corner peg of the lease.

The lode, which is in hybridised, silicified and jointed porphyry, was opened up by an open cut to a depth of 68 feet. At the surface the dimensions of the cut were approximately 18 feet wide and 10 feet long whilst at the 68 feet level the cut had widened out to 25 feet and lengthened to 65 feet. The inclination from the surface to the level is 63° N.

A winze has been sunk in the eastern corner of the open cut on the 68 feet level at an inclination of 68 degrees on a 40 degree bearing for an inclined length of 93 feet. Driving in both easterly and westerly directions has been commenced.

On the 68 feet level it is possible to observe changes in hybridisation and silicification of the porphyry. There is a band of rock which runs from the eastern corner of the cut to the western corner (the long axis of the cut lying in an approximate north-west-south-east direction). This band, in the eastern corner, consists of finely granular *albite* and quartz with muscovite flakes (Lab. No. 4985). Sulphides in the form of *pyrrhotite* and *pyrite* are present. To the west, however, the band becomes more porphyritic in appearance and less silicified. On each side of this band there is a gradation from the hybridised porphyry into normal porphyry.

It is reported that the most constant high values are found in the hard blue silicified band.

The winze is in porphyry for its entire length. On the lower level a lens of ultrabasics makes it appearance just east of the foot of the winze and passes into the hanging wall of the east drive. The west drive is in mineralised porphyry.

Ground water was first encountered in small quantities at a vertical depth of 66 feet.

Blue Lode.

The Blue Lode lies approximately 200 feet south of the Brown Lode. The Blue Lode is so called on account of the bluish-green colour of the ultrabasics in the lode.

The main shaft has been sunk on a hanging wall shear with an underlay of 80° N.E. At the time of inspection only part of the 117 feet level and a winze (which is a continuation of the shaft) from the 117 feet level to 183 feet below the level, were accessible.

The ore body has an approximate N. 50° W. strike and an 82° N.E. dip. No pitch information was available.

On the 117 feet level there is a north-westerly drive which was 80 feet in length. The rock type is chiefly a coarse grained actinolitic rock together with a fine grained ultrabasic rock. The coarse grained variety is conspicuous in the western end of the drive. On the eastern side of the shaft the drive has been stoped out. It was possible to observe two hanging wall shears, dipping at 80° N.E. The more easterly shear stepped towards the south.

On sinking the winze from the 117 feet level a lens of porphyry was intersected from 256 feet to 290 feet below the surface. The maximum width of the porphyry was three feet.

"Lady Mary" G.M.L. 319.

The lease adjoins the south-western boundary of the Surprise G.M.L. 316. The porphyries on this lease are a continuation of those on the "Surprise" Lease. The lease is one of the original leases pegged by the Baker Brothers when they made the find on the "Surprise" Lease. At present it is under option to the Western Mining Corporation Ltd. The yield from this lease up to 31st December, 1946, has been 981.29 fine ounces of gold from 1,742.25 tons.

There are many costeans and prospecting shafts on the lease but the greatest amount of work has been confined to two shafts, one of which (shaft A) is situated 307 feet on 129° 30′ bearing from the north-west corner peg of the lease, and the other (shaft B) is 28 feet south-south-east of shaft A.

In May, 1946, an inspection of shaft B workings and shaft A was made before Western Mining Corporation had commenced operations on the lease.

Shaft B had been sunk vertically for about 16 feet and then 50 feet on an inclination of 70° N.E. to what is known as 66 feet level. On the 66 feet level there was about 125 feet of driving to the south-east and about 26 feet of driving to the north-east. There has been a little overhead stoping for about 10 feet at 25 feet south-east of the shaft and about 55 feet further on there is stoping over a length of 8 feet. The shears, which dip between 60° E. and 80° E. step south moving eastwards.

The upper workings except for a small portion of the 35 feet level were inaccessible. The driving on the 35 feet level consisted of 20 feet to the north-north-west and about 30 feet to the south-south-east. There was a well defined hanging wall shear dipping N.E. at 80°.

The lode is in decomposed ultrabasic rocks and is called the *Yellow Lode* on account of the yellow colour of the weathered rocks. Specimens of these rocks (Lab. Nos. 3981, 4982) were found to be *chlorite* and *talc* schists with some *anthophyllite, limonite* staining and *ilmenite*. One of the specimens (Laboratory No. 4981) contained lumps of calcite and a calcite vein.

Apparently, from the stoping on the 66 feet level, the ore has occurred in narrow shoots, but details could not be obtained owing to the inaccessibility of the upper workings.

Shaft A, which is also called the "Yellow Lode Shaft," was sunk vertically for 25 feet, then a hanging wall shear dipping 80° E. was followed till a vertical depth of 61 feet was reached.

In November, 1946, the shaft was again inspected and it was found that Western Mining Corporation Ltd. had continued sinking the shaft at an inclination of 80° N.E. until a vertical depth of 107 feet was reached. At 90 feet vertical depth a porphyry had appeared in the footwall. This porphyry forms the footwall down to 107 feet, then it dips flatly to the east so that it forms the bottom of the shaft. An east crosscut was put out for 30 feet. It was found that the porphyry formed the floor of the crosscut for 10 feet when its dip steepened up to 30 degrees. An internal shaft was sunk from the end of the crosscut and it was found that the porphyry disappeared into the footwall 12 feet below the level. The shaft was continued vertically downwards and at 217 feet from the surface porphyry again appeared.

The occurrence of an extremely weathered porphyry in the footwall of the shaft about 35 feet from the surface, gives three places in the shaft at which there are noses of porphyry. These occurrences are regarded as noses of dragfolds in the porphyry.

To date results lead to the opinion that, with post-porphyry shearing, a main shear, tangential to the noses of the folds on the hanging wall of the porphyry, developed. It is along this shear that the ore solutions are concentrated.

"Malvern Star" G.M.L. 315.

This lease was inspected in May, 1946. It is situated approximately 15 chains north-east of the "Barbara" G.M.L. 330 and 24 chains north-west of the "Surprise" G.M.L. 316.

The contact of the basic lavas and ultrabasics passes through the lease. The contact is 2 chains north-east of the south-west corner peg, and three chains south west of the north-east corner peg.

All work on the lease has been carried out in ultrabasic rocks in the vicinity of porphyry intrusives.

There is a costean with two shallow underlay shafts (70°N.) about 5 chains north of the south-east corner peg. The shafts have been sunk on a shear plane (strike N. 65° W.) in coarse grained radiating anthophyllite rock grading into a compact dense anthophyllite rock.

Another shaft is situated about 120 feet in a north-easterly direction from the south-west lease peg. This shaft, underlying at 70° N., has been sunk on the footwall contact of a porphyry intrusive with a coarse grained radiating anthophyllite rock (Laboratory No. 4392). The shaft was not accessible but must be between 80 and 100 feet in depth.

One hundred and thirty-eight tons of ore were crushed between 1938 and 1940 for a yield of 88.32 fine ounces of gold.

G.M.L. 318.

The lease, which was inspected in May, 1946, is situated between the "Malvern Star" G.M.L. 315 and the "Surprise" G.M.L. 316.

Except for some basic lavas in the north-western corner of the lease, the lease is in the ultrabasic belt. There are porphyry outcrops on the lease and numerous costeans and potholes are to be found in the vicinity of the outcrops.

At the time of inspection, the Western Mining Corporation was sinking a shaft on this lease. The shaft was situated 420 feet from the north-east corner peg of G.M.L. 324 on a bearing of N. 6° E. The shaft was sunk vertically for 10 feet, then for 24 feet the footwall was followed on an inclination of 65° N., but the footwall flattened out to 43° N. The vertical depth was then 52 feet.

The shaft is in ultrabasic schists which are of a vuggy nature, and good values up to 30 dwts., before the footwall flattened out, are reported. It is reported that the values increased when minor shears intersected the footwall. No values were found when the shaft was down to 52 feet vertical depth.

"Banham" G.M.L. 355.

This lease, which was inspected in May, 1946, is situated about 5 chains due north of the 5-mile peg on the Coolgardie-Norseman road. The Coolgardie-Norseman pipeline passes through the south-western corner of the lease. In 1945, 65.50 tons of ore were crushed for a yield of 25.13 fine ounces of gold.

The only shaft sunk on the lease is 395 feet on a bearing of N. 64° E. from the south-west corner peg of the lease. There are two levels from this shaft, one at a vertical depth of 52 feet and the other at a vertical depth of 97 feet. The shaft was sunk 32 feet on an inclination of 80° N. and then a further 22 feet at an inclination of 55° N. Then the shaft was continued for 43 feet on an inclination of 88°N. The shaft is in ultrabasics but there is a porphyry intrusive about 100 feet to the north-west of the shaft.

52 *feet Level.*—On this level there is 23 feet of driving to the west and 69.5 feet of driving to the east. About 10 feet from the end of the east drive there is 12 feet of crosscutting to the north and 21 feet of crosscutting to the south.

103 *feet Level.*—On this level there is a drive for 40 feet to the west of the shaft. The drive to the east was only partially accessibe owing to its unsafe condition.

No ideas of the values in either of the levels could be obtained. However, it was learned that on the 52 feet (V.D.) level the best values were obtained in a lens of massive hydrobiotite. This lens narrows down to the west and terminated before the end of the east drive. It was to locate the continuation of the hybrobiotite lens that the crosscutting was carried out.

On the 97 feet (V.D.) level the ultrabasics occur as schists with alternating bands of *tremolite* with *actinolite* and *biotite* (Laboratory No. 4399).

Drilling was carried out to the north but apparently unfavourable results were obtained.

G.M.L. 362.

This lease was inspected in May, 1946. The south-east corner peg of this lease is 3 miles on a bearing of N. 44° W. from the 5 mile peg on the Coolgardie-Norseman road. The lease is in ultrabasic rocks, which have a schistosity strike of N. 65° W.

Two shafts—one 11 feet deep and the other 16 feet deep—have been sunk on this lease. The hanging wall shear strikes N. 70° E. and dips from 70° N. to vertical.

G.M.L. 361.

This lease was inspected in May, 1946. The south-east corner peg of this lease is 2.5 miles on a bearing of N. 42° 30′ W. from the 5-mile peg on the Coolgardie-Norseman road.

On this lease there are two porphyry intrusives outcropping—their general trend is N. 70° W. Three shafts have been sunk near the northern edge of the northern porphyry, the distance between the two extreme shafts

being approximately 55 feet. The vertical depths of the shafts vary from 11 feet to 25 feet. The ground between the shafts has been stoped but it is doubtful whether any of it had been crushed as there was approximately 100 tons at grass.

The hanging wall shear has a N. 70° W. strike and a 70° N. dip. The lode material is a micaceous chloritic schist with *manganese oxide* staining. The footwall is a schistose chloritic rock with hydrobiotite. Magnesite is also present.

CONTROL OF ORE DEPOSITION.

The mines of the group occur in shear zones in the Hampton Ultrabasic Belt. The mines are generally associated with porphyries which are within this belt. During pre-gold shearing, the porphyries were more competent than the ultrabasics, hence there was a localisation of shearing near the porphyries.

Generally the shear zones are characterised by a coarse crystallinity of the ultrabasic rocks, but also there may be a development of *talc, chlorite* and/or *biotite* schists. In the ore channels there appears to have been a "hardening up" of the sheared rocks. Usually the shears step south going east, e.g., the Yellow Lode, G.M.L. 319; the Blue Lode, G.M.L. 316; and the North Lode, G.M.L. 330.

In the South Lode, G.M.L. 330, the shear which commences as the footwall shear becomes the hanging wall shear* as work progressed in a westerly direction, but there is no indication of a stepping across of the shears to the south going east.

So far the Brown Lode, G.M.L. 316 is the only lode which is confined to a porphyry which is hybridised, silicified, and jointed. It is thought that there is some local structure which is the cause of ore deposition at this point. On the surface there is evidence of converging porphyries but no evidence to show that these porphyries are definitely separate limbs of a fold. Elsewhere in the field (e.g., Tindal's Mine) the porphyries are sharply folded, and it is possible that the porphyries at this mine are part of a sharp anticlinal fold. It may be that the mere convergence of the two porphyries and the fact that they are jointed were sufficient to localise ore deposition.

As already mentioned†, in the Yellow Lode a main shear tangential to noses of dragfolds on the hanging wall of a porphyry is the main control of ore deposition, but in plan the shears step south going east.

BAKER'S FIND.

COOLGARDIE DISTRICT.

By H. J. Ward, B.Sc., Geological Survey of W.A.

CONTENTS.

* See p. 82.

† See p. 84.

GENERAL INFORMATION.

Baker's Find is situated approximately three quarters of a mile west of the six-mile peg on the western boundary of Location 59, Hampton Plains Estate Ltd.

The find was discovered by the Baker brothers about July, 1947, in an area that had been previously recommended for prospecting by Mr. R. S. Matheson.*

The Baker brothers first found gold on G.M.L. 5754 and subsequently pegged out P.As. 5881, 5882, 5883, 5886, 5887, and 5874. The other principal holdings were taken up by the Franks brothers and Western Mining Corporation. Later a syndicate took an option over the Franks brothers prospecting areas (P.As. 5895 and 5898) which were converted into G.M.L.'s 5743 and 5741.

The Find is reached by a track which branches to the east from the road which passes Tindal's Mine. The branch track turns off to the east just south of the mine.

At present water has to be carted from Coolgardie but probably, if results warranted, arrangements to secure water from the Tindal's pipeline would be made.

Adequate supplies of mining timber are available in the area but later, suitable timber will have to be carted.

The nearest public battery is at Coolgardie where there are 10 head of stamps and a cyanidation plant.

A map, covering an area of approximately 1½ square miles, has been prepared on a scale of 5 chains to the inch. Copies of the map are available at the office of the Mining Registrar, Coolgardie, and the Geological Survey Office, Perth.

GENERAL GEOLOGY.

The Find is situated in an area of metamorphosed basic lavas, ultrabasic rocks and schists, and erosion sediments, all of which have been intruded by members of the porphyry-porphyrite series. To date the ultrabasic schists have proved to be the host rocks.

The basic lavas comprise the hills to the north-west of the Find, whilst the lower lying country to the south-east consists of ultrabasic rocks and schists.

The drainage is to the east but in the eastern corner of the area there is a well-defined creek with a southerly trend.

The Find was made in a low-lying area in which outcrop conditions are generally poor.

Basic Lavas.

In the area mapped the basic lavas, the schistosity of which strikes N. 40° E. and dips indeterminately, lie to the north and west. In the southern corner of the area there is a small portion of fine-grained basic lavas.

The basic lavas are rudely sheared, dark green rocks varying from fine to medium grained in texture. Sometimes amygdaloidal structure is present, e.g., near the north-western corner of P.A. 5882.

Ultrabasics.

The ultrabasics consist chiefly of fine to coarse grained actinolitic schists and fine to coarse grained rudely sheared actinolitic rocks. There are local variations to talc schists, chloritic schists and micaceous schists. The colour of the ultrabasics varies from yellowish green to dark green. In the eastern corner of the area there is a platey type of ultrabasic which is light green in colour.

Decomposition products, usually of cellular quartz, opaline quartz, ironstone and magnesite are frequently found overlying the ultrabasic belt. Due south of Franks' Find and to the west of Dryden's Find there is a hill consisting of these decomposition products.

The general strike of the schistosity is N. 50° E. but there are local variations. In some cases folding is suspected, viz., 15 chains south of G.M.L. 5590.

* Matheson, R. S., G.S.W.A. Ann. Report 1946, p. 77.

Erosion Sediments.

Erosion sediments occur as white to grey graphitic slates and phyllites. In this area there appears to be two bands of graphitic schists, with a north-easterly trend, in the basic lava belt.

Near the northern boundary of P.A. 5889 there are some sediments, revealed in old workings, near the junction of the ultrabasics and basic lavas. Nowhere else are sediments revealed along this junction but it is not unlikely that they would persist.

In various places along the sedimentary bands shallow potholes and shafts have been sunk, indicating that they are auriferous but have contained no large orebodies.

Porphyry-Porphyrite Series.

The porphyries are very abundant in the ultrabasic belt and exhibit the same characteristics as elsewhere, in that they are hard, light coloured rocks whose chief constituents are *quartz* and *albite*. They have been jointed and locally folded. Generally they appear to be concordant intrusions although there is one instance of a porphyry dyke cutting across the boundary of the ultrabasics and the basic lavas in the southern corner of the map.

Mapping has shown that the porphyries are folded. There is one case (e.g. on G.M.L. 5754 and P.A. 5887) of the porphyry being folded in the same manner as the contact of the ultra-basics and basic lavas. Extensive folding of the porphyry-porphyrite series has occurred, especially in the eastern corner of the area, but due to poor outcrop conditions the manner of folding could not be determined.

At Franks' Find there are small changes in strike of the porphyry, and it is here that the ore shoots are located. At Baker's Find the principal ore body occurs on the hanging wall of a porphyry which swings to the east.

The writer thinks that the porphyries at Baker's Find near the boundary of the ultrabasics and basic lavas are continuous along that boundary.

Quartz.

Quartz in the form of reefs appears to be confined to the basic lava belt. In the western portion of the area there appears to be quartz reefs striking in two different directions, one of which is N. 50° E. and the other N. 50° W. Some work has been done on both reefs, especially on the late "Carn Brea," G.M.L. 1762.

There is one instance of a quartz reef intruding a sedimentary band in the northern corner of the area mapped. However, gold values, as may be judged from the work done, were low.

Alluvium.

There is a belt of alluvium with an average width of 6 chains which traverses the southern portion of the area. The present creek bed, which has an easterly trend, is in some places as much as six to seven feet below the level of the alluvium. In the eastern corner of the area there is a narrow strip of alluvium which is about 5 feet deep near the creek.

Structure.

Regional mapping* has shown that the Find is situated in a large fold about three miles south-east of that containing the Hampton Group and probably also influenced by the Tindal's crossfold.

Mapping has shown the occurrence of a dragfold in the ultrabasic-basic lava contact near the nose of which Baker's Find is situated. There is no available pitch information, but near the locality of the Find there are "spears" pitching 35° N. The dip of the porphyry intrusive at the Find is 60° N. but reliable dip information is not plentiful.

On account of the mantle of soil the ultrabasic-basic lava contact is shown as an approximate or doubtful boundary. It is quite possible that there are dragfolds elsewhere along this contact.

*Matheson, R. S., G.S.W.A. Ann. Rept. 1946, Plate VI.

THE MINES.

Baker's Find G.M.L. 5754.

This lease is situated, in a soil covered area, three quarters of a mile west of the six-mile peg on the western boundary of Hampton Location 59. Originally the lease was P.A. 5874, and Baker Brothers hold the following prospecting areas around this lease: P.As. 5882, 5883, 5881, 5886, and 5887 (December, 1946).

Work to date (December, 1946) has been concentrated on this lease. Two lodes about 40 feet apart have been disclosed. Both lodes are on the hanging wall sides of porphyry intrusives striking N. 50° E. and dipping 60° N.W. but insufficient work has been done to establish the pitch of the shoots.

Work on the south lode, which was the first to be opened up, consists of an open cut 35 feet long, 15 feet wide and about 12 feet deep. A shaft 10 feet to the north of the open cut has been sunk vertically for 31 feet. In the eastern end of the open cut there is a change in strike of the hanging wall of the porphyry, and it may have some local influence on ore deposition.

The northern lode has not been opened up extensively, there being only one shaft 12 feet deep.

The host rocks are of ultrabasic origin, being schistose in nature and containing quartz veins. Specimens of coarse crystalline gold were recovered from the open cut.

Favourable results have been obtained by loaming near other porphyries on this lease and the adjoining prospecting areas, but no attempt has yet been made to investigate these prospects.

The first crushing of 52.50 tons of ore yielded 204.12 fine ounces of gold, and the sands assay was 10 dwts. per ton. The next crushing of 252 tons of ore yielded 130.95 fine ounces of gold with a sands assay of 5.25 dwts. per ton.

"Moyajan" G.M.L. 5743.

This lease is situated about 24 chains south-east of Baker's Find G.M.L. 5754, and about 36 chains west of the six-mile peg on the western boundary of Hampton Location 59.

A folded porphyry intrusive traverses the lease, and it was in the vicinity of changes in strike of the porphyry that two small lodes, both of which strike N.-S. and dip 50° E., were discovered.

The lodes are 80 feet apart and a shaft has been sunk on each of them. No. 1 shaft is about 440 feet south-east of the north-west corner peg of the lease. The shaft was sunk vertically for 19 feet then for a distance of 19 feet at an inclination of 40° E. There is 22 feet of driving to the north from the shaft at this level which is called the 38 feet level. The lode consists of lenticular seams of ultrabasic schist with quartz stringers. The maximum width between the surface and the 38 feet level is 2 feet and there is some indication of a southerly pitch.

No. 2 shaft is situated 80 feet on a 98 degree bearing from No. 1 shaft. It is 26 feet deep and there is 14 feet of driving to the north at this depth. The lode strikes N. 30° E. and dips 75° E. At the 26 feet level the lode has pinched out at the north-east end of the drive and is terminated by a shear, striking N. 75° E. and dipping 60° N., at the south-west end of the drive.

A crushing of 138¾ tons of ore from both shafts yielded 12.4 dwts. per ton by amalgamation and 7.8 dwts. per ton in the sands.

PLATE Ix

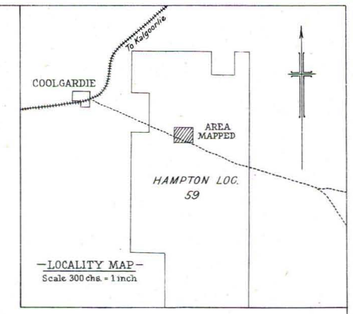
GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

GEOLOGICAL MAP
— OF THE —
HAMPTON GROUP

SITUATED ON LOCATION 59, HAMPTON GOLD MINING AREAS LTD.
APPROX. 5 MILES S.E. OF COOLGARDIE, COOLGARDIE GOLDFIELD

SCALE 10 CHAINS TO AN INCH

10 0 10 20 30 40



—LEGEND—

Alluvium

Ferruginous Laterite

PRE-CAMBRIAN

Metamorphosed Ultrabasic Rocks — Rocks consisting chiefly of fine to coarse-grained actinolite schists, actinolite-tremolite schists and serpentine rocks with local variations to talc schists, chloritic schists and vermiculite schists. Decomposition products in the form of magnesite and jaspery ironstone boulders and cellular opaline quartz rubble are scattered over the area.

Metamorphosed Basic Volcanic Rocks — Fine-grained basic lavas and fine to coarse-grained amphibolites.

Metamorphosed Erosion Sediments — These rocks consist chiefly of graphitic and mica phyllites and they occur as narrow bands interbedded with the meta-basic volcanic rocks.

Porphyry-Porphyrite Series — Sheared porphyritic intrusive rocks mainly light in colour, the phenocrysts consisting of quartz, felspar and/or actinolite. Due to assimilation of wall rock the porphyry-porphrite series, in places, becomes dark grey in colour and is of a hybrid nature.

Lodes — Auriferous deposits occurring in shear zones and which appear to be closely associated with the porphyry-porphyrite intrusives.

Quartz Reefs — These reefs are probably of the same age as the quartz which is, in places, associated with the porphyry-porphyrite intrusives.

Alaskite Dykes — Unsheared, jointed intrusive rocks consisting mainly of felspar, with a little quartz. The physical character of these rocks suggests that they are younger in age than the porphyry—porphyrite series.

— REFERENCE TO SIGNS —

- Approximate geological boundaries
- Strike and dip of schistosity
- Strike of vertical schistosity
- Diamond drill sites showing direction of bore
- Shafts
- Costeans
- Numerous shallow workings
- Form lines
- Drainage channels
- Roads and tracks
- Outcrops with no observable strike or dip

GEOLOGICAL NOTES.

The sudden change in strike of the country near the north-east corner of the group of leases indicates the presence of crossfolding and there is strong evidence for believing this is the east north-eastern extension of the Tindal's crossfold.

The axis of the crossfolding probably strikes in an east north-east direction and passes through the "Surprise" G.M.L. 316.

Work to date suggests that gold deposition has been more or less confined to strips of country about ¼ mile wide, parallel to, and occurring on both sides of the crossfold axis.

Gold deposition appears to have been closely associated with the porphyry-porphyrite intrusives and may be an end mineralisation phase of this magma or may have been introduced later.

Gold deposition has most commonly occurred in the greenstone wall rocks of the porphyry-porphyrite intrusives in intersecting shear zones or in shear zones along the junction. In a few places, however, (e.g., the Brown Lode, "Surprise" G.M.L. 316) a hybrid section of the porphyry (or porphyritised greenstone) constitutes the lode.

Rocks are generally more chloritic and talcose in the shear zones.

The most favourable places for deposition along the porphyries have been at their changes in strike and where they branch.

The best scope for further prospecting at the group is in the vicinity of the porphyries on Gold Mining Leases 332, 334, 346 and 349, and along the south-western boundary of G.M.L. 401 where the graphitic schist bed should intersect the crossfold axis.

Prospecting of favourable horizons over a narrow strip of country along the crossfold axis both to the east north-east and west south-west of the group is also recommended.

The alluvial flat which passes through the centre of the group may obscure some valuable lodes, while the bed of wash occurring at the base of the alluvial deposits may in places contain alluvial gold.

Secondary enrichment has assisted in the formation of the ore shoots near the surface, and the shoots will probably be smaller in size and restricted to the hard mineralised, carbonated and/or silicified sections when they enter the primary zone.

Price 2/-

Lease survey data supplied by Hampton Gold Mining Areas Ltd.
Plane table and telescopic alidade survey and geology
by R.S. Matheson & H.J. Ward, January 1946.

Dryden's Find P.A. 5893.

This find is situated 42 chains, on a bearing of 203 degrees, from the six-mile peg on the western boundary of Hampton Location 59.

At the time of inspection, September, 1946, little work had been done. There had been some costeans dug in ultrabasic rocks which are silicified and which were reported to contain gold.

The only outcrops of porphyry are near the eastern boundary of the prospecting area pegged out. As the porphyry shows changes of strike, further prospecting is warranted in this locality.

"Lady Grace" G.M.L. 5713.

This lease is situated one mile north north-east of Baker's Find G.M.L. 5754, and it is a recent enlargement of G.M.L. 5590. The lease, which contains parts of G.M.L. 664 ("By Chance") and G.M.L. 1739 ("Seek and Find"), was formerly worked by the Macpherson's Reward Gold Mining Company. Blatchford* examined the early workings which are now inaccessible, and an underground plan is available at the Geological Survey.

The present workings are carried out from a main shaft approximately 660 feet on a 115 degree bearing from the south-western corner peg of G.M.L. 5590. The present lessees are operating on a different line of workings to that reported on by Blatchford. The present line of workings is about 90 feet to the north of the old line.

The new line of reef, striking about N. 45° W. and dipping 45° N.E., has been worked over a length of 200 feet to the north-west of the present main shaft, and stoped out to an average depth of 45 feet. The maximum width of the reef is reported to be about one foot, and values are said to decrease when the reef thickens. The main shaft has reached a vertical depth of 60 feet, and it is here that work was in progress at the time of inspection (October, 1946).

Underground mapping of the workings has shown that the quartz reef is in what is thought to be weathered porphyry. About eight feet east of the main shaft on both the 13 feet and 45 feet levels, there is a contact of the weathered porphyry with a coarse grained actinolitic rock.

In regard to the early workings Blatchford states, "Development has so far proved the country to be in diorite or amphibole rock."

After a perusal of Blatchford's map and present available geological evidence, the writer is of the opinion that the drive on the 60 feet level from the old main shaft passed from coarse grained actinolitic rock into weathered porphyry about 20 feet west of the shaft. Also it is to be noted in Blatchford's report† that the greatest part of the workings is confined to the west of the main shaft and between the surface and the 60 feet level. Hence it may be said that this quartz reef is confined to the weathered porphyry and will not continue into the ultrabasic rocks.

Between the years 1897 and 1899 the Macpherson's Reward Gold Mining Company crushed 1,631.20 tons of ore for 1,650.07 fine ozs. of gold.

As G.M.L. 5590, 541.50 tons of ore were crushed for a yield of 183.49 fine ozs. of gold between 1938 and 1940. From G.M.L. 5713, 61.50 tons of ore yielded 107.85 fine ozs. of gold.

Recommendations.

Cross-cutting should be carried out to the north-east or south-west to prospect for parallel reefs.

G.M.L. 5607.

This lease lies 20 chains to the west of G.M.L. 5713 and was examined in October, 1946.

The ore body on this lease consists of a quartz reef, with an approximate north-south trend and a vertical dip, occurring in basic lavas. There have been three shafts sunk on the reef. The most southerly shaft is situated at a distance of 150 feet on a 315 degree bearing from the south-east corner peg of the lease. The northern shaft, which has fallen in, is 90 feet due north of the southern shaft. The central shaft on this line has a vertical depth of 58 feet, whilst the south shaft is 25 feet deep.

There is a shaft 18 feet deep on a bearing of 303 degrees, and 121 feet distant from the south-east corner peg of the lease. Another shaft 25 feet deep is situated 20 feet south-west of this shaft, and the ground between the two shafts has been stoped out.

In 1938 a crushing of 12 tons of ore yielded 2.28 ozs. of fine gold.

Late "Carn Brea" G.M.L. 1762.

This lease lies to the west of G.M.L. 5754 and mining has been confined to auriferous quartz reefs. It is many years since operations ceased and none of the shafts was accessible. The quartz reefs are in fine grained basic lavas, the schistosity of which has an average strike of N. 40° E. One quartz reef has a N. 50° E. strike and indeterminate dip, and another (near the creek) has an approximate N. 50° W. strike and vertical dip.

RECOMMENDATIONS.

The results of prospecting have shown that gold is most likely to occur where there are changes in strike of the porphyry intrusives. There are other changes in strike of the porphyries, and prospecting is recommended in areas around these changes in strike.

BURBANKS GROUP, COOLGARDIE DISTRICT.

By H. J. Ward, B.Sc., Geological Survey of W.A.

CONTENTS.

GENERAL INFORMATION.

The Burbanks Group is situated between four and five miles south of Coolgardie and it is possible to reach the group by the Coolgardie-Londonderry road which passes through the area. The Coolgardie-Norseman railway line lies in the south-east and there is a railway siding about three-quarters of a mile south of the 357-mile peg on the railway line. It is possible to traverse the group by tracks branching from the main road.

Burbanks townsite is shown on the map, but apart from two or three houses nothing remains of the town.

At the time of inspection (November, 1946) there was practically no activity at the group. There was some prospecting activity about 10 chains north-west of the Burbanks Deeps G.M.L. 5738, and Western Mining Corporation Ltd., had pegged leases along the main line of lode. All the old workings were inaccessible.

The group has been denuded of suitable mining timber and it is necessary to transport timber from south of Londonderry. There are two windmills, one of which pumps water from an old shaft and the other is near a dam which is now dry. Drinking water is carted from Coolgardie, and if water in large quantities was required for mining purposes then it would also have to be transported.

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* Blatchford, T., G.S.W.A. Bull. No. 3, p. 69.

†Op. cit.

The State Battery at Coolgardie presents the nearest available crushing facilities.

All amenities, such as post office, stores, hotels, and Mining Registrar's office, are available at Coolgardie.

The last examination of the area by departmental officers was made by Blatchford* in 1912. A map, covering an area of approximately one square mile, has been prepared on a scale of five chains to an inch. Copies of the map are available at the office of the Mining Registrar, Coolgardie, and at the Geological Survey Office, Perth.

Up to 31st December, 1946, 434,962 tons of ore have been crushed, yielding 314,711.2 fine ounces of gold, while there has been 69.95 ounces of alluvial gold and 853.39 ounces of specimen gold produced.

GENERAL GEOLOGY.

The north-western edge of the group is bounded by a ridge of prominent hills which merge into more undulating ground in the south-east. The rocks consist of metamorphosed basic lavas, ultrabasics and erosion sediments, which have been intruded by members of the porphyry-porphyrite series. The general strike is to the north-east and the series has a steep dip to the south-east.

Basic Lavas and Allied Rocks.

The basic lavas, which occupy almost the whole area mapped, are dark green, fine to coarse grained rocks. Variations in grain size and volcanic structures, together with the occurrence of sedimentary bands and volcanic agglomerates, indicate that there are successive lava flows.

The porphyritic lava, which is found along the ridges to the north and north-west of the group, has been named as such for convenience, but it is regarded as an amygdaloidal lava in which the amygdules are larger than usual. This type of rock has a dark green, fine grained groundmass with crystals of felspar up to an inch in length. It represents the rock type mapped by Blatchford† as porphyrite. The average width is 400 feet but, in the northern corner of the group, it decreases to less than 200 feet.

What are thought to be tuffs occur as thin bands, generally light in colour. There is one band of a dark coloured tuff in the northern corner of the group.

Specimens of volcanic agglomerates are to be found on the dumps of the Burbanks Main Lode G.M.L. 5674.

Ultrabasics.

Ultrabasic rocks, occurring near the outer edges of the area mapped, consist chiefly of fine to coarse grained actinolitic schists, and rocks generally green in colour with variations to a straw yellow colour. The decomposition products, consisting of cellular and opaline quartz and ironstone, are scattered over the belt, and were frequently used to map the boundaries of the ultrabasic belts—especially the north-western belt (the Lord Bob's Ultrabasic belt) where the ultrabasics are completely covered by soil. Regional mapping‡ has shown that the Tindal's belt of ultrabasics passes through the southern-eastern portion of the area. In this part of the group, outcrop conditions are extremely poor, and the occurrence of cellular and opaline quartz and ironstone is the only indication of ultrabasics.

Erosion Sediments.

In the northern corner of the group there are grey graphitic schists together with sediments more akin to banded jaspers. None of the sedimentary bands reaches a thickness greater than nine feet. Outcrop conditions prevented proving the continuity of these sedimentary bands, although several isolated outcrops line up along their strike.

A micaceous schist was found on the dumps on the Burbanks Main Lode G.M.L. 5674. Also on the same dumps is found the volcanic agglomerate previously mentioned. This micaceous schist-volcanic agglomerate suite of rocks is also found on a dump on G.M.L. 5545 just over a mile to the south-west of G.M.L. 5674.

Porphyry-Porphyrite Series.

Members of this series are abundant and are found intruding both the basic lavas and ultrabasics. They occur as concordant intrusions with local variations in strike. Some outcrops are highly weathered, and it is hard to determine whether such outcrops really belong to the porphyry-porphyrite series. The origin of a line of outcrop approximately 14 chains north-west of the western corner peg of G.M.L. 5721 is doubtful and for the time being the rocks have been placed in the porphyry-porphyrite series. In general the porphyries are jointed and in some instances a schistosity has been developed.

There is a probable example of a porphyry being intersected by another porphyry about 38 chains north-west of the western corner peg of G.M.L. 5443, but the actual intersection is obscured.

Quartz Reefs.

The general trend of the quartz reefs is to the north-east but there are two examples of reefs with an approximate east-west trend. In the south-eastern part of the area there are a number of lenticular quartz reefs around which some prospecting has been done.

Quartz reefs are found in the main ore channel on G.M.L's. 5617, 5443, 5605, and they constitute the main ore bodies. As the mine workings were inaccessible at the time of inspection (November, 1946), it was not possible to observe their behaviour underground but they have been described by Blatchford§.

Alluvium.

There are two belts of alluvium—one, the larger, traverses the south-western portion of the group, and the other lies in the north-eastern corner. Both belts of alluvium have been dissected by a main creek with an easterly trend. The depth of the alluvium as disclosed in the creeks does not exceed four feet.

Structure.

From the structural geological map prepared by R. S. Matheson‖, it can be seen that the group is situated on the eastern limb of a major anticline. The group is about four miles south-west of the Tindals crossfold axis and is probably influenced by this crossfold.

Surface mapping has not disclosed any evidence of the repetition of lava beds by minor folding as suggested from previous work¶. There may be some local folds in the ore channel itself, as Blatchford states, "The Ballroom reef forms a decided double fold, similar to that in the Burbanks Main Lode, the folding dipping strongly to the north and underlying at a high angle to the east."

The sedimentary bands are not folded but there is one example of a small internal fold which has a strike of N. 60° E. and a pitch of 60° N.E.

The strike of the schistosity varies from N.-S. to N. 60° E. and the dip varies from 60° N.W. to 80° S.E.

There is jointing in two directions, namely, N. 15° E. and N. 55° E., with opposing dips of 60° S. and 70° N. respectively. A joint plane with a strike of N. 40° W. and a dip of 55° N.E. was observed in the western part of the group.

A "spearhead" structure, resulting from the intersection of shears and joints, occurs in the southern end of the group. The "spears" have an approximate pitch of 50° S.

In a porphyry about 17 chains south-west of the south corner peg of G.M.L. 5685, there is a flat cleavage.

*Blatchford, T., G.S.W.A. Bull. No. 53 (1913).
†Blatchford, T. G.S.W.A. Bull. No. 53, Plate II.
‡ Matheson, R. S., G.S.W.A. Ann. Report 1946, Plate VI.
§Blatchford, T., G.S.W.A. Bull. No. 53.
‖ Matheson, R. S., G.S.W.A. Ann. Report 1946, plate VI.
¶Blatchford, T., op. cit.

Evidence of faulting is found in the north-western part of the group. The fault, which is occupied by a porphyry dyke has a north-easterly strike, and is almost parallel to the strike of the porphyritic lava band which it has displaced about 900 feet to the south-west.

THE MINES.

The workings on the leases recently pegged out by Western Mining Corporation were inaccessible at the time of inspection, but it is hoped that an underground examination will be possible before the completion of the survey.

BAYLEY'S GROUP—COOLGARDIE DISTRICT.

By H. J. Ward, B.Sc., Geological Survey of W.A.

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PLATES.

GENERAL INFORMATION.

Bayley's Group is situated on the eastern edge of Coolgardie townsite. It is traversed by both the Coolgardie-Kalgoorlie main road and railway line. A road to Bonnievale passes through the north-western corner of the group. There are numerous tracks traversing the area.

In Coolgardie there are three stores, a post office, hospital, and a Mining Registrar's office. Accommodation may be obtained either at the two hotels or the boarding-house opposite the railway station (December, 1947). A standpipe, from which water may be obtained at sixpence per 50 gallons, is situated in the main street.

There is a public battery, with 20 head of stamps and cyanidation plant, in the group. Mining timber has to be transported from distances of over 20 miles.

At the time of inspection (June-December, 1946) the only large mine in production was the Phoenix Gold Mine. There was some activity on G.M.L's. 5671, 5403, but otherwise work has been confined to spasmodic dryblowing by prospectors.

The area was previously investigated by Blatchford*, whose report also contains a history of the area.

GENERAL GEOLOGY.

The mines are situated in an area of metamorphosed, interbedded, basic lavas, ultrabasic rocks, and erosion sediments, which have been intruded by members of the porphyry-porphyrite series and which are presumably of pre-Cambrian age. The series has a general west-north-west strike, with a steep dip to the north-north-east. There are four faults traversing the area in an approximate N. 20° E. direction. A large part of the area is covered by alluvium and there are some patches of laterite.

Basic Lavas.

The basic lavas are generally dark green rocks varying from a fine to coarse-grained texture. They occupy the central portion of the area mapped, there being rocks of ultrabasic composition on both sides of the basic lava belt. Probable pillow structure has been noted in a number of places, e.g., on the Bonnievale road, 10 chains south of Lindsay's and near the Coolgardie-Kalgoorlie railway line, 10 chains north-east of the southern turn-off into the Phoenix Gold Mine.

Ultrabasics.

The ultrabasics, occurring on the outer edges of the area mapped, consist chiefly of fine to coarse-grained actinolitic schists, serpentine rocks, and fine to coarse-grained, rudely sheared, actinolitic rocks. The serpentine rocks are found on the north-eastern edge of the area. They are of a blocky nature and being soft, mark easily when scratched. In the northern belt of ultrabasics near the contact with the basic lavas are fine to coarse grained actinolitic schists. A massive rock, with radiating crystals of actinolite, is occasionally found in the eastern corner of the area. Light green schists, talcose and sometimes greasy to the touch, and frequently with a satiny sheen along the planes of schistosity, are found near the northern contact of the belt with the basic lavas.

Erosion Sediments.

The erosion sediments occur on the surface as greyish white to dark coloured phyllitic bands. Although sedimentary bands are found in both basic lava and ultrabasic belts, they are more numerous in the basic lava belt. On G.M.L. 5671 there are as many as six sedimentary bands, but as outcrop conditions are poor, it is not possible to trace the bands continuously. Some bands have been intruded by members of the porphyry-porphyrite series and by quartz reefs. An example of the intrusion of a sedimentary band by a quartz reef is to be found on G.M.L. 5671.

Porphyry-Porthyrite Series.

Rocks of this series are light coloured rocks consisting chiefly of quartz and albite. They have intruded the basci lavas, the ultrabasics, and the erosion sediments. There appears to be only one instance of a discordant intrusion, and this occurs in the eastern corner of the area mapped. This porphyry varies from a dark basic porphyry to the normal light coloured porphyry.

In this area the porphyries are generally continuous and show no signs of branching—there being only one exception which is to be found on G.M.L. 5309.

These intrusives have entered along the lines of least resistance and thus they are found in the sedimentary bands and near the ultrabasic-basic lava contacts. There has not been very much assimilation of the country rocks by the porphyries, but it is to be noted that the sedimentary bands are not always continuous along the edge of the porphyry owing to partial assimilation. When this occurs the porphyries become darker in colour.

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*Blatchford, T., G.S.W.A. Bull. No. 3,

*Granitic Rocks**.*

There is only one area of outcrop and that is on the south-western edge of the map just where the Coolgardie-Bonnievale road cuts across the area. The rocks are decomposed and a considerable area is obscured by soil and lateritic rubble. Owing to these unfavourable conditions it is difficult to decide whether the rocks are granites or gneisses of granitic composition, but as the rocks are light in colour and have a granitic composition, the outcrops have been mapped as granite.

Quartz Reefs.

Quartz reefs occur in the group and it is from some of these that most of the gold has been recovered. The quartz reefs have two predominant directions of distribution. One direction is parallel to the strike of the country, and the other is parallel to the strike of the faults with the reefs occurring in the fault zone. The quartz reefs which are parallel to the strike of the country are generally auriferous. In the fault zones there are two types of quartz reefs, viz., the auriferous and the non-auriferous, the former being "dragged" portions of the reefs parallel to the strike of the country, and the latter presumably being reefs post faulting in age.

In the mine workings the reefs are known to taper out and remake both horizontally and vertically. The quartz reefs usually carry arsenopyrite and pyrite at depth.

Laterite.

The laterite, brick red in colour, is confined to the south-western portion of the area mapped. It occurs as cappings overlying both granitic and ultrabasic rocks, and it maintains a fairly constant level. The "Bluff," which consists of a lateritic capping on a granite outcrop, stands above the lower lying ground in its immediate vicinity.

Alluvium.

A large part of the area has been mapped as alluvium, the boundaries of which may encroach upon what is really a soil covering. The depth of the alluvium is not excessive, the deepest parts being approximately six feet. In the western corner of the area the alluvium gives the appearance of depth but a pothole about three feet deep reveals ultrabasic schists as the bedrock. It must be remembered that the alluvial flat in the south-eastern part of the area is not far from Rollo's Bore and Shaft†, the depth of which is reported to be 400 feet. The shaft is reported to be in alluvium for its entire depth.

Dryblowing has taken place almost everywhere on the alluvial flats—the most notable being "Fly Flat" and "Pig Flat." Insufficient work has been done to give a definite opinion on the origin of the gold found in these flats, but it is thought that both eluvial and alluvial gold probably occur.

Structure.

Regional mapping‡ has shown that the area is on the eastern limb of the major Coolgardie structure, which is a steeply north pitching anticline and which has been crossfolded. The group lies approximately two miles north of the main Tindals crossfold axis, and may possibly be situated on a minor crossfold itself, but confirmation of this must await further regional mapping.

The series has a general strike of N. 50° W. and N. 60° W. and a steep easterly dip. In the western corner of the group the beds are beginning to swing to the west and it is thought that the attitude of the porphyry intrusive 8 chains south of the southern corner peg of G.M.L. 5598 is due chiefly to the fact that it is close to the centre of folding.

Surface mapping has shown that four faults traverse the group. Commencing from the south-east and proceeding north-westwards the faults have been named as follows:—"Redemption," "Phoenix," "Hillside," and "Lindsay's," The "Redemption" fault has a strike of N. 30° E., whilst the remaining faults have an approximate strike of N. 20° E. The "Phoenix" fault is the only one on which dip information is available. This fault dips 87° E. between No. 6 and No. 10 levels and 87° W. between No. 10 and No. 12 levels of the Phoenix Gold Mines Ltd.

On all faults the direction of movement has been the same, thus giving a step-faulting pattern. The throw of the faults cannot be accurately ascertained, except in the case of the "Phoenix" fault, but it ranges from 300 to 600 feet. The difference in displacements of various beds suggests a pivotal type of movement.

On the No. 10 level§ of the Phoenix Gold Mines Ltd. a gold-bearing quartz reef (*New Lode* reef) which is adjacent to two porphyry sills, ends abruptly at the "Phoenix" fault. On the eastern side of the fault, and to the south of the place where the *New Lode* reef was terminated, a gold-bearing quartz reef (*Bayley's South* reef), with the same relationship to two porphyry sills as the *New Lode* reef, is encountered. This reef is the faulted portion of the *New Lode* reef and hence the period of faulting is post gold.

THE MINES.

During the year Phoenix Gold Mines Ltd. was the only mine examined and examination was confined to those upon which work is being performed, namely G.M.L's. 5586, 5239, 5257.

The remaining mines will be reported on in the forthcoming field season.

Phoenix Gold Mines Ltd.

General Information.

Phoenix Gold Mines Ltd. is managed by Australian Mines Management and Secretariate Ltd., Perth, and is a C. de Bernales holding.

The area held by the company embraces 367 acres and extends over a length of about one and a quarter miles. It is comprised of 21 gold mining leases and two tailings areas. These are:—

G.M.L's. 5492, 5609, 5586, 5493, 5583, 5256, 5239, 5611, 5612, 5572, 5257, 5344, 5302, 5470, 5613, 5309, 5315, 5533, 5534, 5475, 5535.

T.A's. 98, 99.

These leases include a number of old workings which, though now abandoned, were of importance in the past, namely the "Redemption" (G.M.L. 5533) and the "King's Cross" (G.M.L. 5613). Active mining operations are at present being carried on solely upon G.M.L's. 5586, 5239, 5257, which were formerly G.M.L's. 133, 139.

The main workings are approximately one mile north-east of Coolgardie and are reached by means of a branch road which turns to the north-east from the Coolgardie-Kalgoorlie main road just over a mile from the Coolgardie Post Office.

The mine has a direct water pipeline from the Coolgardie reservoir, and it also possesses a battery with 20 head of stamps.

Mining timber is carted by truck from an area south of Londonderry.

Previous to the present examination, the only recorded geological survey of these leases by departmental officers was carried out by Blatchford‖ in 1898.

The company supplied plans of underground and surface workings as well as longitudinal sections, showing the stoping. Unfortunately the company could not see its way clear to supply complete assay information of the mine workings. Mr. W. Thirloway, mine manager, rendered invaluable assistance to the writer during his geological investigation of the mine.

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*See also Matheson, R. S., G.S.W.A. Ann. Rept. 1946, p. VI.
† Blatchford, T., G.S.W.A. Bull. No. 3, pp. 21-25.
‡ Matheson, R. S., G.S.W.A. Ann. Rept. 1946, plate VI.

§ See plate X.
‖ Blatchford, T., G.S.W.A. Bull. No. 3, pp. 53-58.

Plans and sections are available for inspection at the Geological Survey Office, Perth.

ON MINE PLANS THE *ASSUMED* NORTH LIES AT AN ANGLE OF 73° 20′ TO THE WEST OF *TRUE* NORTH. HENCE NORTH DRIVES, SOUTH DRIVES, ETC., AS SHOWN ON THE MINE PLANS ARE REALLY EAST AND WEST DRIVES, ETC. AS REFERENCE WILL BE MADE TO PHOENIX GOLD MINE PLANS AND SECTIONS, THE MINE DIRECTIONS OF DRIVES, CROSSCUTS, STRIKE AND DIP OF SHEARS, JOINTS, QUARTZ REEFS, ETC., WILL BE USED, BUT SUCH DIRECTIONS WILL BE PLACES IN INVERTED COMMAS, FOR EXAMPLE: MAIN ''WEST'' CROSSCUT, ''SOUTH'' DRIVE, ''N. 16° E.'', ETC.

Geology.

The outcropping rocks and those occurring underground show that there are basic lavas, ultrabasics, erosion sediments and porphyry sills, all of which have already been described (pp. 4, 5).

The workings are near the western contact of the Hampton ultrabasic belt with basic lavas. In the ultrabasic belt approximately 50 feet to 100 feet from this contact with basic lavas, are two porphyry sills, whose distance apart varies up to 60 feet. The more ''western'' sill has been intruded along a sedimentary band, and it is along the ''western'' wall of this sill that one of the favourable horizons of ore deposition occurs.

The following quartz reefs have been located and worked:—*Cockshot* reef, *Price's* reef, *New Price's* reef, *New Lode* reef, *Bayley's South* reef, *Reward* reef. With the exception of the *New Lode* reef and *Bayley's South* reef, all reefs have been formed along prominent lines of shearing in the ultrabasic rocks. The *New Lode* reef and *Bayley's South* reef occur adjacent to the footwall side of the porphyry sill which is the nearer to the ultrabasic-basic lava contact. The quartz reefs have a general ''north-south'' trend and dip approximately ''80° E.'' They are of a milky white and vitreous nature and sometimes have inclusions of ultrabasic and graphitic schists. The reefs are regarded as pre-faulting from evidence on No. 10 level.*. On this level the *New Lode* reef ends abruptly in the ''south'' drive from the main ''west'' crosscut and the reef has a slight turn towards the ''west.'' There is a drive to the ''west'' along the fault, and it is reported that payable quartz was encountered in the fault zone about 100 feet ''west'' of the ''south'' drive in this drive. After 620 feet of driving there is a crosscut to the ''south'' and the quartz reef, which in the upper levels is known as *Bayley's South* reef, was located. This quartz reef has the same relationship to the porphyry sills as the *New Lode* reef, and it is regarded as the faulted portion of the ''southern'' end of the *New Lode* reef.

The Workings.

Phoenix Gold Mines Ltd. have confined their operations to G.M.L's. 5586, 5239, 5257. There is a main shaft on each of the leases, namely, *Price's* shaft, *Bayley's South* shaft, and the *Reward* shaft. Of these shafts only *Price's* shaft and *Bayley's South* shaft were accessible at the time of inspection.

Price's Shaft.

Price's shaft is situated 1,080 feet on a bearing of 324 degrees from the southern corner peg of G.M.L. 5586. It has been sunk vertically for 1,445 feet. There are 13 levels at the following depths from the collar of the shaft:—

No. 1 level	100 feet
No. 2 level	170 feet
No. 3 level	250 feet
No. 4 level	380 feet
No. 5 level	480 feet
No. 6 level	600 feet
No. 7 level	700 feet
No. 8 level	800 feet
No. 9 level	900 feet
No. 10 level	1000 feet
No. 11 level	1148 feet
No. 12 level	1295 feet
No. 13 level	1445 feet

*See Plate X.

The *Cockshot* reef, *Price's* reef, *New Price's* reef, *New Lode* reef, and *Bayley's South* reef (No. 10 level only) have been worked from this shaft. The workings on the *Cockshot* reef and those on No. 1 and No. 2 levels of *Price's* reef were not accessible, as they had either collapsed or else had been mullocked up. It was not possible to map the ore bodies in any of the stopes.

Bayley's South Shaft.

Bayley's South shaft is situated 390 feet on a bearing of 346° 30′ from the southern corner peg of G.M.L. 5257. It has been sunk vertically for 530 feet. There are levels at the following depths from the collar of the shaft:—

No. 1 level	120 feet.
No. 2 level	170 feet.
No. 3 level	230 feet.
No. 4 level	330 feet.
No. 5 level	430 feet.
No. 6 level	530 feet.

The No. 6 level is connected to the No. 10 level workings from *Price's* shaft by winzes.

It was not possible to gain access to the ''north'' drive on No. 2 level beyond mine co-ordinates 1126S, 1461W and on No. 5 level beyond mine co-ordinates 983S, 1385W.

Reward Shaft.

The *Reward* shaft is situated 370 feet on a bearing of 346° 30′ from the southern corner peg of the lease. This shaft and the workings (except for portion of No. 4 level) therefrom were inaccessible at the time of inspection. There are levels at the following depths from the collar of the shaft:—

No. 1 level	100 feet.
No. 2 level	170 feet.
No. 3 level	220 feet.
No. 4 level	280 feet.
No. 5 level	380 feet.

There is a connecting drive from this shaft to No. 4 level workings from *Price's* shaft. The larger part of the drive is under three feet of water and the Reward shaft appears to have collapsed at this level.

ORE BODIES.

Cockshot Reef.

The workings on this reef are not accessible as they have either collapsed or have been timbered up.

From Blatchford's report† and available plans, it appears that the reef has a strike of ''N. 44° E.'' and dip of ''80° S.E.'' It has been stoped over an average length of 100 feet between the No. 3 (250 feet) level and the surface. The reef attains its maximum width of 12 feet on the No. 3 level. It is not possible to determine the pitch of the reef but longitudinal sections show stoping to be almost vertical.

Arsenical and iron pyrites are reported to occur on the No. 3 level.

Price's Reef.

The upper workings of the reef are inaccessible, and timbering on the No. 5 level prevented measurement of the length of the reef, but it must be about 220 feet long on this level.

Blatchford‡, when describing the working on No. 1 level from *Price's* shaft, states, ''A drive from No. 1 winze turns to the north-west and then north to connect with the Everard shaft. In this drive a new reef comes in just north of the airshaft and continues north to McCulloch's shaft. The reef is six feet in thickness in the centre but tapers out at both ends. In the 40 feet level the same reef as in the north of the 100 feet level is followed from the airshaft past McCulloch's shaft. This reef outcrops at the surface. A winze put

†Loc. cit. ‡Op. cit.

down at the 100 feet level proved that the reef tapers out vertically at the 120 feet level and thus proved to be distinct from the Southern quartz body . . . .''

This reef is distinct from the southern quartz body (*Cockshot* reef) and it appears to be a body of quartz which has formed in the same shear as *Price's* reef.

This quartz reef which tapers out at 120 feet below the surface is about 300 feet long on No. 1 level and 260 feet long at the surface.

On the same line of shearing the quartz remakes, and on the No. 3 level it attains a length of 290 feet with a maximum width of six feet. On No. 5 level the reef is about 250 feet in length but decreases to 75 feet on No. 6 level and tapers out completely before reaching No. 7 level.

The reef strikes ''N. 4° E.'' and dips approximately ''80° E.'' No accurate pitch information is available and little stoping has been done on the reef.

New Price's Reef.

New Price's reef extends from No. 8 level to 100 feet below No. 10 level. It attains a known maximum length of about 270 feet and a maximum width of 14 feet on the No. 10 level. The length of the reef on the No. 8 level could not be obtained, but it is more than 80 feet, whilst on the No. 9 level it must be about 200 feet long. The reef has a ''N-S'' strike on No. 8 level and a ''N. 10° E.'' strike on No. 10 level and it has an average dip of ''75° E.''

From the longitudinal section it can be seen that stoping is not extensive, and gives no indication of the pitch of the reef.

The quartz reef has entered along a prominent line of shearing, and occurs in this shear between the Nos. 8 and 10 levels. On No. 6 Level there is a shear which is first encountered 85 feet ''west'' of *Price's* shaft in the ''main west crosscut'' and along which driving has been done to the ''north.'' Lenses of quartz occur in this shear. This shear appears to be the upward continuation of the shear along which *New Price's* reef has formed in the lower levels.

New Lode Reef.

This orebody was first located on No. 10 level by diamond drilling from the drives on the *New Price's* reef on the same level.

It is situated on the footwall side of a porphyry sill, and has a ''N. 20° E.'' strike and ''70° E.'' dip. The reef has been opened up between Nos. 6 and 13 levels and the greater part of the reef has been stoped out between the Nos. 8 and 12 levels. The reef attains its maximum length of 763 feet and a width of 15 feet on the No. 10 level. The minimum length of the reef is on No. 6 level, where it is only about 170 feet long. The reef has an average length of 540 feet on Nos. 11 and 12 levels, and a length of 175 feet on No. 13 level. The orebody is continuous over its entire length on Nos. 10, 11, 12, and 13 levels. The ''Phoenix'' fault terminates the ''southern'' end of the reef on Nos. 6, 10 and 11 levels. The ''southern'' end of the reef tapers out on No. 8 level within 25 feet of the fault on No. 12 level within 190 feet of the fault, and on No. 13 level presumably within 240 feet of the fault which has not yet been encountered in the ''south'' drive.

On No. 4 level a quartz reef occurs in the same position with respect to the porphyry sills as the *New Lode* reef, but as no work has been done between No. 4 and No. 6 levels, it is not known whether the reef on No. 4 level is the upward continuation of the *New Lode* reef or whether another reef has formed in this favourable horizon of ore deposition.

Bayley's South Reef.

This orebody is the ''southern'' continuation of the faulted *New Lode* reef. It is not continuous on any level but has been proved to occur over a length of approximately 360 feet on No. 3 level, 300 feet on No. 4 level, and 400 feet on No. 5 level. The maximum width of the quartz reef is 10 feet.

The general strike is ''N. 16° E.'' and the average dip between No. 2 and No. 10 level (from *Price's Shaft*) is ''83° E.'' From the stoping plans and a knowledge of the quartz reefs mapped on the levels, it appears that the pitch is roughtly vertical. The ore shoot which is at present being worked between the No. 6 and No. 10 levels is almost vertical, but the orebody is increasing in length with depth.

Reward Reef.

At the time of inspection the *Reward* shaft was inaccessible, thus preventing a geological examination of the occurrence of this orebody. However, Blatchford* has reported on the *Reward* reef and details may be obtained from his report.

This reef is regarded as the ''southern'' continuation, on the ''south'' side of the ''Phoenix'' fault, of either Price's reef or New Price's reef.

Mineralisation and Distribution of Gold.

A complete mineralogical examination of the mine has not yet been undertaken but sulphides are known to occur abundantly in the quartz reef and sedimentary bands throughout the mine. From Blatchford's report†, it appears that sulphides were first observed on the No. 3 level from *Price's* shaft. These sulphides are chiefly pyrite and arsenopyrite as well as pyrrhotite. The occurrence of galena has been reported. It is also reported that where there are occurrences of arsenopyrite in the quartz reefs, then there is an increase in gold values. Maitland‡, giving an example of the occurrence of gold and arsenopyrite, states ''Some beautiful specimens of this mineral (arsenopyrite) have been obtained from Bayley's United Gold Mine at Coolgardie. They consist of veined arsenopyrite traversed in every direction by a network of veins of gold, varying in width from 1/20th of an inch down to a microscopic thickness.''

An appreciation of the assay results available leads to the conclusion that the gold occurs erratically throughout the mine, there being no evidence of any distinct shoots of gold in the quartz reef. The thickness of the quartz reefs does not appear to have any effect on the distribution of gold values. The effect of changes in strike and dip of the reefs on the concentration of gold values cannot be ascertained in the absence of complete assay information.

The present company has confined its operations chiefly to the *New Lode* reef. The highest values of gold in this reef are reported to occur between No. 8 and No. 10 levels in No. 3 South and No. 4 South stopes from *Price's* shaft. It is stated that it was the gold from these two stopes which maintained a good average gold value for the *New Lode* reef. With regard to the present production of the mine it is reported that it is the gold from No. 1 ''south'' and No. 2 ''south'' stopes from Bayley's South shaft, which is keeping up the average gold value per ton produced from the mine.

Structure.

Ore deposition has occurred in strong shears which have an approximate strike of ''N. 20° E.'' and an approximate dip of ''75° E.'' There are changes in both strike and dip of the quartz reefs and porphyry sills, and these changes are considered to be due to similar changes of strike and dip of the shear planes along which these bodies have been intruded. The influence of the changes in strike and dip of shear planes on the ore deposition has not been determined owing to the unavailability of complete assay information.

It is hard to reconcile the strike of the *Cockshot* reef (''N. 44° E.'') with a change of strike of the shear in which it was deposited, unless it is due to ''drag'' along the ''Phoenix'' fault, but available evidence§ does not support this conclusion. It is probable that the *Cockshot reef* has entered along a shear which is at an angle to the general trend of the shears containing the main ore bodies.

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*Op. cit. pp. 54-55.

†Op. cit.

‡Maitland, A. G., G.S.W.A. Bull. No. 4, p. 28.

§Blatchford, T., G.S.W.A. Bull. No. 3.

Both major and minor faulting has occurred. Generally the minor faults are parallel or almost parallel to the main fault (''Phoenix'' fault) which passes through the mine. The displacements of the minor faults vary from a few inches up to 20 feet.

The rocks on the ''south'' side of the ''Phoenix'' fault have been displaced between 500 feet and 600 feet to the ''west'' of those on the ''north'' side of the fault. The strike of the fault is ''N. 87° E.'' on No. level* where it has been driven along for a distance of 600 feet. The dip of the fault varies from ''70° S.'' to ''66° N.'' The following are the dips of the fault between various levels:—

Surface to No. 4 level the fault dips ''81° S.''
No. 4 level to No. 6 level the fault dips ''70° S.''
No. 6 level to No. 10 level the fault dips ''86° S.''
No. 10 level to No. 11 level the fault dips ''81°S.''
No. 11 level to No. 12 level the fault dips ''66° N.''

As yet the fault has not been located on No. 13 level, but it is possible that the dip of the fault between No. 12 and No. 13 levels will be to the ''north.''

Diamond Drilling.

Phoenix Gold Mines Ltd. have bored 45 underground and five surface diamond drillholes, of which bore logs for 35 under ground drillholes and five surface drillholes are available at the Geological Survey Office, Perth.

The surface drillholes have proved that favourable shear zones exist, but have not disclosed any new ore bodies.

The underground drillholes are chiefly confined to country in the vicinity of the *New Lode*. Of the drillholes directed ''eastwards,'' all but two (Nos. 17 and 22) were either of insufficient length or not on the correct bearing to locate the favourable ore channels. Underground bores Nos. 17 and 22 prove the probable continuation of *Price's* reef shear, with low gold values occurring therein, on No. 10 level.

Drillholes to the ''West'' from *Bayley's South* shaft workings have not disclosed any ore bodies, and it is considered unlikely that favourable results will be obtained by drilling in this direction.

Summary and Conclusions.

The ore bodies have been deposited in shear zones in the Hampton Ultrabasic Belt. They occur as irregular bodies which taper out both horizontally and vertically and there is no evidence to show at what intervals further ore bodies are likely to occur. All quartz reefs have tapered out vertically when the length has decreased, there being no example of a reef increasing in length at a lower level after there has been a decrease in length in upper levels. Hence it is thought that the *New Lode* reef will not continue downwards for any great depth, as its length on No. 12 and No. 13 levels is decreasing.

The most favourable horizon of ore deposition is that in which the *New Lode* reef occurs, namely, in the vicinity of the junction of the footwall of the main ''western'' porphyry sill with the ultrabasics.

Recommendations.

During the year it was recommended to the company that two diamond drillholes be directed eastwards on the ''south'' side of the ''Phoenix fault,'' from No. 10 level, to determine whether an ore body had developed to the ''south'' of the fault in the *New Price's* reef shear. One diamond drill hole (coordinates of collar S. 1007.89 W. 1298.06 bearing 131° 39′) had been completed by November, 1946, and it showed that there was six inches of quartz at 355½ feet from the collar of the drillhole—the estimated distance being 360 feet. The results of the second diamond drillhole, the direction of which is 131° 39′ and whose collar is situated at S. 1283.58, W. 1393.45, are not yet available.

On the No. 4 level in No. 1 ''south'' drive off the main ''west'' crosscut from *Price's* shaft, the quartz reef was faulted. It was recommended that cuts be taken out until the fault zone was passed and then crosscutting to the ''west'' until the reef was located, as the reef had been dragged to the ''west.'' It is since reported that the reef was displaced three feet to the ''west.''

In No. 1 ''north'' drive off the main ''west'' crosscut from *Price's* shaft on No. 4 level, the quartz reef tapers out. It is recommended that drillholes be directed to the east from No. 2 ''north'' drive off the main ''west'' crosscut to determine whether the quartz remakes in the porphyry sill.

At present (December, 1946) the company is using up its ore reserves, and little exploratory work is being done. An extensive exploratory programme is necessary to locate new ore bodies. The most favourable horizon of ore deposition is at the contact of the ''western'' porphyry sill with the ultrabasics (namely, that horizon in which the *New Lode* reef occurs). It is recommended that both the ''northern'' and ''southern'' continuations of this horizon be tested at depth. It is thought that exploration to the ''north'' is especially warranted. It is probable that the shears in which *Price's* reef, *New Price's* reef, etc., occur, continue to the ''north,'' but a diamond drilling campaign is necessary to test the occurrence of ore bodies at depth.

There is no evidence available to show that the horizon in which the *Reward* reef is found, has been tested to the ''south'' of the present workings. The possible occurrence of ore bodies on this line should not be disregarded.

Production.

The following tables (Nos. 1 and 2) give as complete as possible an analysis of the recorded production for the group of leases held by Phoenix Gold Mines Ltd. No. 2 table gives a more detailed result of the production from late G.M.Ls. 133, 139, and 142 which were the original leases pegged in the area by Bayley's Mines Ltd. This table has been so prepared as it will give the reader a more comprehensive idea of the production from the present workings, G.M.Ls. 5386, 5239, 5257 which now cover these original leases.

*Plate XI.

TABLE 1.

TOTAL PRODUCTION FROM WITHIN BOUNDARIES OF LEASES HELD BY PHOENIX GOLD MINES LTD AT COOLGARDIE.

G.M.L'S. 5256, 5257, 5302, 5309, 5344, 5315, 5475, 5492, 5493, 5533, 5534, 5535, 5572, 5583, 5586, 5609, 5611, 5612, 5613, 5470, 5239.

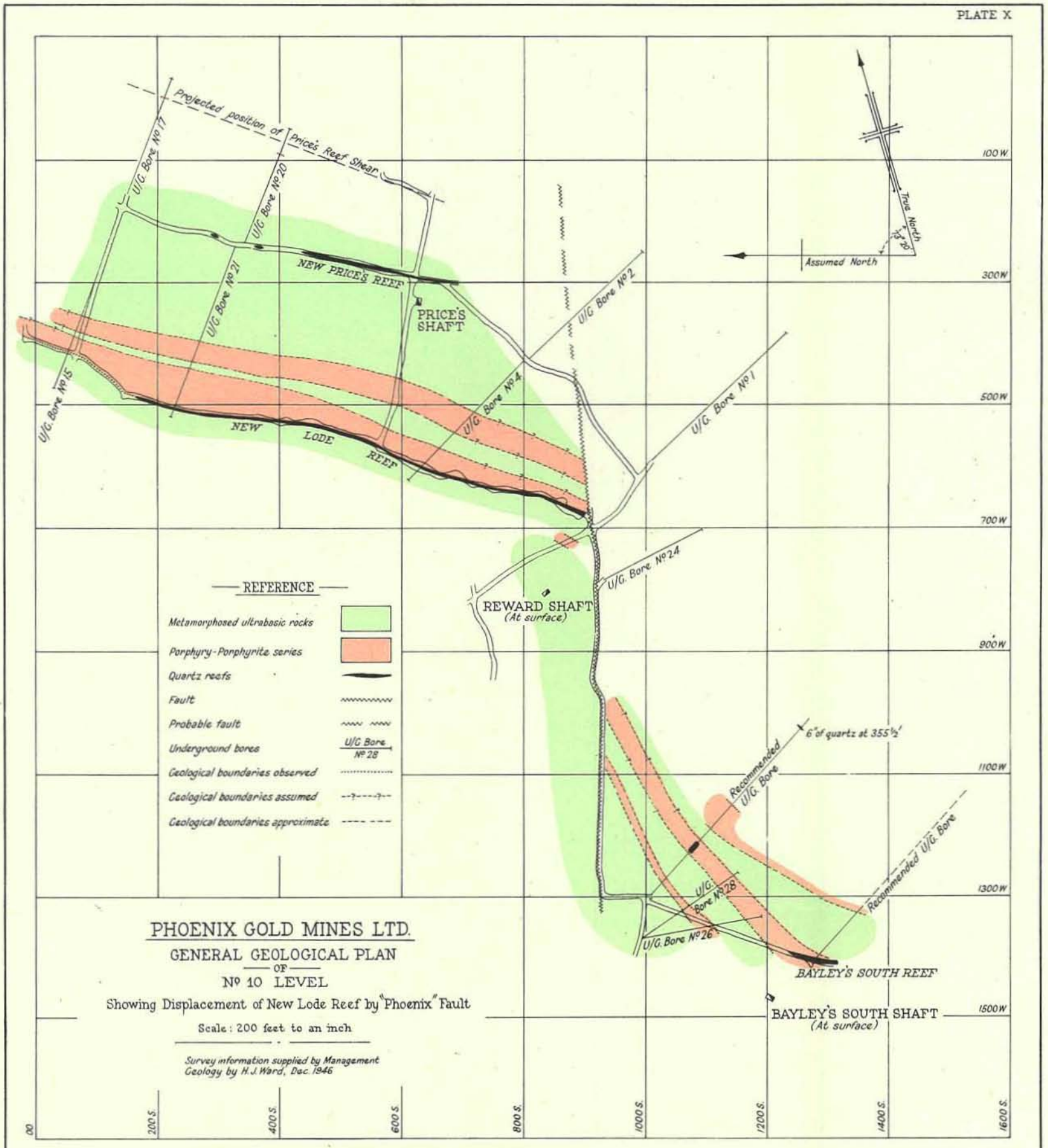
Period	Name of Lease or Company.	G.M.L. Nos.	Alluvial Fine ozs.	Dollied Fine ozs.	Ore treated Tons.	Gold therefrom Fine ozs.	Total Gold Fine ozs.
Prev. 1897–1905	Bayley's Reward: Bayley's United G.Ms. Ltd.	133, 139, 142, 547	882·14	89·41	76,402·97	99,179·62	100,151·17
1905–1907	Bayley's Mines, Ltd. ...	133, 139, 142	15·10	10·59	2,319·74	2,323·66	2,349·35
1907–1912	Bayley's Leases	133, 139, 142	7·18	171·21	7,820·80	8,904·15	9,082·54
Prev. 1897 ...	Old Chum Extended ...	2434	...	...	6·00	7·24	7·24
Prev. 1897–1901	Ritanita Co. Ltd. ...	130, 215, 436, 1145	...	...	402·00	189·52	189·52
1897	Bayley's, South Extended	471	...	...	47·00	7·58	7·58
Prev. 1897–1900	Cosgrove's Bayley's Reward Sth. G.M. Co. N.L.	122, 3618	...	...	2,015·50	1,814·03	1,814·03
1897–1901	Lanarkshire G.Ms. of Aust. Ltd.	3530	60·25	15·07	504·00	281·40	356·72
1898	Blue Peter	3631	...	...	118·00	67·50	67·50
1899	South King's Cross ...	3690	...	...	30·00	4·59	4·59
1900	Caledonia	3599	...	...	25·00	5·09	5·09
1901	London Bridge	3919	...	...	2·50	8·70	8·70
1902–1904	Ritanita	3977	...	...	256·00	38·91	38·91
1901–1902	Tulip Bayley's No.1 South	3936	...	...	118·50	215·17	215·17
1897–1905	Bayley's Consols G.M. Co. N.L.	22	...	...	14,042·00	10,790·97	10,790·97
1903–1904	King's Cross Leases ...	471, 3530, 4067, 4068	...	...	582·00	397·18	397·18
1905	King's Cross	4122	...	...	792·00	561·39	561·39
1905	Lindsay's East	4103	191·31	...	...	105·44	296·75
1905–1906	Bayley's No. 2 South ...	22	...	...	1,075·00	423·75	423·75
1906–1908	Glueck Auf	4267	...	148·79	177·00	58·00	206·79
1907	Bayley's No. 2 South ...	4278	...	...	...	30·41	30·41
1904–1907	Gambier	4056	...	17·89	151·00	47·83	65·72
1901–1907	Coolgardie Redemption	3918	...	1,257·62	4,419·00	3,747·28	5,004·90
1905–1907	W.A. Sluicing Synd. Ltd.	4067, 4122	...	...	742·00	373·22	373·22
1908	Bayley's North East ...	4229	...	...	32·00	3·67	3·67
1909	Coolgardie Redemption G.M. Co. N.L.	3918, 4052	...	...	202·00	68·80	68·80
1909–1910	Columbia Park	4389	...	...	139·50	275·75	275·75
1904–1910	Coolgardie Redemption Extd.	4094	...	...	318·00	237·86	237·86
1911–1913	Columbia Park	4421	...	9·00	14·50	36·45	45·45
1908–1914	New Bayley's Mines Ltd.	4067, 4122, 4372, 133, 139	...	...	596·25	1,179·71	1,179·71
1915	Ethel Doris	4480	...	...	70·00	20·04	20·04
1916–1924	Cockshot	4559	...	182·77	371·43	1,458·76	1,641·53
1922–1923	Coolgardie Redemption No. 1 South	5137	...	...	47·00	5·19	5·19
1921–1924	Bayley's Reward ...	5127	...	...	160·50	68·30	68·30
1933–1934	Redemption	5280, 5281	...	3·48	31·00	3·44	6·92
1902	Bayley's Imperial ...	3833	...	...	27·00	32·33	32·33
1932–1933	New Coolgardie ...	5256	...	...	30·06	4·13	4·13
1931–1934	Bailey's Reward ...	5239	...	2·74	106·15	225·15	227·89
1934	Bayley's Boronia ...	5309	...	...	31·00	8·52	8·52
1938–1946	Phoenix G.Ms. Ltd. ...	5256, 5257, etc.	...	...	199,435·00	55,709·84	55,709·84
		Totals ...	1,155·98	1,908·57	313,659·75	188,920·57	191,985·12

TABLE 2.

PRODUCTION FROM WITHIN BOUNDARIES OF ORIGINAL LATE G.M.Ls. 133, 139, and 142 AT COOLGARDIE.

Period	Name of Lease or Company.	G.M.L. Nos.	Alluvial Fine ozs.	Dollied Fine ozs.	Ore treated Tons.	Gold therefrom Fine ozs.	Total Gold Fine ozs.
Prev. 1897–1905	Bayley's G.Ms. Ltd. ...	133, 139, 142, 547	882·14	89·41	76,402·97	99,179·62	100,151·17
1905–1907	Bayley's Mines Ltd. ...	133, 139, 142	15·10	10·59	2,319·74	2,323·66	2,349·35
1905–1906	Lindsay's East	4103	191·31	...	...	105·44	296·75
1907	Bayley's No. 2 South ...	4278	...	...	...	30·41	30·41
1907–1912	Bayley's Leases ...	133, 139, 142	7·18	171·21	7,820·80	8,904·15	9,082·54
1908–1914	New Bayley's Mines Ltd.	133, 139, 4067, 4122, 4372	...	...	596·25	1,179·71	1,179·71
1915	Ethel Doris	4480	...	...	70·00	20·04	20·04
1921–1924	Bayley's Reward ...	5127	...	...	160·50	68·30	68·30
1932–1933	New Coolgardie... ...	5256	...	...	30·06	4·13	4·13
1938–1946	Phoenix Gold Mines Ltd.	5256, 5257, etc.	...	...	199,435·00	55,709·84	55,709·84
		Totals ...	1095·73	271·21	286,835·32	167,525·30	168,892·24

PLATE X



PHOENIX GOLD MINES LTD.

GENERAL GEOLOGICAL PLAN
— OF —
No 10 LEVEL

Showing Displacement of New Lode Reef by "Phoenix" Fault

Scale: 200 feet to an inch

Survey information supplied by Management
Geology by H.J. Ward, Dec. 1946

PROGRESS REPORT ON THE GEOLOGICAL SURVEY OF COLLIE COAL FIELD.

By J. H. Lord, B.Sc., Geological Survey of W.A.

CONTENTS.

INTRODUCTION.

Previous to the commencement of this present survey in June, 1946, a complete geological survey of Collie has not been carried out. All earlier geological work consisted chiefly of visits by geologists from the G.S.W.A. to advise on certain localised problems or to prepare or revise the geological map for Royal Commissions. Consequently, there is very little published material dealing with the geology of Collie.

The amount of geological mapping that can be done on the surface, is greatly curtailed by the fact that the basin is covered by laterite, by lake deposits probably of Pleistocene age, and by recent alluvial deposits varying from 12 to 80 feet in thickness. Underlying these, uncomformably, are the coal measures, which have not been found to outcrop at the surface. The floor and the boundary of the basin is composed of igneous rocks, mostly granite. Therefore, surface geological mapping has been confined to locating igneous outcrops and to mapping their position, where it is of use in defining the boundary of the coalfield.

Fieldwork was commenced when the Geophysical Survey Party from the Commonwealth Mineral Resources Survey arrived. Due to the type of winter experienced at Collie, the work of both parties was delayed considerably during the winter months, and it was not until October that weather ceased to hamper operations. The two parties worked in conjunction with each other, the Geological Party supplying whatever information and assistance was required.

TOPOGRAPHY.

Situated to the east of the Darling scarp, the coal basin lies between 600 and 850 feet above mean sea level. It consists mainly of parallel east-west lateritic ridges with intervening sandy valleys, that are mainly swampy during the winter.

The drainage system on the coal basin is in late maturity. It appears to have been originally a portion of the old north-south river system of the south-west of Western Australia. The Hamilton, Harris and Bingham rivers all flow from north to south, while the south and east branches of the Collie river flow in a north-westerly direction. Apparently an active river, that has eroded rapidly through the Darling scarp, has captured the waters of the old north-south system resulting in the present Collie river. It shows the features of a mature river in the vicinity of Collie townsite with numerous wide meanders, while young features are exhibited where the river flows through the Darling scarp. This river shows also the other features that are said to be characteristic of the south-west rivers, namely, large right-angled bends and a marked deflection to the south near the mouth before entering Leschenault Inlet.

GEOLOGICAL STRUCTURE.

Boundary of Coalfield.

The coalfield is surrounded by pre-Cambrian igneous rocks. However, the determination of the contact on the surface presents numerous difficulties.

It has been quoted that the coalfield owes its preservation to down-faulting, but no definite evidence has been produced for this theory; on the other hand no evidence has been produced to show why this could not be a basin of sedimentation. As a result of field experience, objections can be raised against both theories. Consequently, a definite conclusion cannot be formed until the completion of the survey and until a study of the geophysical results has been made. If the basin has been preserved by down-faulting it will probably be found that there has been only two major faults; one forming the south-west boundary striking north-west to south-east, and the second parallel to the first and forming the north-east boundary. The faults in the mines appear to be the result of differential compaction.

Laterite proved to be of no use in determining the boundary of the field. Most of the laterite on and around the basin has a gritty appearance and occurs over granite as well as over sediments.

Quartz and quartzite pebbles, well worn by water action, occur on the surface as rubble and also as pebble layers in the Permian sediments of the coal basin, e.g. above the Griffin seam. At some places on the surface these pebbles are bound together by ferruginous material forming a ferruginous conglomerate which occurs in place of the usual laterite.

The position of igneous rocks whenever found has been plotted. They consist of granite and basic intrusions.

The "island" of granite shown on the existing geological map at the south end of C.M.L. 139 and 140 does not exist, but there is an outcrop of a basic dyke and also some weathered granite near the northern boundary of C.M.L. 146. This seems to be the true position of this "island." The other granite "island" south of Shotts may not extend as far east as indicated on the existing map.

When the geophysical results are available it will probably be found that in the granite floor there is a ridge extending from the granite nose at Ewington to the "island" south of Shotts, then to the "island" in C.M.L. 146. From here, it may run on south-eastwards to some granite outcrops which occur near but inside the old boundary.

The boundary to the north of Shotts will probably be moved nearly a mile northwards but decreasing to about half a mile near Buckingham, the boundary to the south of Muja remains doubtful due to the lack of outcrops and its position will depend upon geophysical results; the southern boundary, south of Cardiff on the east side of the river, may be extended further southwards, but will probably take a sharp turn back towards the south-eastern peg of lease 150. Elsewhere the boundary appears to be approximately correct on surface geological evidence.

Structure Contour Plans.

Copies of the latest survey plans and the loan of all available co-ordinate books, were obtained from the existing mining companies, from which were extracted as many reduced levels as possible. These levels were plotted and twenty-foot contours of the workings were drawn. Since all the workings are in the seam the resulting plans represented the structure contours of the seam at each mine concerned.

These plans are most interesting and as far as can be ascertained have not been drawn before for these mines. They should be of great assistance to the mines and are also essential in studying the geological structure of the basin.

*Geological Sections.**

In a basin such as Collie the best method of trying to determine the structure is by drawing sections. Very few sections have been drawn except those by Jack in his 1905 Royal Commission, which have been added to and modified by later writers. A disadvantage of the existing sections is that they are not drawn to natural scale and in consequence are difficult to visualise. All sections done according to the following plan of work have been drawn to a natural scale, namely, 2 chains equal 1 inch.

Sections are being drawn through the existing mines in order to solve the structural problems in areas where most data is available. This work has involved underground examination of all the workings and careful consideration and research into all available bore logs.

Although there are a great number of logs available, the earlier ones are not very reliable. The beds also are subjected to so much lateral variation that it is impossible to find any key or marker beds. Therefore, all correlation must be done primarily by considering the thicknesses of the coal seams intersected; secondly, by their distance from the next seam above or below, and finally, by the type of rock overlying or underlying the seam.

Sections have been completed of all mines except the Co-operative, which will be drawn next. Section-lines have been selected after careful study of the structure-contour plans, faults, and bore information. Many conclusions can be drawn from these sections but these will not be fully discussed until the completion of the survey. However, the following are a few of the points observed.

(1) Boring is necessary on C.M.L. 199, south of the Cardiff handbore No. 3, to locate the extension of the top seam of the Cardiff.

(2) Similarly, boring is required over the northern half of C.M.L. 224, 223 and 222, to follow the blind outcrop of the top seam, which, if it were revealed, would show that the Cardiff seams form a complete basin.

(3) The Cardiff seams are up-thrown along a fault on the north-east side of the mine, and the blind outcrop on the southern end of C.M.L. 203 is its continuation.

On the south-western boundary of the mine, the fault is hinge-type, the seam being up-thrown at the southern end and down-thrown at the northern end. In consequence, it should be possible to work through to the other side of the fault at a selected point.

(4) The structure contours and sections of the Stockton mine are very interesting owing to the change from a southerly to a northerly dip near the entrance to the main tunnel and in the open-cut. Properly sited deep bores would probably locate the seams to the south-west of the mine workings.

(5) It is considered that the Co-operative, Proprietary, Stockton and probably the Premier mines are on the same horizon. Further boring would prove a possible site for a colliery between the Proprietary and the Stockton mines.

(6) The Wyvern seam and Collie Burn No. 1 appear to be on the same horizon, while the Griffen seems to be the same as the Collie Burn No. 2. None of these seams can be correlated with the Stockton or Premier seams.

Numerous other localities require boring. These will be included in the drilling programme which will be recommended at the end of the survey, when the results of the Geophysical Survey are available.

SAMPLING.

In the earlier part of the survey a comprehensive sampling campaign of all working mines was carried out with the view to obtaining a complete set of analyses of the coal seams being worked. The samples were taken by a uniform method and taken at approximately the same period.

The method of sampling employed was as follows: Faces to be sampled were selected as far as possible with a view to obtaining a general representation of the working places. The sample was taken when the face was as "fresh" as possible, usually immediately after firing. A groove was cut from the roof to the floor and about six pounds of coal per foot of face collected on to a sampling sheet. The coal was broken into small pieces and quartered until only about five pounds remained. This was then placed in an air-tight container and sealed. The sample of coal, therefore, was exposed to the air only for a few minutes before being sealed. The samples were forwarded daily to the Government Chemical Laboratories for analysis.

OPEN-CUTS.

During the course of the survey, an investigation was made in order to locate sites for new open-cuts. Five areas were found to have open-cut possibilities. Plans and sections of these areas have been drawn†

These sites were selected after consideration of all the borelogs available. There are other possible sites, but present indications are not as promising as these described. For instance, there is an area of shallow coal to the north-east of the Cardiff Mine as shown in the Collie Boulder bores. Further prospecting laterally along the blind outcrop of the three major horizons may in the future disclose other suitable sites.

Of the sites described, the largest is known as the Black Diamond area near Allanson. However, the seam is rather irregular and has not sufficient holes on it to determine its true structure. The estimates made below for this site may be subject to larger variation than for other sites, but despite this possibility there is a large tonnage available and the coal should be of good quality.

At South Cardiff is a site, with a large tonnage available, in what appears to be a well-defined structure. A disadvantage, however, lies in the fact that the seam is the same as mined in the Cardiff, hence is not the best quality coal.

The Wyvern site is good from all respects, but has a smaller indicated tonnage than any of the other sites.

The North Stockton site has a small indicated tonnage and the area is disturbed, otherwise it should be good.

The Collie Burn site—east of the river—is not such a good economic proposition, as operation costs would be higher than any of the other sites.

With further exploration, the Black Diamond site may prove to be the biggest and best, but the South Cardiff site is at present ready for working. The order of priority of the other sites being:—

Wyvern,
North Stockton,
Collie Burn, east of the river.

The following table gives the estimates for each site, while the position and area of each is shown on the accompanying plans. It should be emphasised that this information is drawn from existing bore logs and that further systematic boring under the control of a geologist is required to verify the estimates. For these calculations it is assumed that 30 cubic feet equal 1 ton.

*Sections not published.

†Plans and sections not published.

Site.	Length of open-cut	Width of open-cut	Average thickness of coal in present bores	Average depth of seam in present bores	Indicated tonnage	Number of bore holes required	Approx. average depth of holes
Black Diamond	1200 ft.	1000 ft.	10 ft 4 in.	40 ft.	331,000	16	60 ft.
South Cardiff	1200 ft.	400 ft.	10 ft. 6 in. (top seam)	28 ft.	168,000	nil.	70 ft.
			4 ft. 6 in. (bottom (seam)	58 ft.	104,000		
					272,000		
Wyvern	1200 ft.	125 ft.	11 ft. 4 in.	20 ft.	57,000	8	50 ft.
North Stockton	700 ft.	270 ft.	11 ft. 4 in. (top)	27 ft.	71,000	12	60 ft.
			7 ft. 6 in. (bottom)	48 ft.	47,000		
					118,000		
Collie-Burn	1200 ft.	400 ft.	8 ft. 5 in.	33 ft.	135,000	12	45 ft.

Black Diamond Site.

This possible open-cut site is situated on the south side of the main Collie-Roelands road about half a mile west of the Allanson turn-off. The area is covered with medium-sized timber and tends to be swampy near the river in winter, but this should not affect operations which would develop from the north.

Communications.—As stated, the main road, which is sealed, passes by the north-eastern corner of the site. The nearest railroad is at Allanson about 1 mile away, where a suitable siding could easily be constructed. This station used to service the Westralia Mine.

Prospects.—The seam has been found to be up to 14 feet thick but somewhat irregular, suggesting that the structure may be a number of steeply dipping seams instead of the interpretation given here. Bore No. 1 did not strike coal at all, but this may be due to its situation at the top of a small anticline which has been eroded away (see section). The coal is said to be good quality. One shaft was recently cleaned out, timbered and sampled by Amalgamated Collieries, Ltd. However, it is now nearly full of water. If the suggested boring plan is carried out, it is thought that up to 80 per cent. of the site blocked out would be found to be workable.

Bores.—At present there are nine bores on the site, of which six are parallel to and near the eastern boundary of the site. To prove the area it is considered that it would be necessary to put down 16 holes set out on a 400 feet grid as the first phase, then after consideration of the results to put down additional holes in the portion of the site thought to be worthwhile, reducing the grid to 200 feet.

After the structure of the seam is ascertained from the above boring, it may be found advisable to test for the continuation of the seam outside the site, although there does not appear to be any northerly extension.

Details of Indicated Coal.—Estimates in this area cannot be made with such confidence as at others. Bore No. 1 which shows no coal, has to be considered. It is, however, thought that 80 per cent. of the site can be classed as "Indicated Coal," but figures would have to be revised after further boring.

Average thickness of seam, 10 feet 4 inches.
Average depth to top of seam, 40 feet (estimated).
Length of open cut, 1,200 feet.
Width, 1,000 feet.
Tonnage, 331,000 assuming 80 per cent. of area productive.

South Cardiff Site.

This possible open-cut site is situated about 1½ miles S.S.E. of the Cardiff tunnel, between the road to Mac-Alinden and the South Branch of the Collie River. The area in the vicinity of the site is covered with medium-sized timber. The ground rises to the S. and S.W. to a lateritic ridge, while it falls to the N. to a swampy area, which should not hinder operations.

Communications.—The nearest road is about 40 chains to the west, and the construction of a road to approach the site from the S.W. along the lateritic ridge should be fairly simple. The nearest railroad is at Collie Cardiff. However, a railway survey has been carried southwards and passes about 10 chains to the west of the site. About 1¼ miles of line would be required.

Prospects.—This site is situated on the up-throw side of the fault which forms the eastern boundary of the Cardiff Mine, and it is the blind outcrop of the seam being worked in that mine.

The area is remarkable for its uniformity of the seams. The sections show how consistent the seams are in this area, as the bores can be correlated better than in any other area so far examined. It also shows how the present system of boring is wasting both time and money. For instance, with the results of bore No. 23 known, it was useless to continue bores No. 24 and No. 25 past the 1 foot 3 inch seam unless the operators were prepared to go the full distance to the 3 feet 1 inch seam and so 80 feet of boring was wasted.

There are two workable seams on this site, and the coal should be of similar quality to that of the Cardiff. Boring, at present in progress, is proving the site and indicating that the blind outcrop is swinging to the south, so will probably swing around the southern end of the Cardiff mine.

Bores.—Originally there were four bores within the site, but recently boring was recommenced in the area and two more holes have been put down on the site as well as other holes nearby. There now appears to be no necessity for any further boring to prove this site. Any additional boring should follow the blind outcrop southwards and thus increase the size of the possible open-cut site.

Details of Indicated Coal.

Average thickness in bores of top seam, 10 feet 6 inches.
Bottom seam, 6 feet 6 inches.
Average depth in bores of coal—top seam, 28 feet.
Bottom seam, 58 feet.

Length of suggested open-cut, 1,200 feet.
Width, 400 feet.
Tonnage in top seam, 168,000.
Bottom, 104,000.
Total, 272,000 tons.

Wyvern Site.

This possible open-cut site is situated to the west of the Wyvern tunnel. The area is covered with medium-sized timber and scrub. There is no swampy ground on the site.

Communications.—This site is not served by a good road capable of handling heavy traffic. The railroad runs to the Wyvern mine and a shunt line extends along the proposed site.

Prospects.—Since this is the blind outcrop of the Wyvern seam, it will dip rather steeply (probably 1ft. in 3½ft.), and consequently the width of any open-cut will not be great. The length of an open-cut is limited to the east by the Wyvern workings, while to the west more prospecting is required. A fault is supposed to cross the north-east corner of this site, but it is thought that as the throw is only slight, it would not affect operations.

Bores.—At present there is only the equivalent of one line of bores along the strike, and to determine the possible width of the open-cut it would be necessary to put a line of six bores parallel to the line from No. 21 to No. 15 and 100 feet further south. One hole to the north of each of bores Nos. 21 and 9 would also be required. This area has a better coverage of bores than any of the other sites, and, although the above holes are desirable, work could be commenced without them. Scout holes to the west may be of use in determining any extension of the site.

Details of Indicated Coal.

Average thickness of seam in bores, 11 feet 4 inches.
Average depth, 20 feet.
Length of suggested open-cut, 1,200 feet.
Width, 125 feet.
Tonnage, 57,000.

Collie-Burn Site—East of River.

This possible open-cut site is situated on the east bank of the South Branch of the Collie River and extends eastwards with the ground rising to a lateritic ridge. This area is covered, near the river, with swamp-type vegetation and some scattered medium-sized timber which increases eastwards as the swamp-type vegetation decreases.

Communications.—A road would have to be constructed either from an existing second-class gravel road about half a mile north of the site, or from the Collie-Burn station nearly the same distance to the west, which would necessitate bridging the river.

Collie-Burn is the nearest railroad.

Prospects.—This is the eastern extension of the seam which was worked by the Scottish Collieries at Collie-Burn. The seam does not show any signs of major faults affecting it and dips at a small angle to the south south-west. The blind outcrop of this seam could be traced eastwards by scout boring at least a mile to the vicinity of the Bedlington Calyx bore on C.M.L. 82 and probably further. There is no bore-log evidence of a second seam.

It is considered that this seam would be better worked as a mine, for the following reasons:—

(a) there is only one seam;

(b) the ground is very swampy in winter;

(c) the seam is in close proximity to the river.

Bores.—The suggested site has seven bores scattered over it, which follow to no grid system. To check and test the site 12 bores would be required spaced at 400 ft. intervals along the strike, and at 200 feet intervals down the dip. Holes would average about 45 feet in depth.

Details of Indicated Coal—

Average thickness of coal in bores, 8ft. 5in.
Depth, 33ft.
Length of suggested open-cut, 1,200ft.
Width, 400ft.
Tonnage, 135,000.

North Stockton Site.

This possible open-cut site is at the junction of the main Collie-Wagin road and the turn-off to Stockton, about half a mile north of the Stockton Mine. The area is covered with medium-sized timber decreasing to semi-swamp near the eastern end.

Communications.—The road to Collie is a first-class gravel road, which will soon be sealed, while the railroad passes within a quarter of a mile of the site.

Prospects.—The seams in this area are the northern extension of the seams worked in the Stockton open-cut. The seams are faulted and disturbed, particularly to the south-east. Inside the site, however, the seams do not appear to be affected. This site has the advantage of two workable seams.

Bore.—There are at present five bores scattered over the area. To test the area and both seams properly twelve holes should be put down on a suitable grid. The average depth of the holes would be about 60 feet.

Details of Indicated Coal—

Average thickness of top seam in bores, 11ft. 4in.
Depth, 27ft.
Average thickness of bottom seam in bores, 7ft. 6in.
Depth, 48ft.
Length of suggested open-cut, 700ft.
Width, 270ft.
Tonnage in top seam, 71,000.
Tonnage in bottom seam, 47,000.
Total, 118,000 tons.

PETROGRAPHICAL NOTES ON ROCKS FROM PORTIONS OF THE YALGOO AND MURCHISON GOLDFIELDS.

By W. Johnson, B.Sc. (Hons), Geological Survey of W.A.

INTRODUCTION.

The rocks described in this report were collected by R. A. Hobson and the writer during a reconnaissance survey of parts of the Yalgoo and Murchison Goldfields from June to November, 1946. The specimens represent most of the rock types seen in the area mapped. Mapping was done on a scale of four miles to an inch and was confined to the delineation of the boundaries of the broad rock groups described by R A. Hobson[1] on pages 61 of his report. It was impossible to map the distribution of the individual rock types on a scale of four miles to an inch.

As this is a petrographical report, the specimens are named from their mineral constituents and the rock textures and structures existing in them. They are classified under headings which do not correspond with names of the broad rock groups as used by Mr. Hobson.

The rocks were examined megascopically and in thin section by the writer during January and February, 1947. Specimens M6, M15, M17, M40, M50, M53, M79, M83, M84 were examined and described by Dr. R. T. Prider of the University of Western Australia. Dr. Prider also gave valuable advice in naming several other rocks of doubtful origin.

The localities from which the specimens were collected will be marked on the final geological sketch map.

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[1]R. A. Hobson. Geology of portion of the north-west division between latitudes 24° S. and 29° S. and between longitudes 110° 30′ E. and 118° 30′ E. Ann. Prog. Rept. Geol. Survey West. Aust., 1946, pp. 61.

TABULAR CLASSIFICATION.

Granites and related acid to intermediate intrusive rocks:—

- Normal granites;
  - Porphyritic granites;
  - Non-porphyritic granites;
- Hybrid granites;
- Soda granites;
- Tonalitic and dioritic porphyrites, granophyre;
- Gneissic granites;
- Injection gneisses.

Younger basic intrusives:—

- Gabbros;
- Dolerites;
- Norites;
- Epidiorites.

Greenstones:—

- Amphibolites derived from basic intrusives;
- Amphibolites derived from basic lavas;
- Ultrabasic rocks.

Metamorphosed sediments:—

- Predominantly arenaceous sediments;
  - Argillaceous sandstones;
  - Feldspathic sandstones;
- Predominantly argillaceous sediments.

GRANITES AND OTHER RELATED ACID TO INTERMEDIATE INTRUSIVE ROCKS.

Normal Granites.

Outcrops of granite cover one third of the area mapped. The granites are grouped into two types: the porphyritic granites and the non-porphyritic granites. The line of demarcation between the groups is indistinct.

Porphyritic Granites.—In hand specimen these rocks consist of phenocrysts of feldspar varying from ¼ inch by 1-8 inch to 1 inch by ½ inch, with a groundmass of coarse to medium grained biotite granite.

In thin section the phenocrysts can be determined as microcline and the groundmass as an aggregate of quartz and microcline in irregular plates with some orthoclase, a little brown biotite and few accessory minerals. Oligoclase is also present. Some specimens show a texture which indicates that the ground mass has moved around the phenocrysts. The phenocrysts show corrosion and occasionally zoning.

The outcrops of porphyritic granite occur as prominent bare hills. The prismatic feldspar phenocrysts are often aligned in parallel rows. At least 75 per cent. of the granite area is of this type.

Typical specimens are M10, M13, M14, M33, M35, M57, M93, M76.

Non-porphyritic Granite.—In hand specimen these granites present a holocrystalline, fine to medium grained appearance. More ferro-magnesian minerals can be seen than in the porphyritic granites. Their colour is grey or pink. In thin section the essential constituents are orthoclase, quartz, biotite, some oligoclase and microcline. Accessory minerals are abundant. Specimen M106 is a porphyritic granite having mineralogical and textural affinities with the non-porphyritic granites.

These granites occur as low rounded hills close to margins of greenstone and gneiss areas.

Typical specimens are M4, M106, M112, M130.

Hybrid Granites.—In hand specimen these rocks are hard to distinguish from the normal granites except that the ferro-magnesian minerals occur in clots instead of being uniformly distributed throughout the rock. The grain size varies from medium to coarse. Specimens M110 and M111 are porphyritic. The prevailing colours are pink and greenish grey. In thin section their common characteristic is the occurrence of clots of ferro-magnesian minerals not usually occurring in granites. Thus epidote, sphene, biotite and chlorite occur together. Specimen M88 contains the rare mineral orthite. The commonest feldspar is orthoclase. Quartz is less abundant than in the normal granite. The order of crystallisation seems to have been reversed. These rocks outcrop as patches in the normal granite. Their relations are usually obscured by soil. M12 is a hybrid rock at the contact between an epidiorite dyke and normal porphyritic granite.

Typical specimens are M12, M34, M88, M110, M111.

Soda Granites.

In hand specimen the appearance of the soda granites is similar to the normal coarse grained non-porphyritic granites. In thin section they are distingushed by the presence of albite and soda bearing ferro-magnesian minerals. The two specimens representing this group come from outcrops whose relation to the normal granite is obscured by soil.

Typical specimens are M60 and M127.

Tonalitic and Dioritic Porphyries, Granophyre.

In hand specimen this group presents a varying appearance. The tonalitic and dioritic porphyries are fine to medium grained, grey to green rocks. The presence of clots of a black mineral is a distinctive feature of the majority of the rocks. These clots resemble phenocrysts and occur regularly spaced throughout the body of the rock. The more basic members of the group lack this "pseudo-porphyritic" appearance. The clots are there but they are equigranular with the other constituents. Quartz and feldspar are always visible in the hand specimens.

In thin section the clots of black mineral are identified as brown hornblende, slightly uralitic, some clots having diopsidic cores. Dr. R. T. Prider is of the opinion that these clots represent small basic xenoliths. The matrix consists of plagioclase feldspar, quartz and brown green hornblende. The writer is of the opinion that the "clots" may represent phenocrysts of diopside altered to hornblende by a process similar to that which converts the pyroxene of a dolerite to the amphibole of an epidiorite or dolerite amphibolite.

The granophyre, represented by specimen M50, in hand specimen shows rounded "phenocrysts" of clear quartz and a dark fine grained ground mass. In thin section the rock is described by Dr. Prider thus: "the phenocrysts of quartz appear to be of xenolithic in character and are rimmed with amphibole. The groundmass is a granophyre consisting of a micrographic intergrowth of quartz and turbid untwinned feldspar.

The tonalitic and dioritic porphyries, though possibly not true porphyritic rocks, invariably occur as dykes in granite, gneiss, or greenstone. It was thought best to give them names indicating their hypabyssal origin.

Typical specimens of the tonalite porphyries are M30, M40, M42, M52.

Typical specimens of the diorite porphyries are M52, M128, M155.

Typical specimen of the granophyre is M50.

Gneissic Granites.

In hand specimen these rocks show only a rude foliation due to the orientation of biotite flakes and the longer feldspar crystals, or to bands rich in biotite. They are holocrystalline coarse grained rocks. Some show phenocrysts of feldspar and a consequent augen structure. Their colour is pink or grey.

In thin section the common characteristic is the presence of large irregular plates of orthoclase, quartz, and occasional large crystals of microcline. Interstitial to these large mineral fragments are small grains of quartz, orthoclase, microcline, oligoclase, and flakes of biotite. The interstitial material appears to have flowed around the larger grains. Some of the large

quartz and feldspar crystals show strain effects. One specimen, M39, shows crushed and bent feldspar crystals and is an augen gneiss.

These gneisses are thought to have been formed solely by movement in consolidated and partially consolidated granitic magmas.

Typical specimens are M8, M36, M39, M45, M59, M83, M85.

Injection Gneisses.

In hand specimen these rocks look similar to the fine grained gneissic granites. The injection gneisses appear richer in ferro-magnesian minerals. In this section the gneissosity is more strongly marked. All the biotite flakes are oriented in the one direction. The feldspar is commonly orthoclase. Quartz occurs in elongated grains. The ferro-magnesian minerals are green biotite and hornblende. Accessory sphene, epidote and apatite are abundant. The inter-relationship of the ferro-magnesians and accessory minerals suggest granitisation of a basic schist.

The field occurrence of the rocks gives confirmatory evidence of their origin from basic schists injected by a granitic magma. A suite of specimens collected by R. A. Hobson, show this granitisation process well. They are specimens M94 to M104 and have not been sectioned.

Typical specimens are M5, M6, M8, M94 to M104.

YOUNGER BASIC INTRUSIVES.

In hand specimen these basic rocks differ in appearance. They vary from fine to coarse grained. One specimen is porphyritic with a fine grained groundmass. The colour range is grey, purple grey, green, and black. All are holo-crystalline hard, tough, rocks with an even fracture.

In thin section the group can be subdivided by mineralogical and textural differences into gabbros, norites, dolerites and epidiorites.

Gabbros.

The rocks representing this group have the typical gabbroidal texture and are usually coarse grained. In some the pyroxene has been much uralitised but all contain recognisable remnants of pyroxene. Magnetite is plentiful in all specimens.

Typical specimens are M16, M44, M84, M154.

Dolerites.

All specimens included under this heading have a doleritic texture. Otherwise they are similar to the gabbros. Some are quartz dolerites. The uralitisation of the pyroxenes and the saussuritisation of the feldspars are almost completed in some specimens, but every specimen contains original pyroxene and remnants of plagioclase feldspar.

Typical specimens are M7, M54, M61, M63, M90, M114, M151.

Norites.

There are two specimens to represent this group, one an enstatite norite and the other a hypersthene norite. The enstatite norite consists entirely of enstatite, labradorite, and magnetite. The hyperstehene norite contains some augite and uralitic amphibole in addition to the hypersthene, labradorite, and magnetite.

Typical specimens are M31, M153.

Epidiorites.

This name is confined to those rocks showing a doleritic or gabbroidal texture in which the pyroxene has been entirely uralitised. Specimen M11 shows the uralite recrystallising to blue-green hornblende and contains comparatively fresh labradorite.

Typical specimens are M11 and M74.

Age of the Younger Basic Intrusives.

Some of these rocks are seen intruding granites and gneisses as dykes. The age of these rocks is definitely post-granite. Others of the group intrude the greenstones, and on petrological similarities are correlated with the post-granite dolerites. Some specimens are from rocks whose relation to granite or greenstone cannot be seen, and on petrological evidence only, are they correlated with the younger basic intrusives. Specimens of doubtful age are M16, M44, M54, M63.

GREENSTONES.

This comprehensive term is used to describe all basic and ultrabasic igneous rocks and metamorphic basic rocks of igneous origin other than those placed under the heading "Younger basic intrusives." The term "greenstone" as used in this report, implies no reference to their field occurrence.

Amphibolites Derived from Basic Intrusives.

In hand specimen all these rocks are black or green coloured, fine to medium grained and slightly schistose. In thin section they are seen to consist of hornblende, feldspar, and some quartz. Remnants of a gabbroidal texture or a coarsely granular texture exist. These relict textures indicate that the amphibolites are derived from basic intrusives. Their relation to other greenstones could not be seen on inspection in the field. Some rocks included under the younger basic intrusives may belong here.

Typical specimens are M49, M72, and M137.

Amphibolites Derived from Basic Lavas.

In hand specimen these rocks are similar to the basic intrusives except that some show variolitic and amygdaloidal structures. In thin section some consist of felted masses of actinolite, amphibolite and zoisitised feldspar. Others are composed of recrystallised hornblende and feldspar with the hornblende crystals oriented in the direction of schistosity.

Specimens showing variolitic and amygdaloidal structures are undoubtedly derived from lavas.

Typical specimens are M9, M17, M18, M43, and M79.

Specimens showing none of these structures are of doubtful laval origin. They are placed in this group because of their mineralogical constitution and degree of metamorphism. Some may be derived from fine grained basic intrusives.

Typical specimens are M47, M80, M89, M91, M126 and M131.

Ultrabasic Rocks.

In hand specimen the ultrabasic rocks are fine grained and grey-green in colour. They have a characteristic greasy feel. Thin sections show ragged fragments of tremolite and actinolite in a matrix of serpentine. Magnetite occurs in a mesh structure indicating serpentinised olivine. The rocks were probably peridotites.

Typical specimens are M105, M107 and M132.

METAMORPHOSED SEDIMENTS.

All metamorphic rocks of sedimentary origin are included in this group. Specimens show varying degrees of metamorphism. The kyanite quartzite, from the meta-sediments surrounding Tallering Peak, is the result of high grade regional metamorphism. A phyllite from the same area is obviously in a lower grade of metamorphism. This suggests that zones of metamorphism may exist within that area. Lack of detailed mapping precludes the establishment of zones, however. The garnetiferous quartzites from Mt. Narryer and an epidote-hornblende-diopside hornfels fom Mt. Dugel are the product of thermal metamorphism. The metamorphosed sediments are divided into two sections, the division depending on the original constitution of the sediment.

Predominantly Arenaceous Sediments.

These rocks vary greatly in appearance owing to the impurities in the sandstones from which they originated. The group may be subdivided into argillaceous and feldspathic sandstones.

Argillaceous Sandstones.—In hand specimen they are dark greenish or black, fine to medium grained banded rocks. Quartz constitutes half the rock. In thin section the light bands are seen to be rich in quartz and the dark bands rich in green to brown-green hornblende. Some specimens contain diopside and epidote, indicating lime in the original impure sandstone. All have been moderately metamorphosed.

Typical specimens are M46, M71, M72, M82, M86, and M134.

Feldspathic Sandstones.—In hand specimen these rocks are cream or bluish-white coloured, and medium to coarse grained. Some are banded, some massive. All show over 50 per cent. of quartz. In thin section the quartz appears as a fine grained recrystallised aggregate containing remnants of larger rounded quartz grains. Specimens M58, M135 must have been sandstones consisting of quartz and bauxite as they are now pure kyanite and sillimanite bearing quartzites. Two other specimens, M113 and M152, contain abundant muscovite. The quartz in M152 is shattered and shows strain shadows. The muscovite flakes are bent around the shattered quartz crystals, indicating purely dynamic metamorphism of the sandstone.

Typical specimens are M58, M113, M135 and M152.

Predominantly Argillaceous Sediments.

In hand specimen these rocks are fine to medium-grained and green-black to light brown in colour. Some are schistose and two are banded hornfels. In thin section they are seen to vary greatly in mineral composition due to the kind and degree of metamorphism more than to the original differences in constituents. Thus M55 and M56 are phyllites containing quartz and sericitic mica much contorted owing to mild regional metamorphism. M92 and M136 are hornblende schists with quartz and feldspar. These two may be granitised. M73 and M149 are banded diopside and epidote bearing hornblende hornfels. The original sediment carried a small proportion of lime. They have undergone a moderate degree of contact metamorphism.

Typical specimens are M55, M56, M73, M92, M136, and M149.

CONCLUSION.

The foregoing is a brief summary of the petrography of the various rocks collected during the 1946 field season. Little light can be thrown on the stratigraphical relationship, the age of the intrusives and the grades of metamorphism. The chief value of the examination was in confirming or modifying names given to rock types in the field.

Index to Geological Survey Annual Progress Report for 1946.

INDEX TO GEOLOGICAL SURVEY ANNUAL PROGRESS REPORT FOR 1946—*continued.*

INDEX TO GEOLOGICAL SURVEY ANNUAL PROGRESS REPORT FOR 1946—*continued.*

DIVISION V.

School of Mines, W.A.

The Under Secretary for Mines.

I submit, for the information of the Hon. Minister for Mines, my Annual Report for 1946.

1.—KALGOORLIE SCHOOL OF MINES.

Enrolments.

Tuition was given throughout the year to 587 individual students, some of whom did not complete the year's work. Class enrolments and individual enrolments were:—

	Class Enrolments.	Individual Enrolments.
First Term ..	1328	489
Second Term ..	1211	476
Third Term ..	901	483

Correspondence Course Enrolments:

Civilian	27
Service and Ex-Service	11

Commonwealth Reconstruction Trainees:

Full-Time	99
Part-Time	144

Fees for trainees under the Commonwealth Reconstruction Training Scheme have been paid by the Commonwealth Government. Books and equipment for trainees have also been provided under the scheme. Full-time trainees received living and travelling allowances throughout the year.

Class enrolments during 1946 constituted an all time record. The school also showed a record number of full-time students. In addition to the 99 trainees, there were 20 civilian full-time students.

Revenue:

	£	s.	d.
From fees	834	9	0
Outstanding (owed by Commonwealth, 3rd term fees ..	455	5	0
*Recoup of staff salaries ..	840	0	0
Total	£2,129	14	0

*This figure is only approximate. The Commonwealth Government agreed to recoup the salaries of two assistants, each of whom received a salary of £420 p.a.

Revenue does not include fees for correspondence classes or for metallurgical investigations.

Services to the General Public:

These included public assays, mineral determinations, advice to prospectors, and a special course of instruction in geology for prospectors and other interested parties.

Public Assays (for gold, and other metals)	483	(152 in 1945)
Mineral Determinations ..	56	(49 in 1945)

A special course of instruction in elementary geology was held at the School of Mines from 17th to 20th December. The course, which consisted of 8 hours lecture and 8 hours practical work, was attended by 54 prospectors. Of these, four were women who held prospecting areas. (Photographs showing various phases of the course are attached.)

Staff.

Dr. B. H. Moore retired at the end of 1945 academic year and Mr. R. W. Fletcher, B.Sc. (Hons.) was appointed Director of the School.

In March, Mr. E. H. Illidge, Lecturer in Charge of the Department of Mathematics and Physics, resigned from this position to accept a similar one with the Melbourne Technical College. His successor, Mr. J. D. Collister, M.Sc., A.F.I.A. (Aust.), commenced duty in June.

Mr. C. Cockram, A.W.A.S.M., was appointed Lecturer in Charge of the Department of Mining and Surveying in February but resigned in September to accept a field post in Malaya.

Mr. F. T. Lynn, B.Sc., and Mr. K. Middleton-White, B.Sc. (Eng) were appointed Assistants in Science and Engineering respectively in May, and on Mr. Lynn's resignation in July, Mr. R. C. Dowson was appointed Science Assistant.

Having reached the compulsory retiring age at the end of the academic year, Mr. H. C. Dod, Lecturer in Charge, Department of Chemistry, Assaying and Metallurgy retired from this position to make his home in Melbourne.

Mr. S. Edelman, who had acted as Lecturer in Charge, Department of Mathematics and Physics, during Mr. Illidge's absence was, during the year, appointed to a full lectureship in Mathematics.

Throughout the year the teaching staff gave excellent service under trying conditions. Large classes featured in every department and the task of each staff member was indeed a difficult one. The office staff, under the direction of Mr. G. M. Lumb, was at times heavily overburdened due to the administrative requirements of the Commonwealth Reconstruction Training Scheme.

That the office was capable of dealing efficiently and expeditiously with the large volume of work is a tribute to Mr. Lumb and the senior typist, Miss M. Maher.

To the cleaning staff of the school an additional female cleaner was appointed. This was necessary owing to the heavy increase in work brought about by the continual use of every classroom and laboratory for three sessions daily.

Under the direction of Mr. R. W. Wilson, the Metallurgical Staff rendered excellent service throughout the year, and on many occasions members of the staff returned at nights and over week-ends to safeguard critical experiments.

Correspondence Courses.

Rapid demobilisation resulted in a drastic reduction of service personnel taking correspondence courses. With a wide variety of full-time and part-time courses offering on professional and vocational lines, it was only natural to find fewer people taking correspondence courses.

Figures for 1946 and, in brackets, 1945, are:—

	Service and Ex-Service	Civilian
Mining I ..	3 (34)	13 (6)
Mining II ..	– (1)	3 (1)
Metallurgy I ..	5 (23)	1 (0)
Assaying I ..	1 (2)	5 (2)
Ore Dressing ..	2 (10)	5 (6)
Totals ..	11 (70)	27 (15)

Buildings.

Work was commenced in March on the interior and exterior painting of the School. For lengthy periods during the year work was suspended owing to shortage of materials. It is probable that the work will not be completed before the middle of 1947.

By arrangement with the Commonwealth Government, through the Deputy Director of Industrial Training, two of the laboratory-type buildings at the R.A.A.F. aerodrome, Boulder, have been allotted to the School of Mines for extra class rooms and laboratories. These buildings will be suitably modified at Commonwealth expense under the Commonwealth Reconstruction Training Scheme. One building will be utilised by the Geology Department and the other by the Chemistry Department.

Academic.

During the year a Mines Excursion Committee was formed to co-ordinate visits to mines of students in mining, metallurgy, engineering and geology. The committee consisted of representatives of the various mines in the district and members of the school staff. A programme of visits was drawn up for each term and was rigidly adhered to. Under this new system certain days are set aside for the visits, classes are split into numerous parties of five or six men, and each mine takes one or two parties and provides a competent instructor for each party. Thus eight or nine parties would visit the various mines on the same day, and by prior arrangement through the lecturer in charge of the particular course, each mine would be provided with a statement setting out the items of interest which should be pointed out to students so that they may dovetail their theoretical knowledge gained during the term, with practical observation.

Similar visits were carried out to various industrial concerns such as the Power Corporation, Kalgoorlie Foundry, Kalgoorlie Brewery (new refrigeration chambers), Hodgson & Cranston (demonstration of rock drilling machines).

During the year the old syllabus was very critically examined and it was unanimously decided by the senior teaching staff that a new syllabus be drawn up. Various changes have thus been made to all certificate and diploma courses; new subjects have been introduced and some old subjects have been omitted or included, wholly or in part, in new subjects. The new syllabus will come into operation in 1947.

The conditions of award of the various scholarships are considered to be very unsatisfactory and it is intended in 1947 to request donors to revise these conditions. For a considerable time now the School has consisted almost entirely of part-time students but the heavy influx of full-time trainees necessitates changes in the terms and conditions of scholarship awards. Furthermore, new scholarships have been gradually introduced and it is necessary to ensure that all students of the school, whether part- or full-time, and irrespective of what course is being pursued, should have equal chances of gaining a scholarship.

Advisory Committee.

For the greater part of the year the Chamber of Mines representative, Mr. J. E. Manners, was abroad and his place was taken by Mr. E. B. Mundle. Mr. W. R. Matthews, the Australian Workers' Union representative, was unable to attend more than one or two meetings, and at the end of the year he tendered his resignation So far his successor has not been appointed.

Mr. G. M. Lumb continued throughout the year as secretary of the committee and carried out his duties in an able manner.

The advisory committee showed a very keen interest in the school and, as the new Director, I take this opportunity of thanking the members for the great assistance rendered to the school and also for the support given to me personally.

Diplomas and Certificates.

The following were issued during the year:—

Diplomas, 7.
Mine Surveyor's Certificates, 3.
Industrial Chemist's Certificates, 1.
Assayer's Certificates, 1.
Geologist's Certificates, 2.

Metallurgical Laboratory.

The work in the metallurgical laboratory during the past year consisted chiefly of routine ore-dressing investigations. Twenty-one investigations were carried out mainly on gold ores. Non-gold bearing materials investigated included vermiculite, copper carbonates, and clays. Reports on the investigations were issued to those concerned.

The chemistry and assaying departments of the laboratory dealt with 947 gold assays, 259 chemical tests and 68 screen analyses during the course of the year.

Gold-bearing materials on which investigations were carried out consisted of sand and slime dumps, oxidised ores and sulphide ores. Particular interest has been shown in some of the large residue dumps scattered throughout the State, such as those of the Great Eastern G.M. at Lawlers, the Cosmopolitan at Kookynie, and the Great Fingal at Day Dawn, and the laboratory was called upon to conduct several lengthy investigations on samples from such dumps.

Of the sulphide ore investigations the most important were those carried out for The Three Boys G.M., Southern Cross; Evanston Gold N.L., at Evanston; and Consolidated Gold Areas, Hampton Plains. A copper-gold ore from the Paris Group was also investigated.

Apart from actual investigations, the staff of the laboratory gave considerable assistance to small operators. Advice was given freely and mineral determinations and chemical tests were carried out on waters and ore bearing materials whenever necessary. Many prospectors and small mine owners write in fairly often for advice as to the installation and operation of small scale treatment plants. Enquiries were received from all parts of the State including Hall's Creek.

The laboratory is limited in staff, building space and equipment and at present can barely keep pace with the work submitted. Research work is absolutely out of the question as all staff members are forced to de-

vote the whole of their time to routine ore-dressing investigations. In this direction the staff is doing excellent work.

General.

The future of the School is particularly bright. As the only mining institution in Western Australia, the school is playing a prominent part in the Commonwealth Reconstruction Training Scheme. Full and part time trainees in large numbers are at present taking our courses and it is anticipated that next year will see a record number of full-time students attending the school.

Additional staff will be essential in 1947 and new apparatus and equipment will be required to supplement existing stocks and to replace obsolete items. For the next few years difficulty will probably be experienced in re-equipping the School. Delivery of instruments at present cannot be effected under 12 to 18 months. However, with the gradual addition of equipment and apparatus the School should be able to re-equip completely within five years.

SCHOOL OF MINES OF W.A.

Class Enrolments—1946.

Subject.	1st term.	2nd term.	3rd term.
Elementary Mathematics ...	61	43	29
Preparatory Chemistry	98	99	81
Preparatory Physics	85	91	58
Preparatory Drawing	68	71	58
Preparatory Mathematics ...	99	96	79
Preparatory Geology	63	68	59
Mathematics I.	92	67	56
Applied Mathematics	42	34	26
Mathematics II.	18	19	16
Physics I	50	47	43
Chemistry I.	35	34	28
Engineering Chemistry I. ...	25	20	18
Engineering Chemistry II. ...	4	3	3
Assaying I.	29	26	27
Assaying II.	6	6	6
Metallurgy I.	16	16	16
Metalurgy II.	10	9	8
Geology	18	14	14
Mining and Economic Geology ...	7	6	6
Mineralogy	30	27	27
Petrology	18	18	18
Mining I.	36	35	29
Mining II.	6	7	7
Ore Dressing	25	26	23
Surveying I.	20	17	15
Surveying II.	8	8	6
Mechanical Drawing I.	60	52	48
Mechanical Drawing II.	36	33	27
Applied Mechanics	17	17	15
Mechanical Engineering I. ...	33	34	29
Mechanical Engineering II. ...	2	2	2
Internal Combustion Engines ...	47	29	23
Building Construction	21	20	16
Machine Design	7	9	9
Electrical Engineering I. ...	19	13	12
Electrical Engineering II. ...	5	5	5
Engine Driving I.	21	23	16
Engine Driving II.	9	11	9
Workshop Practice I.	52	36	28
Workshop Practice II.	30	20	16
Total Class Enrolments, 1946	1,328	1,211	901
Total Class Enrolments, 1945	754	618	522
Individual Students, 1946	489	476	483
Individual Students, 1945	349	372	367

2.—WILUNA SCHOOL OF MINES.

The enrolments for 1946 were:—

	Individual Enrolments.	Class Enrolments.
First Term	24	41
Second Term	20	29
Third Term	19	28

The above figures were approximately half the figures shown for 1945.

Classes were conducted in Elementary Mathematics, Preparatory Mathematics, Mathematics I., Preparatory Drawing, Mechanical Drawing I., Mechanical Drawing II., and Workshop Practice I.

Fees collected during the year amounted to £14 12s. 6d.

Difficulty was experienced in obtaining suitable part-time staff and some classes, for which there was a demand, had to be abandoned early owing to the lack of an instructor.

To the part-time staff, members of the Advisory Committee, and the various Mining Registrars who combined their normal duties with those of Registrar of the School, I tender my thanks for the loyal support given to me throughout the year and for the interest taken in keeping the school going under difficult circumstances.

The population of Wiluna has now dropped to an extraordinary low level and it will not be possible to continue this branch school in 1947.

3.—NORSEMAN SCHOOL OF MINES.

The enrolments for 1946 were:—

	Individual Enrolments.	Class Enrolments.
First Term	70	118
Second Term	67	104
Third Term	58	87

Revenue from fees totalled £26 12s.

Many of the students in attendance were youths under 21 years of age—hence the low revenue.

Classes were held in Elementary Mathematics, Preparatory Mathematics, Mathematics I., Applied Mathematics, Applied Mechanics, Preparatory Chemistry, Chemistry I., Assaying I., Preparatory Physics, Practical Electricity, Internal Combustion Engines, Workshop Practice I., Workshop Practice II., Surveying I., Mining I., Geology I., Preparatory Drawing, Mechanical Drawing I., Mechanical Drawing II.

This school is now fairly stable and is not likely to show any appreciable drop in enrolments over the next few years. A full time instructor will be necessary in 1947 to conduct classwork in some of the practical subjects and to act as a liaison officer between the Norseman part-time staff and the full-time staff of the Kalgoorlie School.

Members of the Advisory Committee and the various part-time lecturers displayed exceptional interest in the running of the school during 1946, and on behalf of the Mines Department I express my appreciation of the excellent service given.

The Acting Mining Registrar, Mr. L. S. Macfarlane proved a very able Registrar of the School and carried out his duties efficiently and tactfully.

The mines managements and townspeople of Norseman are to be commended on the stand they have taken towards technical education. The Mines Department should make every effort to keep the Norseman branch school in operation and to provide extra classes in the higher grades for promising students who are nearing the completion of diplomas or certificates.

R. W. FLETCHER,

Director, School of Mines.

SCHOOL OF MINES OF W.A.

ANNUAL EXAMINATIONS, 1946.

PASS LIST.

(T) denotes Terminal Pass Only.

Names are in order of merit.

* Denotes equal.

ELEMENTARY MATHEMATICS.

Arithmetic Section.

Credit—
Smith, H. A.
Edwards, N. A.*
Walker, H. R. C.*
Webb, H. J.
Chester, H. H.
Timoney, E. G.
Sommers, J. L.
Todman, A. G. A.
Hosie, A.*
Corbett, T. J.*
Higgs, J. W.
Doogue, T.

Pass—
Biltoft, E. M.
Smith, E. H.
Armstrong, M.
Irving, J. L.
Barns, A. H.
MacGregor, D. M.*
Rhodes, D. J.*
Murray, D. C.*
Thomas, R. G.*
Brown, S. D.
Bosenberg, M.
Ward, H.
Mariotti, J.
Sommer, R.

Algebra Section.

Credit—
Ikin, B.
Dunlop, R.
Sommers, J. L.
Stanley, G.*
Webb, H. J.*
Edwards, N. A.
Eade, S. W.
Biltoft, E. M.
Higgs, J. W.
Hosie, A.
Brown, S. D.
Corbett, T. J.

Pass—
Wittmer, J. A.
Murray, D. C.
MacGregor, D. M.
Murphy, H. W.
Smith, H. A.
Lavars, H. L.
Timoney, E. G.
Armstrong, M.
Irving, J. L.
Smith, E. H.
Long, S. E.

Geometry Section.

Credit—
Webb, H. J.
Dunlop, R.
Hosie, A.
Stanley, G.
Timoney, E. G.
Eade, S. W.

Pass—
Higgs, J. W.
Murray, D. C.
Biltoft, E. M.
Murphy, H. W.
Smith, H. A.
Smith, E. H.
Brown, S. D.
Barns, A. H.

PREPARATORY MATHEMATICS

Algebra Section.

Credit—
Baster, L. R.
Zehnder, J. W.
Young, J. G. W.
Skerry, T. F.
Casserley, F. A.
Kanther, H. I.
Turrell, R. M.
McCleary, J.

Pass—
Firns, R. G. L.
Morris, L. W.
Stanley, G.
Moriarty, C. J.
Todman, A. G. A.
Amm, R. A.
Callow, R. D.
Rasmussen, G. P.*
Barclay, V.*
Annear, E. J.*
Harper, D. G.
Madin, R. J.
Mountstephen, A. V.*
Toms, H. E.*
Gillson, R. S.*
Dorrington, N.*
Read, C.*
Litton, E. A. B.*
Dellar, R.
Knight, L. B.*
Harvey, J. J.*
Thomas, A. V.*
Annear, J. L. *
Chester, H. H.*
Clark, A. M.*
Harlond, B. C.*
Woods, J. A.*
Bell, B. W. A.*
Edgar, K. R.*
Holtzman, V. R.
Stronach, B. J.
Rainsford, G. H.*
McMahon, J. P.*

Geometry Section

Credit—
Skerry, T. F.*
Zehnder, J. W.*
Young, J. G. W.
Chester, H. H.

Pass—
Gittos, A. J.
Kanther, H. I.
Baster, L. R.
Webb, H. J.
Annear, J. L.
Griffiths, I. N.
Whitton, W. R.*
Morris, L. W.*
Harper, D. G.
Barclay, V.*
Fraser, H. S.*
Harlond, B. C.*
Todman, A. G. A.
Edwards, N. A.
Knight, L. B.
Kelly, D. H.
Vukobratich, S.*
Harvey, J. J.*
Turrell, R. M.
McCleery, J.
Edgar, K. R.*
Brennan, Miss R. C.*
McMahon, J. P.*
Mathews, W. A.*
Toms, H. E.*
Rhodes, D. J.*
Thomas, A. V.*
Firns, R. G. L.*
Callow, R. D.*
Clark, A. M.*
Casserly, F. A.*
Holtzman, V. R.*
Low, W. H.*
McGlashan, G.*

Trigonometry Section.

Credit—
Young, J. G. W.*
Gittos, A. J.*
Baster, L. R.
Skerry, T. F.*
Kanther, H. I.*
Knight, L. B.
McCleery, J.*
Newton, R. J.*
Kelly, D. H.*
Holtzman, V. R.
Zehnder, J. W.
Rhodes, D. J.
Webb, H. J.
Moriarty, C. J.*
Harvey, J. J.*
Callow, R. D.
Harper, D. G.*
Casserley, F. A.*
Mathews, W. A.*
Barclay, V.*

Pass—
Chester, H. H.
Thomas, A. V.*
Edwards, N. A.*
Stanley, G.*
Griffiths, I. N.*
McEwan, V. H.*
Amm, R. A.*
Toms, H. E.*
Edgar, K. R.*
McGlashan, G.
Firns, R. G. L.*
Taylor, S. R.*
Turrell, R. M.*
Clark, A. M.*
Gillson, R. S.*
Whitton, W. R.*
Vukobratich, S.*
Harlond, B. C.*
Fraser, H. S.*
Morris, L. W.
Low, W. H.
Delaney, R.

PREPARATORY CHEMISTRY.

Credit—
Zehnder, J. W.
Knight, L. B.*
Hastings, R. W.*
Skerry, T. F.*
Mathews, W. A.*
McCarthy, M. G.*
Kanther, H. I.*
Manners, J. E.*
Barclay, V.
Abotomey, J.*
Ibbotson, A. W.*
Newton, R. J.*
Harvey, J. J.*
Chester, H. H.*
Forster, E. T.*
Harper, D. G.
Morris, L. W.

Pass—
Sarrell, R. G.
Rhodes, D. J.
Lloyd, J. K. N.*
Griffiths, I. N.*
Baster, L. R.*
Callow, R. D.*
Gillson, R. S.*
Gittos, A. J.*
McDonald, T. G.*
Turrell, R. M.*
Martin, D. J.
McCleery, J.*
Edwards, N. A.*
Firns, R. G. L.
Moriarty, C. J.*
Toms, H. E.*
McGlashan, G.*
Doran, R. R. *
Webb, H. J.*
Edgar, K. R.*
Vukobratich, S.
Brown, S. D.
Rocchi, Miss Y. P.*
Thomas, A. V.*
Manners, M. D. L.*
Pegler, A. V.*
Poole, R. H.*
Howard, G.*
Hudson, H. R.*
Whitton, W. R.*
Fariss, T. W. L.
Carter, K. J.
Clark, A. M.

Pass in Theory Only.

Delaney, R.

PREPARATORY PHYSICS.

Credit: —
Skerry, T. F.*
Kanther, H. I.*
Gittos, A. J.
Zehnder, J. W.
Holtzman, V. R.*
Kelly, D. (T)*
Mathews, W. A.*
Newton, R. J.*
Barclay, V.
Firns, R. G. L.*
McCleery, J.*
Chester, H. H.*
Carter, K. J.*
Thomas, A. V.*
Casserley, F. A.*
Harper, D. G.*
McDonald, T. G.*
Harvey, J. J.
Turrell, R. M.

Pass—
Callow, R. D.*
Edgar, K. R.*
Edwards, N. A.*
Knight, L. B.*
Rhodes, D. J.*
Toms, H. E.*
Baster, L. R.*
Griffiths, I. N.*
Fariss, T. W. L.
Braithwaite, A.*
Low, W. H.*
Fraser, H. S.*
Webb, H. J.*
Moriarty, C. J.
McGlashan, G.*
Whitton, W. R.*
Metcher, I. S.
Clark, A. M.
Rocchi, Miss Y. P.
Stanley, G.
Amm, R. A.
Woods, J. A.*
McMahon, J. P.*
Morris, L. W.*
Vukobratich, S.*
Howard, G. L. (T)
Higgs, J. W.
Duthie, W. H.
Harlond, B. C.

PREPARATORY GEOLOGY.

Credit—
Coldwell, V. G.

Pass—
Baster, L. R.
Barclay, V.
Gittos, A. J.
Knight, L. B.*
Sarrell, R. G.*
Morris, L. W.*
Burrows, H. L.*
Manners, J. E. L.
Turrell, R. M.
Young, J. G. W.*
Edwards, N. A.*
Gordon, A. H.*
Kingsbury, C. J.*
Myers, E. O.*
Moriarty, C. J.*
Considine, D. C.*
Dunlop, R.*
Hille, W. C.*
Zehnder, J. L.*
Ibbotson, A. W.
Watson, F. G.
Green, E. J.
Rocchi, Miss Y. P. (T)*
Harvey, J. J.*
Webb, H. J.*
Garratt, N.*
Firns, R. G. L.*
Mathews, W. A.*
Griffiths, I. N.*
McCleery, J.*
Manners, M. D.*
McGlashan, G.*
Conway, J. S.*
Callow, R. D.*
Harper, D. G.*
Rhodes, D. J.*

PREPARATORY MECHANICAL DRAWING.

Credit—
Zehnder, J. W.
Mathews, W. A.*
Thomas, A. V.*
Ewing, D. A.
Smith, H. A.*
Lugg, R.*
Gislingham, L. G. (T)
Brown, S. D.
Vukobratich, S.*
McCleery, J.*
Edwards, N. A.
Walker, H. R.*
Stanley, G.*
Harvey, J. J.*
Kanther, H. I.*
Skerry, T. F.
Holtzman, V. R.*
Moriarty, C. J.*
Young, J. J.*
Baster, L. R.*
Barclay, V.*
Newton, R. J.*
Low, W. H.*
Poole, R. H.*
Abotomey, J.*
Rhodes, D. J.*
Kelly, D. H.*
Carter, K. J.*
Firns, R. G. L.*
McMahon, J. P.*
Biltoft, E. M.*
Webb, H. J.*

Pass—
McKenzie, G. F.*
Clark, A. M.*
Rocchi, Miss Y. P.*
Amm, R. A.*
Cecil, R. C. (T)*
Morris, L. W.*
McGlashan, G.*
Whitton, W. R.*
Kingsbury, C. J.*
Turrell, R. M.*
Murphy, H. W. (T)*

Selleck, G. R.*
Griffiths, I N.*
Callow, R. D.
Dunlop, R.
Timoney, E. G.
Murray, D. C. (T)
Harlond, B. C.
Murray, C. A. (T)
Marshall, R.*
Edgar, G. S.*
Hosie, A.
Isle, R. F.
Martin, H. R.*
McCarthy, M. G.*
Irving, J. L. (T)*
Jones, A. D.*

MATHEMATICS I.

Algebra Section.

Credit—
Wells, T.
Tasker, E.

Pass—
Ibbotson, A. W.
Cole, H. E.
Smith, B. R.
Edgar, G. S.
Hille, W. C.
Crogan, T. P.
Gibson, A. A.
Wood, J. A.
Huxtable, D. A.
Doran, R. R.
Garrett, N.*
Collin, A.*
Rocchi, Miss Y. P.*
Jamieson, P. H.*
Sarrell, R. G.*
Evans, R. E. *
Martin, D. J.*
Donald, D. T.

Geometry Section.

Credit—
Abotomey, J.
Holland, A. J.
Wells, T.

Pass—
Doran, R. R.*
Collin, A.*
Donald, D. T.
Bonner, M. H.
Hille, W. C.
Martin, D. H.
Long, B. W.
Rocchi, Miss Y. P.
Sarell, R. G.
Franklyn, R. P.
Edgar, G. S.*
Ibbotson, A. W.*
Melville, R. J. *
Smith, B. R.
Bradshaw, J. R.*
Gibson, A. A.*
Martin, D. J.*
Lazberger, A.*
Jamieson, P. H. *
Livingstone, J.*

Trigonometry Section.

Credit—
Wells, T.
Smith, B. R.
Jamieson, P. H.
Long, B. W.
Hille, W. C.
Franklyn, R. P.
Abotomey, J.
Collin, A. *
Ibbotson, A. W. *
Sarell, R. G.

Pass—
Martin, D. J.
Edgar, G. S.
Gibson, A. A. *
Gray, F. E. *
Donald, D. T.*
Cole, H. E.
Bradshaw, J. R.
Doran, R. R. H.*
Power, F. W. G.*
Lazberger, A.
Rocchi, Miss Y. P.
Kelly, K. W.
Pegler, A. V.*
McCarthy, M. G.*
Hogg, J. M.

MATHEMATICS II.

Credit—
Redmond, L. H.
Burrows, H. L.
Martin, J. D.

Pass—
Redmond, G. J.
Inman, R. D.
Laffer, G.
Gordon, A. H.
Fowler, R. W.*
Green, E. J.*
Erbe, J. W.
Edlington, W. B.
Carew-Reid, D. M.

APPLIED MATHEMATICS

Credit—
Tasker, E.

Pass—
Inman, R. D.
Inman, E. G.*
Hille, W. C.*
Griffin, A. F.
Brodie-Hall, L. C.
Martin, J. D.*
Paterson, J. R.*
Green, E. J.
Hay, W. I. (T)
Wells, T.
Smith, B. R.*
Braham, P. G.*
Hair, K. R.*
Way, I. E.
Martin, D. H.
Crowley, P. J.
Huxtable, D. A.*
Olive, L. C.*
Sarell, R. G. (T)*

PHYSICS I.

Credit—
Griffin, A. F.
Young, J. G. W.
Wells, T.*
Bradshaw, J. R.*
Smith, B. R.
Franklyn, R. P.
Collin, A.
Martin, D. H.
Lloyd, J. K. N.

Pass—
Ibbotson, A. W.
Hille, W. C.
Hogg, J. M.
Martin, D. J.
Clayton, J. L.*
Gibson, A. A.*
Forster, E. T.
Abotomey, J. (T)*
Edgar, G. S.*
Doran, R. R. (T)*
Long, B. W.*
Gillson, R. S.
Pegler, A. V.*
Fowler, R. W.*
Gray, F. E.
Poole, R. H.
Gardner, J. A.
Canning, D. G.*
Holland, A. J.*
Shaw, S. C.*
Kelly, K. W.
Lazberger, A.*
Taylor, S. R.*
Warren, R. E.*

CHEMISTRY I.

Credit—
Wells, T.
Quadrio, J. E.
Sweet, F. B.
Edgar, G. S.*
Rasmussen, L. A.*
Burrows, H. L.
Bradshaw, J. R.
Collin, A.*
Griffin, A. F.*

Pass—
Way, I. E.
Kingsbury, C. J.*
Bonner, M. H.*
Donald, D. T.
Smith, B. R.
Thomas, R. P.*
Thomson, A. W.*
Fisher, E. W.
Myers, E. O.
Brennan, Miss R. C.
Hay, W. I. (T)
Bell, B. W.
Gray, F. E.
Gibson, A. A.
Holland, A. J.

ASSAYING I.

Credit—
Ewing, D. A.
Lynn, F. T.
Nairn, F. B. (T)
Considine, D. C.
Hamilton, F. G.
Donald, D. T.
Wells, T.
Quadrio, J. S.
Sweet, F. B.
Gordon, A. H.
Cackett, W. S.
Collin, A.
Myers, E. O.

Pass—
Middleton-White, K.*
Burrows, H. L.*
Long, B. W.
Knight, L. B.
Watson, F. G.
Shaw, S. C.
Franklyn, R. P.
Green, E. J.
Conway, J. S.
Hooker, L. C.
Gray, F. E.

ASSAYING II.

Credit—
Hughes, E. E.

Pass—
Hickey, L.

ENGINEERING CHEMISTRY I.

Credit—
Mead, G. F.
Wilson, R. G.*
Considine, D. C.*
Dowson, R. C.

Pass—
Quartermaine, M. K.*
Redmond, G. J.*
Dunstan, H. R.
Redmond, L. H.
Inman, E. G.
Gordon, A. H.
Crowley, P. J.
Forward, H. G.
Cecil, R. C.
Hickey, L.

Pass in Practical only—
Carew-Reid, D. M.
Fennell, W.
Olive, L. C.

ENGINEERING CHEMISTRY II.

Credit—
Martin, J. D.

Pass
Hughes, E. E.
Brodie-Hall, L. C.

METALLURGY I.

Credit
Lynn, F. T.*
Nairn, F. B. (T)*
Ewing, D. A.
Wilson, R. G.*
Bradley, S. W. (T)*
Long, B. W.
Casserly, F. A.
Griffin, A. F.*
Middleton-White, K. C.*

Pass
Young, J. G. W.*
Watson, G. F.*
Shaw, S. C.
Gray, F. E.
Wills, W. E.
Hearne, K.

METALLURGY II.

(Provisional pending Theses.)

Credit—
Watson, A.*
Brodie-Hall, L. C.*
Chilvers, J. E.
Nairn, F. B. (T)
Martin, J. D.
Hughes, E. E.

Pass—
Greenhill, W.

Thesis accepted—
Meharry, C.

GEOLOGY I.

Pass—
Brodie-Hall, L. C.
Ewing, D. A.
Chilvers, J. E.
Collin, A.
Edgar, G. S.
Donald, D. T.
Gibson, A. A.
Pegler, A. V.
Christopher, L. F.
Carew-Reid, D. M.
Canning, D. G.

MINERALOGY

Credit—
Brodie-Hall, L. C.

Pass—
Walton, A. H.
Mitchell, J. A.
Wilson, R. G.
Way, I. E.
Edgar, G. S.
Taylor, R. J.
Collin, A.
Canning, D. G.
Power, F. W. G.
Donald, D. T.
Gibson, A. A.
Crowley, P. J.
Huxtable, D. A.
Carew-Reid, D. M.
Pegler, A. V.

PETROLOGY

Credit—
Brodie-Hall, L. C.
Matheson, W. R.
Chilvers, J. E.*
Ewing, D. A.*

Pass—
Haddow, J.
Way, I. E.
Griffin, A. F.
Martin, J. D.
Lee, G. S.
Redmond, L. H.
Taylor, R. J. (T)
Fowler, F. K.
Redmond, G. J.
Airey, J. A.*
Miles, H. G. K.*
Ryder, K. N.
Cackett, W. S.
Paterson, J. R.

MINING AND ECONOMIC GEOLOGY

(Provisional pending Theses.)

Credit—
Quartermaine, M. K.

Pass—
Taylor, R. J.
Matheson, W. R.
Bonner, M. H.
Lee, G. S.
Paterson, J. R.
Cackett, W. S.

Theses accepted—
Moore, M. A.
Ibbotson, G. R.

MINING I.

Pass—
Considine, D. C.
Pepper, R. S.*
Collin, A.*
Hogg, J. M.*
Middleton-White, K. C.*
Edlington, W. B.
Burrows, H. L.
Inman, R. D.*
Woodham, H. P. .B.*
Myers, E. O.*
Poole, R. H.*
Lloyd, J. K. N.
Gillson, R. S.*
Baster, L. R.*
Hille, W. C.*
Harper, D. G.*
Bonner, M. H.*
Lord, J. H.
Stodart, J. W.*
Turrell, R. M.*
Stronach, B. J.*
Green, K. C. B.*
Warne, R.*
Davidson, R. E.
Turner, K. R.
Armstrong, M.
Watson, F. G. (T)*
Melville, R.*
Thomas, R. G.*
Huxtable, D. A.
McQuilten, R.
Smith, P. P.

MINING II.

Credit—
Power, F. W. G.
Mitchell, J. A.

Pass—
Braham, P. G.
Matheson, W. R.
Hosie, A.*
Coldwell, V.*
Christopher, L. F.

ORE DRESSING

Credit—
Nairn, F. B. (T)
Lynn, F. T.
Ewing, D. A.
Wilson, R. G.*
Hamilton, F. G.*
Power, F. W. G.*
Coldwell, V. (T)
Cackett, W. S.*
Fisher, E. W.*
Carew-Reid, D. M.*

Pass—
Middleton-White, K. C.*
Long, B. W.*
Ryder, K. N.
Bradley, S. W.
Young, J. J.
Hosie, A.
Fennell, W.
Dowson, R. C.
Gray, F. E.
Crowley, P. J.
Watson, F. G.

SURVEYING I.

Credit—
Burrows, H. L.
Considine, D. C.
Collin, A.
Inman, R. D.
Lloyd, J. K. N.
Fisher, E. W.
Edlington, W. B.
Thomson, A. W.
Pepper, R. S.

Pass—
Crowley, P. J.
Myers, E. O.
Anderson, J. B.
Gillson, R. S.
Stronach, B. J.
Melville, R. J.
Slee, A. P.
Solomon, B. (T)

SURVEYING II.
(Provisional pending Plan)

Credit—
Lord, J. H.
Huxtable, D. A.
Power, F. W. G.

Pass—
Faichney, J. M.
Matheson, W. R.
Christopher, L. F.

Plans accepted—
Peek, K.
Boyd, J. P.
Paterson, J. R.

MECHANICAL DRAWING I.

Credit—
Wells, T.
Martin, J. D.*
Lazberger, A.*
Smith, B. R.*
Forster, E. T.*
Manners, J. E.
Edgar, K. R.*
Martin, J. D.*
Gittos, A. J.
Holland, A. J.
Clayton, J. L. (T)

Pass—
Lynn, F. T.
Sarell, R. G.
Young, J. G. W.*
Fariss, T. W. L.*
Webb, H. J.*
Reid, B.*
Quan, L.*
Toms, H. E.*
Hay, W. I.*
Lloyd, J. K. N.*
Gillson, R. S.
Green, E. J.*
Fennell, W. (T)*
Smith, H. A.*
Braithwaite, A.*
Franklyn, R. P.
Anderson, J. B.
McDonald, T. G. P. (T)
Green, K. C. B.
Dowson, R. C.*
Greenway, J.*
Harper, D. G.
Kelly, K. W.
Brennan, Miss R. C.
Gray, F. E.

MECHANICAL DRAWING II.

Credit—
Hastings, R. W.
Chilvers, J. E. (T)
Lazberger, A.
Martin, D. J.
Boyd, J. P.
Inman, R. D.*
Crowley, P. J.*
Hamilton, F. G.
Paterson, J. R.
Power, F. W. G.*
Sweet, F. B.*
Wilson, R. G.*
Ibbotson, A. W.*
Redmond, L. H.*
Armstrong, L. H.*
Redmond, G. J.*
Watson, F. G.*

Pass—
Fowler, R. W. (T)*
Pegler, A. V.*
Jamieson, P. H. (T)
Way, I. E.
Beck, A. J.
Miles, H. G. K.
Considine, D. C.
Henderson, D. C.
Hudson, H. R.
Lambert, K. C.
Edlington, W. B.

APPLIED MECHANICS

Credit—
Hastings, R. W.
Hair, K. R.
Mitchell, J.
Rasmussen, L. A.
Wilson, R. G.

Pass—
Considine, D. C.
Sweet, F. B.
Erbe, J. W.
Redmond, G. J.
Redmond, L. H.
Braham, P. G.
James-Wallace, W.
Green, E. J.
Olive, L. C.

BUILDING CONSTRUCTION

Credit—
Hastings, R. W.
Rasmussen, L.
Mitchell, J.
Martin, D. J.
Brodie-Hall, L. C.
Wilson, R. G.

Pass—
Forster, E. T.
Morris, L. W.*
Davis, F. A.*
Airey, J. A.
Miles, H. G. K.*
Lambert, K. C.*
Ryder, K. N.
Cain, J. M.
Hunt, C. A. S.
James-Wallace, W.

WORKSHOP PRACTICE I.

Credit—
Edgar, K. R.
Newton, R. J.
Rasmussen, L. A.
Marshall, R.
Fariss, T. W. L.
Holland, A. J.
Hay, W. I.
Medlen, F.

Pass—
Dellar, R. (T)
Madin, R. J.
Moore, R.
Clark, J.
Irving, J. S.
Wood, A. (T)
LeCras, P. A. (T)
Mitchell, K. R.

Pass in theory only—
Cadiolo, R.
Sommers, J. L.

Pass in practical only—
Elliot, L.*
Lawson, G. C.*
Beilken, C.*
Leslie, W.

WORKSHOP PRACTICE II.

Credit—
Watson, F. G. (T)
Watson, A. (T)
Skerry, T. F.
Thomas, A. V.
Smith B. R.
Braithwaite, A.
Lugg, R.
Clark, A. M.

Pass—
James-Wallace, W. (T)
Wood, H. C.
Harloud, B. C.
Annear, R. J.

Pass in theory only—
Cadiolo, R. D.

Pass in practical only—
Johnson, S. W.

MECHANICAL ENGINEERING I.

Credit—
Hastings, R. W.
Tasker, E.
Collister, J. D.*
Young, J. G. W.*
Brodie-Hall, L. C.*
Mitchell, J.*
Redmond, L. H.*
Lynn, F. T.*
Martin, D. J.*
Redmond, G. J.*
Griffin, A. F.*
Chilvers, J. E.
Rasmussen, L. A.
Crowley, P. J.*
Hamilton, F. G.*
Dowson, R. C.*
Forster, E. T.*
Cole, H. E.
Ibbotson, A. W.*
Way, I. E.*
Ryder, K. N.*
Duthie, W. H.*
Airey, J. A.*

Pass—
Braithwaite, A.*
Lambert, K. C.*
Cain, J. M.
Sweet, F. B.
Toms, H. E.
Considine, D. C.
Madin, R. J.

MECHANICAL ENGINEERING II.

Credit—
Thomson, A. W.

Pass—
Watson, F. G.

ELECTRICAL ENGINEERING I.

Credit—
Mead, G. F.
Wallis, F. A.
Pepper, R. S.
Rasmussen, L. A.
Gardner, J. A.

Pass—
Lambert, K. C.
Thomson, A. W
Dowson, R. C.
Crowley, P. J.
Fisher, E. W.
Ryder, K. N.
Davis, F. A.

ELECTRICAL ENGINEERING II.
(Provisional pending Thesis)

Credit—
Hair, K. R.
Harris, G. D.*
Watson, A.*
Jones, C. G.*

Pass—
Hunt, C. A. S.
Watson, F. G.

Thesis accepted—
Weedon, P. H. G.

MACHINE DESIGN
(Provisional pending Thesis)

Credit—
Martin, D. J.
Rasmussen, L. A.

Pass—
Hastings, R. W.*
Martin, D. H. (T)*
Watson, A.*
Watson, F. G.
Burnett, W. H. (T)
Theses accepted—
Fisher, E. W.
Burnett, W. H.
Weedon, P. H. G.

INTERNAL COMBUSTION ENGINES

Credit—
Beavis, R. J.
Munro, E. G.*
Rigbye, L.*
Hurley, J. E.
Lapsley, F. R.*
Lee, H. A.*
Zani, V. R.*
Robartson, J. S.*

Pass—
Needham, G.
Medlen, F.
Moore, R.
DeCampi, R.
Barker, K. G.
Gale, G. B.
Dower, S. A.
Duggin, J. A.

ENGINE DRIVING I.

Credit—
Jordan, N.*
McAlister, A.*
Lobb, E. J.*
Bostleman, E. J.*
Rose, D. C.*
Mitchell, A. J.
Brooks, S. A.

Pass—
McGinty, J.
Christie, W. T.
Selsmark, K. E.
Tester, W. A

ENGINE DRIVING II.

Pass—
Curran, W. F.

SUPPLEMENTARY EXAMINATIONS, 1946

ELEMENTARY MATHEMATICS
Arithmetic Section

Murphy, H. W.

PREPARATORY MATHEMATICS
Geometry Section

Moriarty, C. J.
Newton, R. J.

PREPARATORY PHYSICS

Quan, L.
Brennan, Miss R. C.

MATHEMATICS I.
Geometry Section

Jacobs, N.
Garrett, N.
Lambert, K. C.

PHYSICS I.

Henderson, D. C.
Crowley, P. J.
Hooker, L. F.
Carew-Reid, D. M.

APPLIED MECHANICS

Watson, F. G.

MATHEMATICS II.

Watson, F. G.
Harris, D. G.

ENGINEERING CHEMISTRY I.

Watson, F. G.

ASSAYING I.

Bradley, S. W.
Brennan, Miss R. C.

MINERALOGY

Christopher L. F.
Boyd, J. P.

SURVEYING I.
Matheson, W. R.
Watson, F. G.

SURVEYING II.
Dowson, R. C.

YEAR'S FEE SCHOLARSHIPS

ELEMENTARY MATHEMATICS
Webb, H. J.

PREPARATORY MATHEMATICS
Young, J. G. W.

MATHEMATICS I.
Wells, T.

PREPARATORY CHEMISTRY
Zehnder, J. W.

PREPARATORY PHYSICS
Skerry, T. F.

PREPARATORY GEOLOGY
Coldwell, V.

PREPARATORY DRAWING
Zehnder, J. W.

MATHEMATICS II.
Redmond, L. H.

APPLIED MATHEMATICS
Tasker, E.

PHYSICS I.
Griffin, A. F.

CHEMISTRY I.
Wells, T.

ASSAYING I.
Ewing, D. A.

ASSAYING II.
Hughes, E. E.

ENGINEERING CHEMISTRY I.
Mead, G. F.

ENGINEERING CHEMISTRY II.
Martin, J. D.

METALLURGY
Lynn, F. T.

METALLURGY II.
Watson, A.

MINERALOGY
Brodie-Hall, L. C.

PETROLOGY
Brodie-Hall, L. C.

MINING AND ECONOMIC GEOLOGY
Quartermaine, M. K.

MINING II.
Power, F. W. G.

ORE DRESSING
Nairn, F. B.

SURVEYING I.
Burrows, H. L.

SURVEYING II.
Lord, J. H.

MECHANICAL DRAWING I.
Wells, T.

MECHANICAL DRAWING II.
Hastings, R. W.

BUILDING CONSTRUCTION
Hastings, R. W.

WORKSHOP PRACTICE I.
Edgar, K. R.

WORKSHOP PRACTICE II.
Watson, F. G.

MECHANICAL ENGINEERING I.
Hastings, R. W.

MECHANICAL ENGINEERING II.
Thomson, A. W.

ELECTRICAL ENGINEERING I.
Mead, G. F.

ELECTRICAL ENGINEERING II.
Hair, K. R.

MACHINE DESIGN
Martin, D. J.

INTERNAL COMBUSTION ENGINES
Beavis, R. J.

ENGINE DRIVING I.
Jordan, N.

APPLIED MECHANICS
Hastings, R. W.

NORSEMAN SCHOOL OF MINES.

ELEMENTARY MATHEMATICS

Arithmetic Section

Credit—
Sweet, E. T.
Kennedy, F. B.
Perkins, E. J.
Bastow, H.
Hicks, R. V.
Kerr, G. L.
Lambert, F.

Pass—
Jennings, R. T.
Harvey, L. C.
Newman, M. F.
McGillivray, D. A.

Algebra Section

Credit—
Perkins, E. J.
Sweet, E. T.
Kennedy, F. B.
McGillivray, D. A.
Lambert, F.

Pass—
Kerr, G. L.
Hicks, R. V.
Newman, M. F.
Jennings, R. T.

Geometry Section

Credit—
Sweet, E. T.

Pass—
Jennings, R. T.

PREPARATORY MATHEMATICS

Algebra Section

Pass—
Doig, G. R.
Stubbs, J. R.

Geometry Section

Pass—
Kerr, P.

PREPARATORY CHEMISTRY

Pass—
Gatti, F. V.
Cottrell, K. K.

PREPARATORY PHYSICS

Pass—
Cottrell, R. H.
Stubbs, J. R.

PREPARATORY MECHANICAL DRAWING

Pass—
Jennings, R. T.
Kenyon, L. J.

PRACTICAL ELECTRICITY

Pass—
Waters, J. V.
Pugh, D. D.

MECHANICAL DRAWING I.

Pass—
Clark, L.

APPLIED MECHANICS

Pass—
Peek, D. K.

APPLIED MATHEMATICS

Pass—
McKenna, D. M

ASSAYING I.

Pass—
Hennessey, P. W.

MINING I.

Pass—
Moir, R. R.
Dickinson, W.

SURVEYING I.

Pass—
Dodd, K. C.
Brett, R. L.
Joplin, W.
Gatti, F. V.*
Morton, J. L.*

CHEMISTRY I.

Pass—
McKenna, D. M.

WORKSHOP PRACTICE I.

Pass—
Halse, E. J.
Winston, J.

WORKSHOP PRACTICE II.

Pass—
Clarke, L.
Turnor, J. S.
Gray, C. J.
Baker, I. A.
Pugh, D. D.

INTERNAL COMBUSTION ENGINES

Credit—
Dodd, K. C.

Pass—
Williams, R. M.*
Forgan, F. A. (T)*
Benson, A. D.
Radosevich, J. D.
Trotter, E. J.
Dodd, L. C.

YEAR'S FEE SCHOLARSHIPS

INTERNAL COMBUSTION ENGINES
Dodd, K. C.

CHEMISTRY I.
McKenna, D.

SUPPLEMENTARY EXAMINATIONS, 1946

MATHEMATICS II.
Peek, K.

PHYSICS, I.
Peek, K.

MINERALOGY
Peek, K.

WILUNA SCHOOL OF MINES.

ELEMENTARY MATHEMATICS

Arithmetic Section

Pass—
Robinson, W.

Algebra Section

Credit—
Robinson, D.
Rowe, E. R.
Rowe, R.
Clinch, W.
Clinch, J. M.

Pass—
Robinson, W.

Geometry Section

Pass—
Robinson, W.
Rowe, R.

PREPARATORY MATHEMATICS

Algebra Section

Pass—
Herring, W.
Toussaint, F.

Trigonometry Section

Pass—
D'Alton, A.
Ramsay, I.

PREPARATORY MECHANICAL DRAWING

Pass—
Herring, W. J.
Robinson, Miss D.
Rowe, E.
Robinson, W.

MECHANICAL DRAWING I.

Credit—
Ellis, J. A.
Carroll, J. H.

Pass—
D'Alton, A.
O'Brien, M.

MECHANICAL DRAWING II.

Pass—
Ashdown, B.
Toussaint, F.

SURVEYING I.

Pass—
Ellis, J. A.

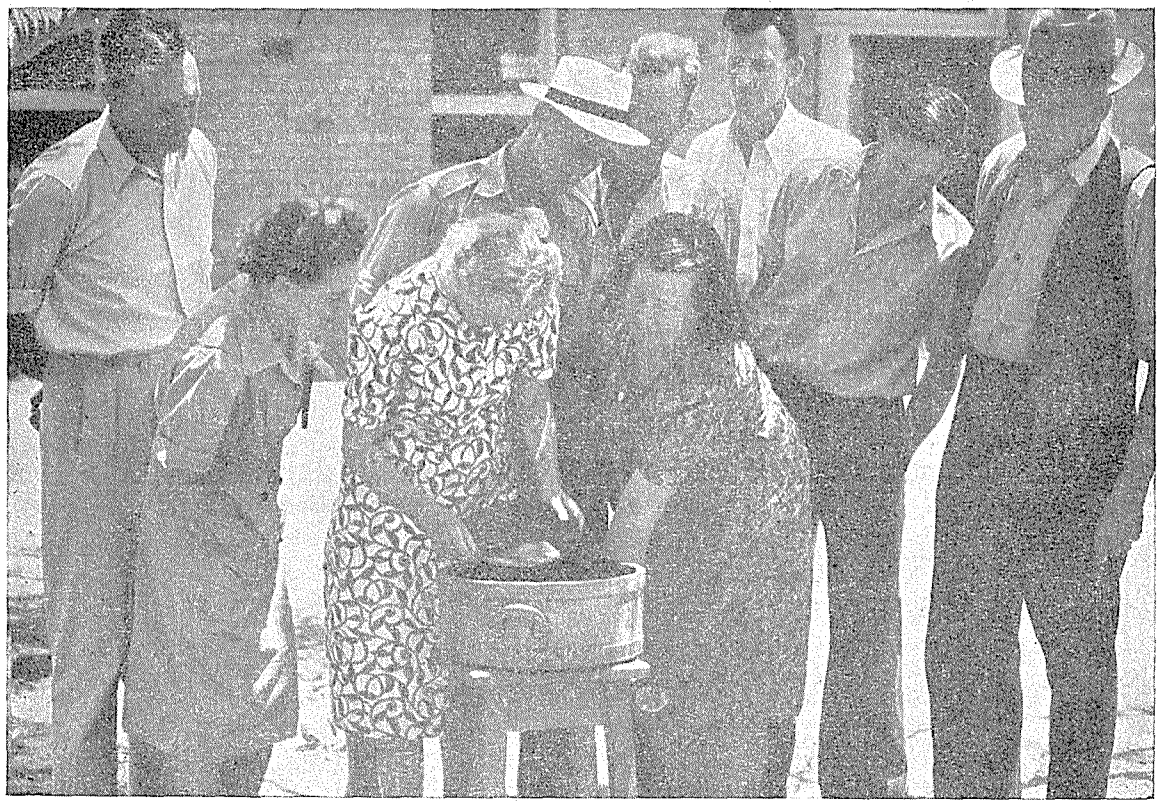
WORKSHOP PRACTICE

Pass—
Giltrap, C. (T)
Moiler, R.

Pass in practical only—
Mulligan, H.

YEAR'S FEE SCHOLARSHIP

MECHANICAL DRAWING I
Ellis, J. A.



DIVISION VI.

Annual Report of the Inspection of Machinery Branch of the Mines Department for the Year 1946.

OPERATIONS UNDER THE INSPECTION OF MACHINERY ACT, 1921.

ANNUAL REPORT OF THE CHIEF INSPECTOR OF MACHINERY AND CHAIRMAN OF THE BOARD OF EXAMINERS FOR ENGINEDRIVERS, FOR THE YEAR ENDED 31st DECEMBER, 1946, WITH STATISTICS.

The Under Secretary for Mines:

For the information of the Hon. Minister for Mines, I submit the report of the Deputy Chief Inspector of Machinery on the administration of the Inspection of Machinery Act, 1921, for the year ended 31st December, 1946.

J. S. FOXALL,
Chief Inspector of Machinery.

SECTION 1.

INSPECTION OF BOILERS, MAINTENANCE, ETC.

See Returns Nos. 1, 2, and 3.

The term "Boiler" as defined in the Act includes any vessel in which steam is generated, above atmospheric pressure for working any kind of machinery, or for any manufacturing purpose, also unfired pressure vessels, such as steam jacketed pans, stills, sterilisers, digesters, vulcanisers, air or gas receivers, montejus, etc.

Return No. 1, gives the type and the country of origin of the 325 boilers which were registered during the year. These boilers are not necessarily all new, for instance the Vertical Multitubular Portable made in U.S.A. is a second hand boiler which was originally not subject to the provisions of the Act because it was installed in a steam car, and the Watertube made in the United Kingdom is one half of a double drum Babcock & Wilcox boiler which has been re-erected as 2 single drum boilers, one drum retains the original number and the other is treated as a new registration.

Return No. 2 gives the number of boilers in proclaimed districts as 5,482 and the number out of use 3,131 or 57.1 per cent.; although all these boilers were still potentially serviceable when discarded, the majority will not be used again as steam generators due to the original working pressure being low, depreciation from long exposure, the cost of repair, or their distance from railways, etc. For years past it has been increasingly difficult to find second hand boilers suitable for 100 lbs. working pressure or over.

Return No. 3 shows that 3 second hand boilers imported from the Eastern States, and 4 transferred from other Departments in this State were added to the register, the deductions were: 1 converted to other uses not subject to the provisions of the Act, 25 permanently condemned or cut up, 2 sent out of this State, and 3 transferred to other Departments, leaving a net increase of 299 registered boilers and pressure vessels.

The number of thorough inspections made during 1946 was 318 more than in the previous year, but the number of inspections made under working conditions for which separate reports were submitted was 37 less. The number of certificates issued was 288 more, and 221 more repair notices were sent to owners.

NEW CONSTRUCTION.

Return No. 1 shows that 196 new boilers and pressure vessels were built in this State, but the majority of the steam generators were of small size designed for the use of dairy farmers, etc.

None of the new boilers or pressure vessels was of unusual design.

MAINTENANCE.

Because boiler quality plates and tubes are very hard to obtain, only absolutely essential repairs can be carried out, and it appears that it will be some considerable time before pre-war standards can be attained.

Owners are paying more attention to the treatment of boiler feed water, thus reducing the cost of fuel and boiler cleaning, but there is still considerable room for improvement in many cases.

Throughout the year coal has been strictly rationed and only supplied to boiler owners who could not burn other types of fuel. Wood fuel which used to be plentiful and cheap is now dear and supplies are frequently unobtainable. As a result many owners have installed oil firing equipment, the actual cost of oil fuel per pound of steam generated is greater than that of either coal or wood fuel, but its many advantages offset the increased cost. One great advantage in the city is that there is no dust nuisance from the smoke stack, also less bunker space is required and there are no ashes to dispose of. Most of the oil firing installations are automatically controlled, which is another great advantage.

One owner who was contemplating installing a larger boiler to meet his steam requirements, relined the casing of his underfired boiler with refractory insulating bricks before he installed oil firing, the increased evaporation more than met his needs, and so saved the expense and inconvenience of putting in a larger boiler.

RETURN No. 1—SHOWING THE NUMBER OF BOILERS OF EACH TYPE, AND COUNTRY OF ORIGIN OF NEW REGISTRATIONS FOR THE YEAR ENDED 31st DECEMBER, 1946.

Type	Country of Origin					Total
	United Kingdom	U.S.A.	Eastern States	Western Australia	Unknown Sources	
Semi Cornish	....	....	....	1	....	1
Cornish	....	....	....	16	....	16
Vertical Stationary	....	....	28	35	....	63
Vertical Multitubular Portable	....	1	....	....	....	1
Return Multistat, Underfired	....	....	1	12	....	13
Return Multi-Stat, Int. Fired	....	....	1	....	....	1
Water Tube	1	....	6	36	....	43
Locomotive	....	....	....	1	....	1
Saddle Back	....	....	....	6	....	6
Digester	....	....	1	15	....	16
Vulcaniser	....	....	4	....	....	4
Steam Jacketed Vessel	....	....	5	25	1	31
Steriliser	2	....	2	4	....	8
Air Receiver	5	1	31	44	39	120
CO_2 Receiver	....	....	....	1	....	1
	8	2	79	196	40	325

RETURN No. 2.—SHOWING CLASSIFICATION OF VARIOUS TYPES OF USEFUL BOILERS IN PROCLAIMED DISTRICTS ON 31st DECEMBER, 1946.

Types of Boilers	Districts Worked from PERTH	Districts Worked from KALGOORLIE	Totals	
			1946	1945
Lancashire	41	57	98	98
Cornish....	115	471	586	571
Semi-Cornish	12	37	49	48
Vert. Stat.	370	351	721	664
Vert. Port.	72	15	87	88
Vert. Mult. Stat.	42	25	67	67
Vert. Mult. Port.	18	3	21	20
Vert. Pat. Tubular	49	....	49	49
Loco. Rect. Firebox Stat.	88	64	152	150
Loco. Rect. Firebox Port.	255	67	322	324
Loco. Circ. Firebox Port.	137	8	145	145
Locomotive	78	36	114	122
Water Tube	257	119	376	331
Return Mult. Underfired Stat.	203	62	265	250
Return Mult. Underfired Port.	....	8	8	8
Return Mult. Int. Fired Stat.	43	12	55	56
Return Mult. Int. Fired Port.	2	....	2	2
Egg ended and other types not elswhere specified	273	26	299	287
Digesters	177	7	184	169
Air Receivers	700	464	1,164	1,049
Gas Receivers....	7	....	7	7
Vulcanisers	294	10	304	300
Steam Jacketed Vessels	394	13	407	378
Total Registrations useful Boilers	3,627	1,885	5,482	5,183
Total Boilers out of use 31st December, 1946	1,638	1,493	3,131	3,120

RETURN No. 3.—SHOWING OPERATIONS IN PROCLAIMED DISTRICTS DURING YEAR ENDED 31st DECEMBER, 1946.

(BOILERS ONLY).

	Districts worked from PERTH	Districts Worked from KALGOORLIE	Totals	
			1946	1945
Total number of useful boilers registered	3,627	1,855	5,482	5,183
New Boilers registered during year	314	11	325	145
Boilers reinstated	....	....	....	....
Boilers converted	1	....	1	2
Boilers Inspected :—				
Thorough	2,031	353	2,384	2,066
Working	156	9	165	202
Boilers condemned during year :—				
Temporarily	9	1	10	16
Permanently	11	14	25	21
Boilers sent to other States during year	....	2	2	11
Boilers sent from other States during year	1	....	1	3
Transferred to other Departments	3	....	3	....
Transferred from other Departments	4	....	4	5
Number of Notices for Repairs issued during year	712	9	721	500
No. of Certificates issued including those issued under Section 30 during the year	1,989	362	2,351	2,063

SECTION II.

EXPLOSIONS AND INTERESTING DEFECTS.

After about three months' use, an underfired return multi-tubular boiler, size 16ft. x 6ft. x ½in. shell plate, was found to have an almost perfect spherical depression on the bottom; measured lengthways of the boiler the depression was approximately 24 inches in diameter and the greatest depth 4¼in. At the deepest part the remaining thickness was 9/32in. This defect was discovered one Sunday when preparations were being made to light up after the week-end shut down, and, on enquiry, no evidence was forthcoming as to when the overheating occurred. During the previous week-end the boiler was cleaned and washed out, and when the boiler was opened up after the defect was discovered, there was only a thin scale adhering to the plate and a small deposit of soft loose mud, so that the overheating was not likely to have been due to scale or mud. Shortage of water can also be ruled out because none of the tubes were leaking. The bottom of the shell was about 5 feet above the fire bars and the bridge was about 2 feet clear of the boiler bottom. The boiler was fired with wood fuel, and, as heavy fires were the usual practice, the overheating appears to have been due to a local concentration of heat at the point where the depression occurred. This is the first case recorded in this State where a depression has occurred in an underfired boiler without heavy scale deposit being present.

The inner shell of a hemispherical seamless copper steam jacketed pan, 14in. radius by 12 gauge or 0.104in. thick, which had been in daily use for 28 years, at a working pressure of 10lbs. per square inch, collapsed when being tested for steam tightness at the authorised working pressure of 30 lbs. per square inch. Using Hillers formula the compressive stress at collapsing should have been 16,478 lbs. per square inch, whereas the compressive stress at 30 lbs. steam pressure would only have been 2,019 lbs. per square inch, and as there was no sign of water hammer or other shock, it is hard to explain why the pan should have failed at such a low stress The recommended working stress is one-sixth of the calculated collapsing stress or 2,746 lbs. per square inch. The extreme bottom of the pan bulged upwards over about 12in. diameter with several cracks and short fractures at the root of the reverse bend.

SECTION III.

INSPECTION OF MACHINERY.

See Returns 4, 5 and 6.

The machinery groups registered increased by 1,109 and 517 more groups were inspected than there were during the previous year. One goods lift was converted to a passenger-goods lift, and two new service lifts were installed.

Return No. 4 Showing Classification According to Motive Power of Groups of Machinery in Use or Likely to be Used in Proclaimed Districts and Which Were on the Register During the Year Ended 31/12/1946.

Classification	Districts Worked From Perth	Districts Worked From Kalgoorlie	Totals	
			1946	1945
No. of Groups driven by steam engines	454	527	981	983
No. of Groups driven by oil engines	1,415	862	2,277	2,190
No. of Groups driven by gas engines	70	187	257	259
No. of Groups driven by compressed air	....	63	63	60
No. of Groups driven by electric motors	12,685	3,749	16,434	15,411
No. of Groups driven by hydraulic pressure	5	....	5	5
	14,629	5,388	20,017	18,908

Return No. 5 Showing Operations in Proclaimed Districts During Year Ended 31/12/1946. (Machinery Only)

Classification	Districts Worked From Perth	Districts Worked From Kalgoorlie	Totals	
			1946	1945
Total registrations useful machinery	14,629	5,388	20,017	18,908
Total inspections made	8,703	3,047	11,750	11,233
Certificates (bearing fees)	2,636	467	3,103	3,142
Certificates (steam without fees)	45	7	52	55
No. of extension certificates issued under Section 42 of the Act	....	....	....	....
Notices issued (Machinery Dangerous	315	3	318	369

Return No. 6 Showing Classification of Lifts on 31/12/1946.

Types	How Driven	Totals	
		1946	1945
Passenger	Electrically driven	189	188
	Hydraulically driven	1	1
Goods	Electrically driven	94	95
	Hydraulically driven	3	3
	Belt driven	4	4
Service	Electrically driven	33	31
		324	322

Accidents to Machinery.

The crank shaft of a duplex horizontal double drum steam winding engine fractured without causing any other damage. This engine has cylinders 22 in. diameter by 60 in. stroke, the drums are 10 ft. diameter by 48 in. wide, the depth of the shaft is 3,700 ft. and the maximum load is 12,548 lb. including the weight of the 4 in. circumference rope. The crank shaft which fractured was fitted in June 1923, to replace one which failed at exactly the same place, viz. the end of the keyway for fixing the band clutch spider, the diameter at that point is 13½ in. A spare crank shaft which was on hand was installed and the engine was in commission again after a stoppage of only eight days.

Crankshaft failures also occurred on two 1,150 h.p. Diesel engines on another mine; the crankcase was also fractured in each case.

SECTION IV.

Prosecutions for Breaches of the Act.

An employer was fined £20 for employing two persons who did not hold the required engine driver's certificate and the two employees were each fined £5 for taking charge of an engine without holding the required certificate. The Act provides a maximum penalty for both the employer and employee of £5 per day or part of a day, on which a person who does not hold the required engine driver's certificate is employed as a driver. In this case the fines might have been very much heavier.

SECTION V.

Accidents to Persons.

Return No. 7 includes only those accidents caused by working machinery subject to the povisions of the Act, which are classed as serious, that is those which prevented the injured person from following his usual occupation for a period of two weeks or more. Accidents which occurred on timber mills which are subject to the provisions of the Timber Industry Regulation Act, 1926, are not included.

Ten more serious accidents were reported during 1946 than were reported in 1945, but only one fatal as compared with three fatal the previous year.

Circular saws caused one third of the accidents. In one case a piece of wood was picked up by the saw and struck the sawyer in the chest causing broken ribs and serious internal injuries. This accident would probably not have occurred had the owners fitted a riving knife as instructed by the inspector at the previous inspection. Unfortunately, the owners could not be prosecuted because the Justices Act limits the time in which a complaint may be laid to a period of six months, and in this case more than six months had elapsed between the time when the fitting of the riving knife was ordered and the date on which the accident occurred.

In another case, the injured person was cutting firewood and throwing the billets into a truck fitted with high sides, one piece which hit the side of the truck fell back on the saw, which threw it forward hitting the unfortunate man in the stomach causing serious internal injuries.

The remaining injuries caused by circular saws ranged from the loss of the thumb and all the fingers on the right hand of one victim, through loss of finger joints down to laceration. The majority were caused by carelessness or lack of skill on the part of the injured person.

The type of machine which caused the next highest number of accidents was the buzzer. In two of these accidents the injured person lost the thumb and index finger of the right hand, one lost the first joint of his right little finger and one the ball of his right thumb. The other accident was of an unusual type as one of the blades of a circular buzzer head flew out and hit an apprentice across his left shoulder and the lower part of his face knocking out several teeth. The circular head had been trued up in the lathe and was replaced in the machine by a fitter, the table gap was open about five to six inches. The blades had not been adjusted nor had the keeps been tightened. As the box spanner could not be found the fitter attempted to tighten the nuts by means of a hammer and drift. When the machine was started one blade flew out and hit the apprentice, who was passing in front of the machine.

RETURN No. 7.—SHOWING NUMBER OF SERIOUS ACCIDENTS BOTH FATAL AND NON-FATAL WHICH OCCURRED IN PROCLAIMED DISTRICTS DURING THE YEAR ENDED 31ST DECEMBER, 1946.

(F) DENOTES FATAL.

	Wood-Working.	Metal Working and Engineering.	Printing	Firewood cutting.	Flour Milling	Leather Working.	Agriculture.	Mining.	Laundry.	Dehydration.	Brush Manufacturing.	Harbour Works.	Refrigeration and Ice Making.	Butchering.	Crown Seal Manufacturing.	Wool Scouring.	Other Industries.	Total Machines.
Boilers	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1
Belts and Shafting	...	...	1	...	1	...	1 (F)	...	...	...	...	...	...	...	...	...	1	4
Buzzer...	4	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	5
Crane	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1
Chaffcutter	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1
Circular Saw	9	...	...	1	...	1	...	...	...	1	1	...	2	...	1	...	...	16
Capstan	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1
Drill Sharpener	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	1
Emery Wheel	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Ironing	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	2
Lemon Squeezers	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	1
Mincer...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...	1
Mixing...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	2
Press	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Rolls	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	2	...	3
Spindle Shaper	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Thicknesser	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
Miscellaneous	...	...	...	...	...	...	...	...	...	...	...	...	2	...	2	...	1	5
Total (Industries) ...	15	2	1	1	1	2	2	1	2	1	1	1	4	1	3	2	8	48

Instead of using a portable air grinder as the makers intended, the owners fixed it to a post, and unless the air valve was opened to the full extent, the vibration would close it. When the original grinding wheel wore out a larger diameter one was fitted, this combined with the full open air valve resulted in a peripheral speed of over 10,000 ft. per minute or nearly twice the recommended speed. The wheel burst when a man was grinding an axe; he was lucky to get off with only a gash in the abdomen. This outfit has been replaced by an electrically driven double ended grinder.

Instead of using the equipment provided, a refrigerator attendant used an ordinary piece of ½ in. rubber hose to connect an ammonia bottle to the compressor which was used for charging ammonia into a large refrigerator plant. The hose blew off the connecting tail and the attendant received burns on the face and throat; he was lucky not to have been blinded.

Only one accident was caused by a spindle moulder, which is generally considered to be one of the more dangerous wood working machines. In this case the injured man, who had had over 30 years' experience, lost all the fingers and the thumb of his left hand. The machine was being used in the orthodox manner for cutting a stopped rebate ¾ in. deep by 2 in. wide in pencil cedar, so it is rather extraordinary that he should have been caught.

One lad, aged 18, had his left arm torn off at the elbow through his hand becoming entangled in a belt which had fallen on to and become wrapped round a shaft.

A man, aged 40, had his right forearm cut off in chaff lengths by a chaff cutter when feeding short loose meadow hay into the feed trough with the guard removed.

A splinter of steel from the nose of a power operated punch, used for cutting the teeth on a circular saw blank, hit the operator in the right eye, destroying the sight. Since this accident a metal guard with a perspex window has been fitted to the press.

The fatal accident was caused by the deceased using the loose driving belt as a brake on the fly wheel of a 4½ h.p. kerosene engine which he had been adjusting and testing. The belt gripped and entangled his right leg tearing off the flesh from the knee down. This leg was amputated above the knee and he died from the effects of his injuries three weeks later.

SECTION VI.

EXAMINATION OF ENGINEDRIVERS.

Examinations were held as follows:—

Perth 4, Kalgoorlie 4, Bunbury 2, Collie 3, Stirling Dam 1. Examinations were held at all advertised centres except Mt. Magnet.

Examinations occupied 18 days; travelling 14 days; dealing with applications, marking examination papers, making inquiries, etc., 32 days.

There were 367 applications received and 339 certificates were granted, being increases of 81 and 102, respectively, over the previous year.

Return No. 8.—Showing Total of Engine Drivers' and Boiler Attendants' Certificates (all Classes) Granted in 1946 compared with 1945.

	Number Granted.	
	1946.	1945.
Winding Competency, including certificates issued under Regulation 40 and Section 60 of the Act	6	5
First Class Competency, including certificates issued under Regulations 40 and 45 and Sections 60 and 63 of the Act	16	31
Second Class Competency, including certificates issued under Regulation 40 and Section 60 of the Act	39	19
Third Class Competency, including certificates issued under Regulations 40 and 45 and Sections 60 and 63 of the Act	42	32
Locomotive Competency, including certificates issued under Regulation 40 and Section 60 of the Act	10	9
Traction Competency, including certificates issued under Regulation 40 and Section 60 of the Act	3	1
Internal Combustion Competency, including certificates issued under Regulation 40 and Section 60 of the Act	47	49
Crane and Hoist Competency, including certificates issued under Regulation 40 and Section 60 of the Act	32	10
Boiler Attendant Competency, including certificates issued under Regulation 40 and Section 60 of the Act	130	71
Interim	....	....
Copies	13	9
Transfer	1	1
	339	237

SECTION VII.

STAFF.

One inspector who had been on the temporary staff for six years was appointed to the permanent staff and one of the clerical officers returned to duty after 5 years' active service with the military forces.

Revenue and Expenditure, Return No. 9.—The year's working resulted in a loss of £1,951 compared with a loss of £463 3s. 6d. for 1945.

Return No. 10 shows the particulars of miles travelled in making inspections.

I wish to thank all those who assisted in carrying out the work of this Branch, and to record my appreciation of the co-operation received from the officers of other departments of the State Service and the Commonwealth. In particular, I desire to thank all the officers of this Branch for the good work they have performed, and also all other officers of the Mines Department for their unfailing courtesy and assistance.

G. MOORE,

Deputy Chief Inspector of Machinery.

RETURN NO. 9 SHOWING REVENUE AND EXPENDITURE FOR YEAR ENDING 31ST DECEMBER, 1946.

Revenue.			Expenditure.		
	1946	1945		1946	1945
	£ s. d.	£ s. d.		£ s. d.	£ s. d.
Fees for Boiler Inspection	2,915 12 4	2,734 19 4	Salaries ...	7,992 11 0	7,144 19 3
Fees for Machinery Inspections	4,876 14 7	5,115 12 3	Incidentals ...	2,229 16 6	1,430 15 4
Engine Drivers' Fees ...	457 18 0	291 2 0	Engine Drivers	49 5 3	94 15 4
Incidentals	70 3 8	65 11 10			
Increase £113 3s. 2d.	£8,320 8 7	£8,207 5 5	Increase £1,601 2s. 10d.	£10,271 12 9	£8,670 9 11

Loss = £1,951 4s. 2d.

RETURN No. 10 SHOWING DISTANCES TRAVELLED, NUMBER OF NSPECTIONS MADE AND AVERAGE MILES TRAVELLED PER INSPECTION FOR THE YEAR ENDED 31ST DECEMBER, 1946.

Areas Traversed.	Rail Miles.			Road Miles.			Water Miles.			Air Miles.			Total Miles.			Total number of Inspections.			Average miles per Inspection.		
	1946	As compared with 1945		1946	As compared with 1945		1946	As compared with 1945		1946	As compared with 1945		1946	As compared with 1945		1946	As compared with 1945		1946	As compared with 1945	
		Increase	Decrease		Increase	Decrease		Increase	Decrease		Increase	Decrease		Increase	Decrease		Increase	Decrease		Increase	Decrease
Districts worked from Perth ...	167	...	11	45,305	7,985	...	15	15	...	3,946	...	2,761	49,433	5,228	...	10,890	117	...	4·53	·43	...
Districts worked from Kalgoorlie	1,650	1,500	...	15,946	1,752	...	...	...	...	...	...	...	17,596	3,252	...	3,409	680	...	5·16	...	·09
Totals	1,817	1,500	11	61,251	9,737	...	15	15	...	3,946	...	2,761	67,029	8,480	...	14,299	797	...	4·68	= Average all Districts, 1946.	
																			4·33	=Average all Districts 1945.	
Increases or Decreases ...	Increase 1,489			Increase 9,737			Increase 15			Decrease 2,761			Increase 8,480			Increase 797			= Average increase ·35 miles per inspection.		

Division VII.

Annual Report of the Government Mineralogist, Analyst and Chemist for the Year 1946.

FOODS, DRUGS, TOXICOLOGY AND INDUSTRIAL HYGIENE DIVISION.

ANNUAL REPORT FOR THE YEAR ENDED 31st DECEMBER, 1946.

By J. C. Hood, B.E.M., A.A.C.I., Deputy Government Analyst.

FOODS.

Food inspection samples amounted to 116 of which 69 consisted of milk samples.

Milk Inspection Samples (69).

Following the usual practice of making periodic checks of the quality of milk supplied to the metropolitan area, 63 official samples were received from the Department of Public Health. In all, 21 samples did not comply with the Food and Drug Regulations with respect to chemical composition, 17 being deficient in solids not fat only, whilst the others were deficient in both total solids and solids not fat. Only one sample fell below the 3.2% fat standard.

Successful prosecutions against the vendors were lodged in a number of cases.

Arising out of a dispute over two samples, check analyses were made on the reserved third samples. Although prolonged freezing had affected the homogeniety of the samples to some extent, good agreements with the original analyses were obtained.

Other samples of milk examined were, a soured referee sample by order of a magistrate and a number on behalf of the Department of the Army which showed evidence of sophistication.

Miscellaneous Food Samples.

A number of samples of imported tinned salmon were examined for the presence of artificial colouring matter. The contents were all coloured pink, the intensity varying with the different portions of the flesh.

No artificial colourings were detected, the colouring matter in all resembling carotene and zanthophyll, both of which, together with salmic acid have been detected in pink salmon.

The oil content of blue sprats and sea pilchards from local waters were determined for the purpose of processing and exploitation.

Samples of butter, honey, tomato sauce, vinegar,, canned potatoes and self-raising flour were all found to comply with the several provisions of the Food and Drug Regulations. The analytical characteristics of two fermented vinegars showed them to contain the products of acetous fermentation of a distilled alcoholic fluid but doubt was expressed as to whether wholly derived from this source.

The examination of a number of cordials and fruit juices disclosed some which did not comply with the labelling provisions and others with regard to composition. From available analytical figures it was doubtful whether one sample, purporting to be a genuine fruit cordial, contained more than 20% of natural fruit juice.

The analysis of a diabetic bread agreed closely with the stated composition and the protein-carbohydrate ratio of 1:1.62.

A sample of olive oil said to have been imported from Palestine was found to be adulterated with peanut oil to the extent of 8%.

A proprietary brand of iodised table salt packed in grease-proof paper and closely fitting into a cardboard carton was examined for total iodide and the distribution of iodide at various parts of the contents. Some variation in the iodide content was observed. For even distribution it was considered the grain size was required to be less than 60 mesh.

Owing to the high figures which have been obtained elsewhere for the fluorine content of phosphate baking powders, a survey of the brands for sale in Perth was made. With one exception they were found to be below the limit of 70 parts per million of fluorine proposed as a provisional standard by the Society of Public Analysts in England.

Nine samples of Vienna bread and doughs were examined for the Factories Department. Analyses were made for fat and other statutory constituents which might be used for diagnostic purposes or as a basis for regulations under the Bread Act.

Foodstuffs contaminated with poisonous arsenical sprays, phosphorus and D.D.T. were also submitted for identification and estimation.

Human Milks (27).

Partial analysis were made of 27 samples of human milk to assist Infant Health Centres and Clinics in the diagnosis of abnormal conditions thought to be due to the composition of mothers' milk.

Although the specimens received cannot be considered as representative of nursing mothers as a whole, an examination of the figures obtained over a number of years would indicate a noticeably lower average figure for protein than quoted elsewhere.

Liquors, Beverages, etc.

The number of samples received for the year were exceptionally small. Two samples, representative of the

development of public taste in apple beverages were examined. One of these, although labelled "Cyder—sweet and non-intoxicating" contained less than two parts per centum of proof spirit and, consequently, came within the definition of a non-excisable fermented drink.

The other sample was an egg-nog cider, one of the products of a recently established apple processing industry within the State.

This was a nutritious and pleasant drink containing 14.1% of proof spirit.

MILK INVESTIGATIONAL SAMPLES (407).

Departmental Investigation.

The small investigation initiated last year with the co-operation of Mr. A. Mitchell, of Oldbury, via Mundijong, with the purpose of securing data of factors governing the compositions of milk and freezing point, was concluded.

The samples, which were the morning milk of good stock representing individual cows of Jersey, Friesian and Shorthorn breed, gave valuable information confirming the influence of breed in producing substandard milk.

Seasonal variations were noted and also fluctuations in freezing point.

Interdepartmental Committee on Dairy Products.

The work on behalf of this committee was mainly the investigation during the previous year on milk produced in a commercial dairy located on the sandy country adjacent to Perth.

With the co-operation of Mr. Bradley, of Osborne Park, 10 cows were selected for the tests. The record of breeding of the cows was obtained by Mr. K. Needham, Agricultural Adviser, who also collected the necessary information on feeding, yields, etc., and personally sampled the evening and morning milking each week.

The yields were recorded and analyses made for total solids, fat, solids not fat, ash, protein and lactose (by difference). Freezing point determinations were at first made on samples from individual cows but for the remainder of the investigation they were made on composite samples of morning and evening milks bulked according to yield.

The results obtained indicate a very definite and significant seasonal variation in solids not fat, while in the case of some individual cows the figure remained consistently low throughout the year.

Corresponding low figures were also obtained for protein and variations noted in freezing points, contrary to generally accepted standards.

Interdepartmental Fruit Technical Committee (323).

The programme of work on apples was largely to check whether conclusions arrived at as the result of analyses for acidity, astringency, etc., and relationship between sugar and acidity were subject to seasonal variations. The work was continued with Granny Smith and Yates apples grown at Karragullen. In order to compare the relative stages of maturity with these apples, samples were also examined from the Albany district.

Primarily for the purpose of fixing a Western Australian standard for citrus fruits in respect to juice content and acidity, an investigation in association with the Department of Agriculture was initiated during the year.

As the programme was very extensive it was proposed during 1946 to confine it to Washington navel and Valencia oranges grown in six districts. Samples were taken fortnightly for the first two months and then at monthly intervals.

The scope of the investigation was broadened to include the analysis of the juice for specific gravity, vitamin C, and total sugars. With every collection a composite sample, bulked in proportion to yield of juice, was examined for sucrose, invert sugar, ash, phosphoric anhydride, alkalinity of ash, and formol titration.

The analyses are shown in Appendix.

Interdepartmental Vegetable Research Committee (10).

Tomatoes grown in connection with fertiliser experiments conducted by the Department of Agriculture and also from a commercial crop were examined for moisture, reaction, titratable acidity and vitamin C. Carotene, fibre and pectin were determined on a bulked sample.

Observations on the ripening stages, keeping qualities, and flavour were made for correlation with the fertiliser applications.

MISCELLANEOUS WORK ON AGRICULTURAL PRODUCTS.

Linseed.

The number of samples of linseed grown in experimental plots at Avondale Research Station and the Wokalup State Farm was not so large this year. In all 29 samples were received and examined for moisture and linseed oil content.

The oil content on the moisture free basis varied from 32.4% to 44.4% with an average of 38.7%.

Some samples of linseed varying in maturity and in method of harvesting gave similar results for oil content.

Insecticides.

Nine insecticides of varied types and ingredients were submitted from a variety of sources.

A considerable amount of work has been done in finding methods of analysis suitable for composite dusts and fluids containing D.D.T. submitted for analysis to support applications for registration under the Plant Diseases Act.

Little success has been achieved in determining the para, para isomer of D.D.T. present in a complex mixture although it is hoped that the attention focussed on this insecticide all over the world will be productive of methods workable under all circumstances.

DRUGS AND MEDICINES.

39 samples of anaesthetic ether were received from the Government Stores Department and Public Hospitals. These were examined for compliance with the British Pharmacopoeia tests for purity. Three samples did not comply with the requirements for both peroxides and aldehydes and one in respect to peroxides only.

Impounded anaesthetics sent by direction of district coroners in suspected cases of death under anaesthesia numbered three. One sample of ether showed the presence of appreciable quantities of peroxides and aldehydes indicating marked deterioration of the ether.

A proprietary preparation sold as a tonic was examined under the section of the Health Act which empowers the Commissioner of Public Health to publish any facts which may be contrary to the advertised claims or statements.

A remedy sold as a "cure" for the tobacco habit was examined as the result of a case of sickness extending over three months reputedly caused by taking the cure according to directions. The "cure" which consisted of a mouth wash and gargle, apparently relied on the repugnant taste produced in the mouth by the combination of tobacco smoke with compounds of the heavy metals.

A quantity of pills or tablets for chewing only and others for swallowing apparently intended to play a subsidiary or "build up" part in the cure. They contained in one, a bitter principal and the other mainly dehydrated magnesium sulphate or Epsom salts.

The preparations taken according to direction would not have caused the reported symptoms.

Unlabelled ampoules were submitted for identification and some medicines for compliance with formulae of the British Pharmaceutical Codex or doctors' prescriptions.

Biochemical Work.

The thiocyanate content of a series of blood samples from a patient under treatment for blood pressure were examined in order to maintain effective concentrations and guard against toxic consequences.

A number of intervertabral disks were examined for total and sulphate sulphur in an investigation being carried out by a medical practitioner.

For the Red Cross Blood Transfusion Service, samples of reagents and distilled water were examined for the presence of pyrogen factors and poisonous impurities.

TOXICOLOGY.

Human Poisoning Cases.

Toxicological work has been particularly heavy during the year, and consisted largely of human poisoning cases or suicides totalling 57 cases.

The poisons detected covered a wide range of substances such as preparations of arsenic (7), strychnine (2), barbiturates (5), cyanides (3), alcohol (3), corrosive sublimate (1), carbon monoxide (1), phosphorus (1), aspirin (1), nicotine (1), caustic soda (1), spirits of salts (1), chlorodyne (1) and chloroform (1).

In 18 cases no poisons were detected or the recovered material found to be inocuous in character and unlikely to be the cause of death.

A woman died suddenly as the result of taking a full bottle of a mixture containing chloral hydrate, potassium bromide and phenobarbitone while yet another as the result of an overdose of aspirin believed to be in the region of 500 grains.

A considerable amount of the drugs taken were found in the stomach in each case.

In one case of death by carbon monoxide poisoning, the blood was also examined for its alcohol content in an attempt to ascertain the degree of intoxication of the deceased at the time of death.

Most of these analyses were made in connection with coroners' inquests and evidence in these and other courts were given by Messrs. J. C. Hood, H. Sedgman or N. R. Houghton.

Evidence of the inflammability and explodability of alcohol and air mixtures was also given at a coroner's inquiry into the death of an excise officer during a fire in a distillery at Middle Swan.

Animal Poisoning.

Thirteen specimens of viscera, baits and materials were received in connection with real or supposed animal poisoning.

A heavy mortality in sheep occurred following dipping operations, the circumstances of which appeared to incriminate the chemical composition of a "milk oil" fluid rather than any faulty procedure in the dipping operations. The determination of the amount and nature of the phenolic constituents in the original preparation showed it to conform to the registered formula and the diluted dip to recognised safe limits.

CRIMINAL INVESTIGATION.

A number of exhibits were received from the Criminal Investigation Branch in connection with a case of death resulting from the injection of a 2 per cent. solution of pantocaine, normally used as a surface anaesthetic, in mistake for procaine in a tonsilectomy operation. Analysis of the residual anaesthetic solutions confirmed their identity and nominal concentrations, but no butethanol (pantocaine) was recovered from the small exhibits of heart blood, cerebral spinal fluid, urine and section of liver and kidney.

A death, thought to have resulted from the injection of bismuth compounds for treatment of syphilis, resulted in an examination being made of the kidneys and colon of the deceased person. Toxic amounts of bismuth were found in these organs.

In another case of death following injection of adrenaline, the concentration of the solution was found to be as prescribed and no poisonous impurities were detected.

Miscellaneous materials such as whisky, toast, antacid powder and tank water were at various times examined for poisons in cases of reputed or suspected malicious poisoning.

The identification and analysis of preparations and materials said to have been used in cases involving charges of abortion and indecent dealing respectively, were made and evidence tendered at the resulting Criminal Court proceedings.

Specimens of urine taken from a horse suspected of being "doped" and also specimens feloniously attempted to be substituted, were examined in a case involving a charge of corruption. The putrescent state of the samples when received and other factors made the identification difficult and negative in character.

Identification of stains on a hat were made in an attempt to ascertain the cause of a skull fracture resulting in the sudden death of a man. The nature, distribution and significance of the stains were embodied in a comprehensive report.

A similar report was also made on the identification of metallic particles removed from the eye of a police sergeant assaulted whilst in execution of his duty.

INDUSTRIAL HYGIENE AND PRODUCTS.

Lead and Arsenic Hazard.

For the purpose of supporting diagnosis of industrial poisoning of workers by lead and arsenic, samples were received from the Department of Public Health and private medical practitioners, mainly from workers in the mining industry.

Periodically samples of urine were also examined for lead from workers exposed to a lead hazard at the Western Australian Government Railways. In all a total of 35 samples were received from this source.

Factory Sanitation.

Complaints of irritation to eyes and nose by operatives engaged in spray painting, caused a number of paints and thinners to be examined for the presence of injurious substances. It was considered that the solvents from the thinners were the most likely source of the observed irritation. All the thinners consisted basically of petroleum fractions with varying amounts of solvent acetates and alcohols and consequently not likely to be attended by any discomfort or chronic effects.

One solvent which contained 25 per cent. acetone and 6 per cent. benzene in addition to the basic mixtures was considered to have the greatest potential hazard, but, if used with efficient ventilation serious results from toxicity would be avoided.

A comprehensive examination was made of samples of leather clippings and dust submitted by the Chief Inspector of Factories as the result of a number of cases of dermatitis in the bootmaking industry. The clippings, mainly chrome tanned, consisted of dyed and undyed piece leather with various dressings and also dyed lambskins with wool attached. Substances known to be corrosive to skin were specifically tested for, with negative results. Negative reactions were also obtained for dyes and intermediates frequently involved in cases of dermatitis. Finally, extracts applied to healthy skin, failed to produce any irritation whatever, indicating the possibility of other sources of irritation within the industry or personal idiosyncrasies.

Severe irritation to the skin and eyes was suffered by naval personnel coiling a submarine cable which had been laid between Rottnest Island and the mainland. An examination of a section of the cable showed the wrapping material to be impregnated with a brittle coal-tar pitch containing phenolic substances. Dust from the pitch apparently resulted in the observed conditions. The use of goggles and liberal application of petroleum jelly or lanoline to the exposed parts were recommended.

The examination of materials used in process engraving and an inspection of premises carrying out the work failed to disclose any serious hazard or discomfort which could not be overcome by efficient ventilation.

Air from Coal Mines.

Samples of air from several localities in a coal mine where a fire had occurred some time previously were examined to ascertain if, and to what extent, vitiation of the air existed.

The analyses showed the samples to be relatively pure and free from vitiation by products of combustion.

Coking of Collie Coal.

Samples of gas and tar produced during an experimental coking test on Collie coal by Mr. E. C. Fox were tested for the Department of Industrial Development.

No details of the process were given relating to the preparation of the charge or the temperature and duration of preheating before the mass started to gasify.

As no means were available of estimating the total yield of gas, the gas samples taken were in the nature of grab samples taken shortly after gassing, midway through the gassing period and towards the end.

From the analysis of the gas the calorific value was calculated.

Period after gassing commenced.	Calculated Calorific Value (B. Th. U. gross per cubic ft. at 60°F. and 30 in.)
15 minutes	393
35 minutes	397
45 minutes	332

The tar produced was weighed and subjected to a partial analysis.

Explosives.

Owing to a shortage of commercial explosives representations were made by certain organisations to purchase surplus military explosives for use underground.

The use of ammonal was suggested for this purpose, a sample of which explosive submitted by the Chief Inspector of Explosives was found to contain ammonium nitrate, trinitrotoluene, aluminium and carbon.

The "oxygen balance" of the several constituents of ammonal calculated from the analysis, showed a large deficiency of oxygen for complete combustion, which would result in the formation of considerable amounts of carbon monoxide and consequently made it unsafe to use underground.

Wood and Wood Products.

Twenty-five samples of timber were submitted by the Forests Department for the purpose of establishing the identity of the samples by analysis. The determination of ash and alkalinity of ash and selected chemical tests were used as a means of differentiating between karri and jarrah.

In the majority of samples the identification of the samples was clearly indicated but figures for ash and alkalinity of ash in a few exceeded the range previously recorded for jarrah, although other chemical tests confirmed the timbers as jarrah.

For the purpose of establishing the initial preservatising process used on karri timber removed from Fremantle Harbour, samples were submitted by the State Saw Mills.

The original processes in use were Powellising (a molasses and arsenic mixture) and Fluarising (mainly sodium fluoride with a small quantity of arsenic and dinitrophenol).

Residual quantities of arsenic found in the timber and no trace of fluorine indicated that the timber had been treated by the Powellising process.

Natural Products.

A sample of ambergris found on the beach some 20 miles south of Mandurah weighing over 7 pounds, was submitted for identification. This proved to be genuine grey ambergris which is reputed to be the best quality for the purpose of perfumery.

Other specimens of marine flotsam submitted for identification bore no resemblance to any of the forms of ambergris.

A deposit forwarded from Laverton was found to be a typical dung bitumen—the inspissated water extract of bat or marsupial guano.

Various materials were submitted as possible sources of mineral oil. None of them gave any indication of petroleum or its residuums.

Lubricating Oils.

A sample of oil which a private investigator had reported as having been contaminated with sugar was submitted for confirmation by analysis.

Oils from Government departments were examined to determine cause of faulty performances or deterioration and for comparison with new oils or the accepted Government tender.

A number of brake fluids from a motor assembly factory suspected to have been accidentally contaminated were tested qualitatively for the presence of mineral oil. The tests indicated only one sample as containing mineral oil.

Miscellaneous Samples.

Amongst the miscellaneous samples was a preparation containing methyl violet for colouring beer-drip trays, Cheecol—a preparation for increasing the fluidity of cement, a residue from petrol tank, bituminous material, paints, mineral turpentine, casein glue, leather and mallet bark.

CHEMICAL SEWAGE CONTROL.

Weekly.

Routine control consisted of weekly inspections of the Subiaco and Swanbourne treatment works together with samples taken for reaction (pH), solids in suspension and combustible matter in sludge. The Fremantle works which is on the septic tank principle with no controlled sludge digestion was not regularly visited.

Owing to the continued occurrence of high suspended solids in the supernatant liquor at Swanbourne treatment works, another secondary sedimentation tank was built and connected in series with the first on June 13th. The results obtained have been disappointing and it is hoped that the commissioning of the new digester, now under construction, will overcome some of the vagaries in operation. The possibilities of two-stage sludge digestion which is the established practice in many plants in Australia and abroad, is also under examination for local adoption. At the Subiaco treatment works digesters 1 and 2 have been so connected that increments of raw sewage into No. 2 (designated the primary digester) result in the displacement of an equal volume of partially digested sludge into No. 1 (designoted the secondary digester). Contrary to expectations the first noticeable effect was an improved primary supernatant liquor and a poor secondary one.

At both treatment works there appears to be a definite, though broad, effect of temperature on reaction over the summer months, digester fractions are higher in reaction than during winter. Effluents from sedimentation tanks, however, do not exhibit any such relationship.

Flies are not now troublesome at either plant.

Ocean Outfall Survey.

The survey, aimed at determining the extent of ocean pollution by sewage effluents, was conducted along the usual lines at the end of April.

During the ocean sampling a variable land breeze prevailed, later veering to north-west with rougher conditions. Samples for chemical analysis were taken at each surveyed position and small samples for bacteriological examination, together with a reference sample of unpolluted water far removed from the outfall and free from seaweed, etc.

Shore samples were collected later at positions up to 2,000 feet north and south of the outfall.

The extent of pollution was again demonstrated to fan out only some hundreds of feet from the outfall in the direction away from the prevailing wind.

Beach Surveys.

Another survey for the purpose of determining whether pollution of ocean beaches occurred was made during the summer.

It was planned to take samples at these beaches under the influence of a south-westerly wind—the normal "sea-breeze" of the metropolitan area.

The breeze from this quarter was manifest during the taking of samples from beaches northwards of Swanbourne. Samples were taken at 26 localities from Marmion Beach to Robb's Jetty.

No evidence of pollution occurred except at the unfrequented beach adjacent to the Perth sewage outfall and the Fremantle outfall at Robb's Jetty.

Trade Wastes.

With the return to more normal trade conditions more attention is being paid to the disposal of factory wastes.

Inspections were made and samples taken at a vegetable processing factory. The liquid wastes showed high figures for biochemical oxygen demand and suspended solids. The high suspended solids was largely due to the inability of the sedimentation tank to deal with surge flows.

Owing to the known deleterious effect of hexavalent chromium on sewage treatment, the wastes before and after passage through a neutraliser in a chromium plating plant were examined for this and other metals. In addition to a relatively high concentration of chromium, the presence of cyanide in the waste also constituted a potential hazard.

The waste from a plant dealing with forests' products running into a creek was examined for the Fisheries Department as to its possible effect on fish life. The high avidity for oxygen and the presence of acids and phenols would make this effluent particularly deleterious to fish unless a very considerable degree of dilution could be obtained.

A report was also submitted to the Commissioner of Public Health on the wastes from photographic establishments. Whilst the complicated nature of the various baths rendered chemical treatment difficult it was considered that the large volume of washing water used reduced the harmful action of chemicals to almost neglible proportions.

To become cognisant with the latest information and established practice in trade waste disposal in the Eastern States and particularly with reference to wool scouring wastes, Mr. F. F. Allsop, Analyst and Research Officer of this Division in company with Mr. Morison of the Metropolitan Water Supply and Sewerage Department visited Adelaide and Melbourne in the latter part of the year. Valuable contacts were made and first-hand information obtained on sewage treatment and disposal processes, hydrogen sulphide problems and trade effluents generally which will be of inestimable value in dealing with problems associated with similar undertakings in Western Australia.

FOODS, DRUGS, TOXICOLOGY AND INDUSTRIAL HYGIENE DIVISION.

Source and description of samples received during the year 1946

	Department of Public Health	Police Coroner	Police—Criminal Investigation Branch	Police—Liquor Inspection Branch.	Government Stores Department and Tender Board	Department of Agriculture.	Department of Industrial Development.	Hospital.	Chief Inspector of Factories.	Metropolitan Water Supply, Sewerage and Drainage Department.	State Mining Engineer.	Superintendent of State Batteries.	Department of Works and Labour.	Fisheries Department.	Mines Department — Explosives Branch.	Children's Hospital.	Crown Law Department.	Free.	Pay—Public.	Pay—Forests Department.	Pay—Western Australian Government Railways.	Pay—Royal Australian Navy.	Pay—Department of the Army.	Pay—Aeronautical Inspection Directorate.	Pay—State Saw Mills.	Departmental—Director Government Chemical Laboratories.	Total.
Foods—																											
Cows' Milk	65	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	3	....	....	407	476
Butter	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Honey	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Marmalade	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Self-Raising flour	4	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
Tea	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Tinned Salmon	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
Meat	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Diabetic Bread	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Vinegar	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Tomato Sauce	4	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Cordial fruit syrup	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Apples	....	....	....	....	....	15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	15
Oranges	....	....	....	....	....	312	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	312
Potatoes	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	3
Tomatoes	....	....	....	....	....	10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10
Vegetables (sprayed)	3	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Powdered Milk	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1
Baking Powder	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	6
Jam	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2
Salt	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1
Bread and Dough	....	....	....	....	....	....	....	....	9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9
Fish: Sea Pilchard	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1
Fish: Sprats	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1
Insecticides and Fungicides—																											
Preparations	2	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	4	....	....	....	....	....	....	....	9
Linseed	....	....	....	....	....	31	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	31
Drugs and Medicines—																											
Ether	4	....	....	....	22	....	....	11	....	....	....	....	....	....	....	1	....	....	1	....	....	....	....	....	....	....	39
"Smokova"	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Clements Tonic	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Three syrups	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Capsules of liquid	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Pills and fluid	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Human Toxicology—																											
Specimens and exhibits	4	126	6	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	139
Anaesthetics	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Animal Toxicology—																											
Specimens	....	....	....	....	....	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12
Dog Food	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Cattle Dip	....	....	....	....	....	18	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	18
Criminal—																											
Racehorse case (Kalgoorlie)	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Indecent dealing (Gadsden)	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Attempted suicide	....	....	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	
Abortion case	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	
Felt hat (stains)	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	

Assault charge	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Suspected poisoning	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Water (? Poison)	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Whisky (? Poison)	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Industrial Toxicology and Hazard—																												
Hair and nails	....	....	....	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
Urine	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	35	....	....	....	....	41
Rubber face mask	....	....	....	....	....	....	....	....	....	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Thinners	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Iron cable and dust	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	2
Leather, scrappings and bloom	....	....	....	....	....	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Spray paint	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Liquid cleaning fluid	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Developing fluid	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Air from coal mine	....	....	....	....	....	....	....	....	....	....	....	8	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8
Sewage—																												
Weekly routine	....	....	....	....	....	....	....	....	....	....	1233	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,233
Trade Waste	....	....	....	....	....	....	....	....	....	....	5	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	6
Photographic effluent (Perth Hospital)	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Ocean water and effluent	....	....	....	....	....	....	....	....	....	....	72	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	72
Water	....	....	....	....	....	....	....	....	....	....	25	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	25
Liquors—																												
Wine	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Cider	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Oil—																												
Olive oil	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Lubricating	....	....	....	....	....	....	....	....	....	....	....	....	1	2	....	....	....	....	....	1	....	....	....	....	....	....	....	4
Putitive petroleum	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	1	....	....	....	....	....	....	....	3
Brake fluid	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	....	....	....	....	....	....	....	6
Mineral turpentine	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Ambergris	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	1
Supposed Ambergris	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	1
Human Milk	....	....	....	26	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	27
Coking Experiments—																												
Gas	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Tar	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Wood and Wood Products—																												
Timber	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	25	....	....	....	....	....	....	25
Preservatised timber	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	3
Explosives—																												
Ammanol	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1
Biochemical Work—																												
Blood	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Intervertebral disks	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	....	....	....	....	....	....	....	6
Miscellaneous—																												
Mist Senega et Ammon.	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Vi-met compound	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Distilled water	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Chemicals	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
White powder	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Cheecol	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Bituminous material	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Lime	....	....	....	....	....	....	....	....	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Paint	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Pitch-like material	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	1
Dung bitumen	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	1
Casein glue	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1
Residue ex petrol filter	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1
Leather	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1
Mallet Bark	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1
	166	130	32	5	22	408	4	14	18	1340	8	6	11	3	1	1	1	6	27	25	35	2	3	2	3	416	2,689

APPENDIX—ORANGE SURVEY.

ANALYTICAL FIGURES FOR NAVEL AND VALENCIA ORANGES GROWN IN THE BINDOON-SWAN, MUNDARING, KALAMUNDA, KELMSCOTT, HARVEY, DONNYBROOK-CAPEL (VALENCIAS ONLY), DISTRICTS.

DATE OF COLLECTION — 6TH MAY, 1946.

Grower	Ogden	Sandow	Perich	Newman Bros.	Goode	Mitton	Lemmey	Cos grave-	Annetts	Logie and Son	Pinti	Martin	Samp-son	Madd-erson	Page	Blakeney and Son	Dutton	Brown	Irvine	Simpson	Smith	Stan-ford
District	Bindoon	Bindoon	Millen-don	Millen-don	Mun-daring	Sawyer's Valley	Sawyer's Valley	Parker-ville	Carmel	Kala-munda	Forest-field	Forest-field	Maida Vale	Maida Vale	Gosnells	Kelms-cott	Arma-dale	Arma-dale	Keys-brook	Pinjarra	Harvey	Harvey
Soil	Red to to Black Loam	....	Heavy to Sandy Loam	Heavy to Sandy Loam	Red Loam	Gray Sandy Loam	Light Gray Sandy Loam	Red Loam and Gravel	Grav-elly Loam	Grav-elly Loam.	Sandy Loam	Sandy Loam	Light Gravelly Loam	Sandy	Gravelly and Sandy Loam	Dark Choco-late	Gray Clay	Gray Clay	Red Loam and Gravel	Light to Sandy Loam	Rich River Loam	Good Loam
Subsoil	Clay	....	....	....	Free	....	Red Loam	....	Gra-velly Clay	Gravel and Yellow Clay	Friable Little Gravel	Yellow Sand	Friable Sand and Clay	Yellow Sandy Gravel Little Clay	Clay	Loam very Deep	Sandy Loam	Sandy Loam	....	Sandy Loam	....	Light Clay
Irrigation	....	....	Not Irri-gated	Irri-gated	Irri-gated	Not Irri-gated	Not Irri-gated	Irri-gated	Irri-gated	Irri-gated	Not Irri-gated	Irri-gated	Not Irri-gated	Irri-gated	Not Irri-gated	Irri-gated	Not Irri-gated	Irri-gated	Not Irri-gated	Not Irri-gated	Irri-gated	Irri-gated
Variety	NAVEL-ENCIAS	WASHINGTON NAVEL																				
Colour	Slightly green	Ripe	Ripe	Ripe	Slightly green	Slightly green	Slightly green	Slightly green	Green	Slightly green	Slightly green	Very slightly green	Slightly green	Ripe	Slightly green	Slightly green	Slightly green	Slightly green	Slightly green	Ripe	Ripe	Slightly green
Size, inches	2¾	3–3¼	2½–2¾	2¾–3	2¼–2½	2¼–2½	2¼–2½	2½	2½–2¾	2½	2¼	2¾	2½–2¾	3	2½–2¾	2½	2¼	2¼	2¼–2½	2½–2¾	2¾	2¼–2½
Taste	Sour	Slightly sour	Tart	Tart	Slightly sour	Slightly sour	Slightly sour	Sour	Slightly sour	Sour	Tart	Very Slightly sour	Slightly sour	Sweet	Tart	Tart	Tart	Sweet	Tart	Swee	Sweet	Slightly sour
Weight of 16 fruits, grams	2863	3061	2197	2920	2098	2098	2126	2353	2183	2013	1815	2722	2353	3261	2722	2183	1985	2041	2240	2466	2892	2240
Volume of Juice, ml.	960	1280	860	1340	800	760	820	900	750	680	560	1140	820	1410	1170	970	840	680	800	1200	1320	1080
% Juice v/w.	33·5	41·8	39·1	45·9	38·1	36·2	38·6	38·3	34·4	33·8	30·9	41·9	34·8	43·2	43·0	44·4	42·3	33·3	35·7	48·7	45·6	48·2
Analysis of juice strained through linen 45 threads to the inch.																						
Specific Gravity 15·5° C.	1·044	1·041	1·054	1·049	1·045	1·050	1·045	1·046	1·040	1·045	1·054	1·038	1·048	1·040	1·041	1·041	1·048	1·045	1·037	1·043	1·042	1·042
Equivalent to °Brix	10·9	10·2	13·3	12·1	11·2	12·3	11·2	11·4	9·9	11·2	13·3	9·5	11·9	9·9	10·2	10·2	11·9	11·2	9·3	10·7	10·4	10·4
Acidity (ml N/10 soda per 10 ml juice)	29·1	29·1	30·2	26·8	33·1	32·7	34·5	30·0	23·4	25·8	27·0	25·8	31·8	19·9	36·7	22·3	24·5	25·8	30·5	28·0	30·6	27·1
Vitamin C (mgm ascorbic acid per 100 ml)	71	70	75	60	74	69	67	69	58	62	70	67	69	56	80	60	67	63	78	60	74	69
Sugars, as invert sugar, % w/v.	7·9	7·5	12·2	9·6	9·7	10·1	8·9	8·4	7·0	7·3	10·1	6·8	10·0	8·3	7·3	8·5	9·4	8·6	6·2	8·7	8·6	8·3

DATE OF COLLECTION—20TH MAY, 1946

wer	Ogden	Sandow	Perich	Newman Bros.	Goode	Mitton	Lemmey	Cos-grave	Annetts	Logie and Son	Pinti	Martin	Samp-son	Madder-son	Page	Blakeney and Son	Dutton	Brown	Irvine	Simpson	Smith	Stan-ford
riet	Bindoon	Bindoon	Millen-don	Millen-don	Mun-daring	Sawyer's Valley	Sawyer's Valley	Parker-ville	Carmel	Kala-munda	Forest-field	Forest-field	Maida-Vale	Maida-Vale	Gosnells	Kelm-scott	Arma-dale	Arma-dale	Keys-brook	Pin-jarra	Harvey	Harvey
Variety	NAVEL-ENCIAS	WASHINGTON NAVEL																				
Colour	Slightly green	Ripe	Slightly green	Slightly green	Ripe	Ripe	Ripe	Slightly green	Slightly green	Slightly Green	Slightly Green	Slightly Green	Slightly Green	Slightly Green	Slightly Green	Slightly Green	Slightly Green	Slightly Green	Green	Slightly Green	Ripe	Very Slightly Green
Size, inches	2½–3¼	3	2¾–3	2¾–3	2½–2¾	2¼–2½	2½–2¾	2½–2¾	2½ 2¾	2½–2¾	2½	3	2½	3–3¼	3	2½–2¾	2¼	2½–2¾	2½–2¾	2½–2¾	2¾	2½
Taste	Slightly Sour	Slightly Sour	Sweet	Tart	Sweet	Sweet	Slightly Sour	Slightly Sour	Slightly Sour	Tart	Tart	Slightly Sour	Tart	Sweet	Slightly Tart	Sweet	Sweet	Slightly Sour	Sour	Tart	Sweet	Slightly Tart
Weight of 16 fruits, grams	3062	3090	3118	2977	2410	2041	2297	2325	2410	2212	2183	3289	2382	3515	3317	2325	2070	2155	2438	2325	2835	2325
Volume of juice, ml.	1130	1405	1205	1310	870	740	820	725	800	790	660	1515	1010	1570	1505	1060	810	760	920	1030	1240	960
% juice v/w.	36·9	45·5	38·6	44·0	36·1	36·3	35·7	31·2	33·2	35·7	30·2	46·1	42·4	44·7	45·4	45·6	39·1	35·3	37·7	44·3	43·7	41·3
Analysis of juice strained through linen 45 threads to the inch.																						
Specific Gravity, 15·5° C.	1·041	1·041	1·058	1·046	1·053	1·053	1·042	1·043	1·041	1·041	1·048	1·040	1·051	1·043	1·041	1·042	1·048	1·048	1·037	1·047	1·048	1·046
Equivalent to ° Brix	10·2	10·2	14·2	11·4	13·0	13·0	10·4	10·7	10·2	10·2	11·9	9·9	12·6	10·7	10·2	10·4	11·9	11·9	9·3	11·7	11·9	11·4
Acidity (ml N/10 soda per 10 ml. juice)	28·8	26·9	26·5	24·2	32·2	31·9	31·1	28·1	21·1	24·5	22·5	21·5	29·3	18·3	32·1	19·6	24·2	23·1	29·7	26·0	32·0	25·8
Vitamin C (mgm. ascorbic acid per 100 ml.)	71	74	67	63	81	69	70	70	61	57	65	64	68	57	75	57	62	61	74	60	80	69
Sugars, as invert sugar % w/v.	8·9	7·8	12·7	9·8	10·9	11·1	8·2	8·9	8·4	7·8	10·1	7·7	10·0	8·6	7·9	8·7	10·1	9·0	6·8	9·7	9·7	9·1

DATE OF COLLECTION—3RD JUNE, 1946.

Grower	Ogden	Sandow	Perich	Newman Bros.	Goode	Mitton	Lemmey	Cos-grave	Annetts	Logie and Son	Pinti	Martin	Samp-son	Madd-erson	Page	Blakeney & Son	Dutton	Brown	Irvine	Simpson	Smith	Stan-ford
District	Bin-doon	Bin-doon	Millen-don	Millen-don	Mun-daring	Sawyer's Valley	Sawyer's Valley	Parker-ville	Carmel	Kala-munda.	Forest-field.	Forest-field.	Maida Vale.	Maida Vale.	Gosnells	Kelm-scott.	Arma-dale.	Arma-dale.	Keys-brook.	Pin-jarra.	Harvey	Harvey
Variety	NAVEL-ENCIAS	WASHINGTON NAVEL																				
Colour	Ripe	Ripe	Ripe	Slightly Green	Ripe	Ripe	Slightly Green	Ripe	Ripe	Very Slightly Green	Very Slightly Green	Ripe	Slightly Green	Ripe	Ripe	Very Slightly Green	Ripe	very Slightly Green	Slightly Green	Ripe	Ripe	Ripe
Size, inches	3	3	2½–2¾	2¾–3¼	2½	2½	2½	2½	2¼–2½	2½	2¼	2¾–3	2½	2¾–3¼	3	2¼–2½	2½	2½	2½–2¾	2½	2¾	2¼–2½
Taste	Sweet	Sweet	Tart	Sweet	Tart	Sweet	Tart	Sweet	Sweet	Sweet.	Sweet.	Sweet	Sweet	Sweet	Tart	Sweet	Sweet	Sweet	Tart	Slightly Tart	Slightly Tart	Sweet
Weight of 16 fruits, grams	3260	3317	2660	3540	2440	2210	2295	2325	2210	2155	2070	2950	2580	3540	3317	2380	2183	2495	2722	2523	2950	2380
Volume of Juice, ml.	1110	1490	1080	1630	870	800	820	750	830	845	710	1370	1170	1600	1440	1120	830	995	1075	1130	1290	1075
% juice v/w	34·1	44·8	40·6	46·1	35·7	36·2	35·7	32·2	37·5	39·2	34·3	46·4	45·3	45·1	43·5	47·1	38·0	39·9	39·5	44·7	43·7	45·1
Analysis of juice strained through linen 45 threads to the inch.																						
Specific gravity 15·5° C	1·044	1·039	1·050	1·048	1·044	1·051	1·043	1·042	1·038	1·038	1·048	1·043	1·049	1·041	1·042	1·044	1·046	1·044	1·038	1·042	1·047	·042
Equivalent-to ° Brix	10·9	9·7	12·4	11·9	10·9	12·6	10·7	10·4	9·5	9·5	11·9	10·7	12·1	10·2	10·4	10·9	11·4	10·9	9·5	10·9	11·6	10·4
Acidity (ml. N/10 soda per 10 ml. juice)	25·5	25·8	26·7	23·1	27·7	29·6	25·7	25·0	20·9	23·0	20·1	20·3	26·0	16·7	28·4	18·7	22·2	19·1	25·2	23·5	27·1	21·0
VitaminC(mgm.ascorbicacidper100ml.)	73	70	79	60	78	72	68	69	63	61	70	64	69	53	73	56	62	61	75	59	73	64
Sugars, as invert sugar % w/v	8·1	7·6	11·1	10·1	9·6	10·6	8·0	8·7	8·7	8·0	9·8	7·4	10·2	8·2	7·4	8·9	9·6	9·1	7·1	9·4	9·6	8·4

DATE OF COLLECTION—17TH JUNE, 1946.

Grower.	Ogden.	Sandow.	Perich.	Newman Bros.	Goode.	Mitton.	Lemmey.	Cos-grave.	Annetts	Logie & Son.	Pinti.	Martin.	Samp-son.	Madder-son.	Page.	Blakeney & Son.	Dutton	Brown	Irvine.	Simp-son.	Smith.	Stanford.
District	Bin-doon.	Bin-doon.	Millen-don.	Millen-don.	Mun-daring.	Sawyer's Valley.	Sawyer's Valley.	Parker-ville.	Carmel.	Kala-munda.	Forest-field.	Forest-field.	Maida Vale.	Maida Vale.	Gosnells.	Kelm-scott.	Arma-dale.	Arma-dale.	Keys-brook.	Pinjarra.	Harvey.	Harvey.
Variety	NAVEL-ENCIAS	WASHINGTON NAVEL																				
Colour	Ripe.	Ripe.	Ripe.	Slightly green.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Slightly green.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.
Size, inches	2¼–3	3	2¾	3–3½	2¾	2½–2¾	2¾	2¾	2½–2½	2½	2–2½	2½–2¾	2–3	2¾–3	3¼–3½	2¾	2½–2¾	2¾	2½	2½	2¾–3	2½–2¾
Taste	Sweet	Sweet	Sweet	Sweet	Slightly tart	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet
Weight of 16 fruits, grams	3203	3430	2835	4110	2580	2240	2495	2523	2268	2410	2211	2977	2722	3175	4026	2665	2381	2637	2580	2495	3115	2495
Volume of juice, ml.	1060	1380	1180	1820	900	730	980	1000	810	890	720	1360	1120	1420	1750	1200	1050	1000	940	1150	1320	1000
Percentage juice, v/w.	33·1	40·2	41·6	44·3	34·9	32·6	39·3	39·6	35·7	36·9	32·6	45·7	41·1	44·7	43·5	45·0	44·1	37·9	36·4	46·1	42·4	40·1
Analysis of juice strained through linen 45 threads to the inch																						
Specific gravity 15·5°C	1·045	1·042	1·058	1·045	1·042	1·051	1·040	1·041	1·043	1·042	1·041	1·041	1·050	1·044	1·041	1·044	1·047	1·044	1·039	1·047	1·048	1·044
Equivalent to ° Brix	11·2	10·4	14·2	11·2	10·4	12·6	9·9	10·2	10·7	10·4	10·2	10·2	12·3	10·9	10·2	10·9	11·7	10·9	9·7	11·7	11·9	10·9
Acidity (ml. N/10 soda per 10 ml. juice)	25·1	23·8	23·9	21·6	27·1	28·6	22·1	23·3	19·1	20·4	16·9	19·7	25·5	15·2	23·2	16·0	21·1	19·9	25·0	22·0	26·5	20·4
Vitamin C (mgm. ascorbic acid per 100 ml.)	75	69	69	57	72	65	61	70	61	58	68	60	64	51	73	56	62	57	75	59	74	67
Sugars, as invert sugar, percentage w/v	7·8	8·1	12·5	9·1	9·3	10·1	7·8	7·7	8·7	8·2	9·0	7·9	10·4	8·4	8·0	8·9	9·7	8 ·5	7·1	9·2	8·8	8·5

DATE OF COLLECTION 1ST JULY, 1946.

Grower	Ogden.	Sandow.	Perich.	Newman Bros.	Goode.	Mitton.	Lemmey.	Cos-grave.	Annetts.	Logie & son.	Pinti.	Martin.	Samp-son.	Madder-son.	Page.	Blakeney & son.	Dutton	Brown	Irvine.	Simp-son.	Smith.	Stanford.
District	Bin-doon.	Bin-doon.	Millen-don.	Millen-don.	Mun-daring.	Sawyer's Valley.	Sawyer's Valley.	Parker-ville.	Carmel.	Kala-munda.	Forest-field.	Forest-field.	Maida Vale.	Maida Vale.	Gosnells.	Kelm-scott.	Arma-dale.	Arma-dale.	Keys-brook.	Pinjarra.	Harvey.	Harvey.
Variety	NAVEL-ENCIAS	WASHINGTON NAVEL																				
Colour	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Very Slightly green.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.
Size, inches	3¼	3	2¾–3	3–3½	2¾	2½	2¾	2¾–3	2¼–2¾	2½–2¾	2½–2¾	2¾–3	2½–2¾	2¾–3	3¼–3¾	2½	2½	2¾	2½	2¼–2½	3	2½–2¾
Taste	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet
Weight of 16 fruits, grams	3742	3401	3232	4082	2637	2325	2495	2636	2524	2208	2721	3145	2903	3090	4167	2495	2495	2722	2495	2523	3345	2722
Volume of juice, ml.	1000	1280	1305	1740	840	780	880	890	890	840	1040	1480	1300	1450	1755	1135	1040	1100	1125	1205	1410	1080
Percentage of juice, v/w.	26·7	37·6	40·4	42·6	31·9	33·6	35·3	33·8	35·3	38·0	38·2	47·1	44·8	46·9	42·1	45·5	41·7	40·4	45·1	47·8	42·1	39·7
Analysis of juice strained through linen 45 threads to the inch.																						
Specific gravity 15·5°C	1·038	1·040	1·053	1·051	1·042	1·047	1·040	1·043	1·042	1·043	1·042	1·038	1·049	1·041	1·042	1·040	1·048	1·043	1·039	1·048	1·048	1·048
Equivalent to ° Brix	9·5	9·9	13·0	12·6	10·4	11·6	9·9	10·6	10·4	10·6	10·4	9·5	12·1	10·2	10·4	9·9	11·9	10·6	9·7	11·9	11·9	11·9
Acidity (ml. N/10 soda per 10 ml. juice)	23·5	23·3	24·8	20·0	24·7	27·9	20·6	22·0	19·8	18·2	18·6	18·4	25·3	14·4	23·4	15·4	19·5	17·9	25·1	22·5	25·0	19·4
Vitamin C (mgm. ascorbic acid per 100 ml.)	74	68	80	57	79	68	64	69	62	62	70	62	66	46	74	57	63	63	78	61	74	66
Sugars as invert sugar, percentage w/v.	8·2	6·7	9·0	8·5	8·3	8·8	7·6	7·7	8·0	7·4	8·4	6·8	7·7	7·0	6·6	7·6	8·3	7·8	6·7	9·0	8·5	7·5

DATE OF COLLECTION—29th JULY, 1946.

Grower	Ogden	Sandow	Perich	Newman Bros.	Goode	Mitton	Lemmey	Cosgrave	Annetts	Logie & Son	Pinti	Martin	Sampson	Madderson	Page	Blakeney & Son	Dutton	Brown	Irvine	Simpson	Smith	Stanford
District	Bindoon	Bindoon	Millendon	Millendon	Mundaring	Sawyer's Valley	Sawyer's Valley	Parkerville	Carmel	Kalamunda	Forestfield	Forestfield	Maida Vale	Maida Vale	Gosnells	Kelmscott	Armadale	Armadale	Keysbrook	Pinjarra	Harvey	Harvey
Variety	NAVELENCIAS	WASHINGTON NAVEL																				
Colour	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe
Size, inches	3	3¼	3¼	3¼	2½–2¾	2½	2½–2¾	2½–2¾	2½–2¾	2½–2¾	2½–2⅞	2½–2¾	2¼–3	3–3¼	2¾–3½	2½–2¾	2½	2½–2¾	2½	2¼–2¾	2¾	2½
Taste	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet
Weight of 16 fruits, grams	3430	3715	3743	3630	2720	2380	2665	2690	2380	2380	2780	2977	2950	3760	4020	2950	2780	2920	2470	2660	3090	2440
Volume of juices. ml.	1120	1400	1660	1690	900	840	1080	1000	760	850	1030	1400	1320	1740	1685	1280	1070	1140	960	1220	1170	1060
Per cent juice w/v	32·7	37·7	44·3	46·6	33·1	35·3	40·5	37·2	31·9	35·7	37·1	47·0	44·7	46·3	41·9	43·4	38·5	39·0	38·9	45·9	37·8	43·4
Analysis of juice strained through linen 45 threads to the inch.																						
Specific gravity 15·5°C	1·041	1·041	1·052	1·049	1·046	1·047	1·044	1·042	1·036	1·041	1·041	1·041	1·052	1·038	1·042	1·045	1·051	1·043	1·038	1·051	1·049	1·045
Equivalent to ° Brix	10·2	10·2	12·8	12·1	11·4	11·6	10·9	10·4	9·0	10·2	10·2	10·2	12·8	9·5	10·4	11·2	12·6	10·7	9·7	12·6	12·1	11·2
Acidity (ml. N/10 soda per 10 ml. juice)	17·6	21·1	23·3	18·7	22·5	24·1	20·1	18·8	16·1	14·9	14·6	15·8	19·8	13·4	22·1	13·0	16·7	15·4	20·1	19·5	20·6	15·1
Vitamin C (mgm. ascorbic acid per 100 ml)	74	72	80	56	72	66	65	61	60	60	61	61	60	45	74	52	58	57	76	58	76	61
Sugars as invert sugar, per cent. w/v	9·0	7·0	9·6	9·1	7·8	8·5	7·3	6·9	7·3	8·4	8·5	7·5	10·1	7·1	8·4	9·3	9·5	8·4	7·9	10·3	9·7	9·0

DATE OF COLLECTION—26TH AUGUST, 1946.

Grower	Ogden.	Perich.	Newman Bros.	Goode.	Mitton.	Lemmey.	Cosgrave.	Annetts.	Logie & son.	Pinti.	Sampson.	Maddersson.	Page.	Blakeney & son.	Dutton.	Brown.	Irvine.	Simpson.	Smith.	Stanford.
District	Bindoon.	Millendon.	Millendon.	Mundaring.	Sawyer's Valley.	Sawyer's Valley.	Parkerville.	Carmel.	Kalamunda.	Forestfield.	Maida Vale.	Maida Vale.	Gosnells.	Kelmscott.	Armadale.	Armadale.	Keysbrook.	Pinjarra.	Harvey.	Harvey.
Variety	NAVELENCIAS	WASHINGTON NAVEL																		
Colour	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.
Size, inches	2½	2¾	3–3½	2¾	2½–2⅞	2¾	2½	2¾–3	2½–2¾	2¾	2½	3¼–3¾	3–3¾	2¾	2¾	2¾–3	2¾–3	2½	2¾	2¾
Taste	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet
Weight of 16 fruits, grams	2495	2892	4253	2778	2382	2637	2495	3204	2665	2835	2608	4735	4310	2935	2720	3232	3120	2550	2948	2948
Volume of juice, ml.	1130	1050	1850	835	740	1040	920	960	920	1140	1070	1900	1740	1195	1090	1240	1120	1020	1120	1340
Percentage juice, v/w.	45·3	36·3	43·5	30·1	31·1	39·4	36·9	30·0	34·5	40·2	41·0	40·1	40·4	40·7	40·1	38·4	35·9	40·0	38·0	45·4
Analysis of juice strained through linen 45 threads to the inch.																				
Specific gravity 15·5°C	1·042	1·048	1·047	1·044	1·047	1·043	1·042	1·042	1·041	1·043	1·053	1·040	1·043	1·046	1·050	1·047	1·038	1·057	1·051	1·047
Equivalent to ° Brix	10·4	11·9	11·7	10·9	11·7	10·7	10·4	10·4	10·2	10·7	13·0	9·9	10·7	11·4	12·3	11·7	9·5	14·0	12·6	11·7
Acidity (ml. N/10 soda per 10 ml. juice)	28·3	18·7	15·2	17·3	19·6	16·0	17·6	14·3	12·2	12·3	20·5	10·7	18·3	11·0	14·5	13·3	14·9	17·9	20·0	13·0
Vitamin C (mgm. ascorbic acid per 100 ml.)	68	65	56	75	64	66	66	59	57	54	65	49	74	50	53	54	74	62	72	59
Sugars, as invert sugar percentage w/v.	7·2	9·1	9·7	8·5	8·5	8·3	8·3	8·4	8·4	7·9	9·8	8·4	8·1	9·4	9·4	8·7	7·9	10·5	7·9	9·4

DATE OF COLLECTION— 9th SEPTEMBER, 1946.

Grower	Ogden	Sandow	Perich	Newman Bros.	Goode	Mitton	Lemmey	Cosgrave	Annetts	Logie & Son	Pinti	Martin	Sampson	Maddeson	Gordon	Blakeney	Dutton	Brown	Irvine	Simpson	Smith	Stanford	Doyle	Payne	Tichbon	Gemmell
District	Bindoon	Bindoon	Millendon	Millendon	Mundaring	Sawyer's Valley	Sawyer's Valley	Parkerville	Carmel	Kalamunda	Forestfield	Forestfield	Maida Vale	Maida Vale	Gosnells	Kelmscott	Armadale	Armadale	Keysbrook	Pinjarra	Harvey	Harvey	Capel	Cape	Argyle	Donnybrook
Variety	VALENCIA																									
Colour	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Slightly Green	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe
Size, inches	2½–2¾	2½–2¾	2¾–3	2¾–3	2½–2¾	2½	2½	2¾	2½–2¾	2½	2½	2¼–2½	2½–2¾	2¾–3	2½–2¾	2¾	2¾	2¾	2¾	2½–2¾	2½–2¾	2¾	2½	2½	2½	2½
Taste	Tart	Slightly Tart	Slightly Tart	Slightly Tart	Tart	Slightly Tart	Slightly Tart	Slightly Tart	Slightly Tart	Slightly Tart	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Slightly Tart	Sweet	Slightly Tart	Slightly Tart	Slightly Tart	Slightly Tart	Sweet	Slightly Tart	Sweet	Slightly Sour
Weight of 16 fruits, grams	2382	2325	2459	3402	2722	2380	2550	2890	2466	2098	2126	1956	2382	3289	2495	2835	2665	2608	2665	2465	2410	2835	2268	2126	2410	2126
Volume of juice, ml.	1075	1080	1820	1840	1150	1060	1200	1320	1190	880	1020	880	1230	1720	1200	1495	1320	1240	1175	1200	1140	1295	1000	1000	1000	920
Per cent juice v/w *Analysis of juice strained through linen 45 threads to the inch.*	45·1	46·4	52·6	54·1	42·2	44·5	47·1	45·7	48·3	41·9	48·0	45·0	51·6	52·3	48·1	52·7	49·5	47·5	44·1	48·7	47·3	45·7	44·1	47·0	41·5	43·3
Specific gravity 15·5° C	1·043	1·047	1·047	1·041	1·035	1·038	1·038	1·039	1·033	1·036	1·040	1·035	1·045	1·037	1·042	1·038	1·035	1·036	1·032	1·044	1·046	1·037	1·037	1·037	1·034	1·031
Equivalent to ° Brix	10·7	11·7	11·7	10·2	8·8	9·5	9·5	9·7	8·3	9·0	9·9	8·8	11·2	9·3	10·4	9·5	8·8	9·0	8·0	10·9	11·4	9·3	9·3	9·3	8·5	8·5
Acidity (ml. N/10 soda per 10 ml. juice)	28·5	28·0	25·1	20·1	22·7	28·1	27·6	22·0	19·8	17·8	17·2	16·9	22·7	17·6	24·3	16·4	16·5	16·5	23·5	24·4	24·6	16·5	21·0	25·0	25·0	26·1
Vitamin C (mgm. ascorbic acid per 100 ml.)	69	77	74	55	70	73	76	68	62	56	56	65	64	50	68	56	60	57	71	64	70	61	67	66	67	74
Sugars as invert sugar per cent. w/v	7·6	8·2	8·8	7·6	5·4	6·3	6·4	6·2	6·3	6·6	8·2	7·1	8·8	7·5	8·0	7·5	6·7	7·1	4·6	6·9	7·3	7·1	7·0	7·0	5·6	6·4

DATE OF COLLECTION—23RD SEPTEMBER, 1946.

Grower	Perich.	Newman	Goode.	Mitton.	Lemmey.	Cosgrave.	Annetts.	Logie.	Pinti.	Martin.	Sampson.	Maddeson.	Gordon.	Blakeney & sons.	Dutton.	Brown.	Irvine.	Simpson.	Smith.	Stanford.	Doyle.	Payne.	Tichbon.	Gemmell.
District	Millendon.	Millendon.	Mundaring.	Sawyer's Valley.	Sawyer's Valley.	Parkerville.	Carmel.	Kalamunda.	Forrestfield.	Forrestfield.	Maida Vale.	Maida Vale.	Gosnells	Kelmscott.	Armadale.	Armadale.	Keysbrook.	Pinjarra	Harvey	Harvey	Capel	Capel	Argyle	Donnybrook.
Variety	VALENCIA																							
Colour	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.
Size, inches	2¾	2¾–3	2¾	2½–2¾	2½–2¾	2¾	2½	2½–2½	2½–2½	2½–2½	2½	2¾–3	2½	2½–2¾	2½	2½	2½	2½	2½	2½–2¾	2½–2½	2½–2½	2½–2½	2½
Taste	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet
Weight of 16 fruits, grams	3232	3572	2864	2580	2665	2805	2552	2098	2070	2013	2466	3147	2296	2722	2580	2466	2523	2438	2438	2722	2182	2154	2098	2268
Volume of juice, ml.	1520	1840	1300	1080	1300	1260	1185	860	960	1020	1170	1720	1140	1380	1220	1125	1240	1200	1240	1360	1000	1000	975	1040
Percentagejuice,v/w. *Analysis of juice strained through linen 45 threads to the inch.*	47·0	51·5	45·4	41·9	48·8	44·9	46·4	41·0	46·4	50·7	47·4	54·6	49·6	50·7	47·3	45·6	49·1	49·2	50·9	50·0	45·8	46·4	46·5	45·9
Specific gravity 15·5°C	1·041	1·039	1·037	1·034	1·039	1·038	1·034	1·031	1·040	1·031	1·045	1·038	1·043	1·036	1·037	1·037	1·031	1·039	1·038	1·037	1·037	1·037	1·034	1·036
Equivalent to ° Brix	10·2	9·7	9·3	8·5	9·7	9·5	8·5	7·8	9·9	7·8	11·2	9·5	10·7	9·0	9·3	9·3	7·8	9·7	9·5	9·3	9·3	9·3	8·5	9·0
Acidity (ml. N/10 soda per 100 ml. juice)	·5	18·4	21·5	25·7	22·9	23·5	18·1	16·7	17·0	15·0	21·5	17·1	24·6	15·4	16·1	16·3	17·0	22·3	23·7	15·7	24·3	22·9	23·0	23·0
Vtamin C (mgm. ascorbic acid per 100 ml.)	84	58	72	69	67	72	61	53	61	62	61	48	70	56	58	59	64	64	73	61	74	59	67	69
Sugars as invert sugar percentage, w/v.	7·8	7·4	6·5	6·7	6·8	7·0	6·1	6·0	8·0	6·2	8·5	7·0	7·8	7·0	6·7	6·8	5·6	7·4	7·2	7·1	6·8	6·7	5·9	6·8

DATE OF COLLECTION—7th OCTOBER, 1946.

Grower	Sandow	Perich	Newman	Goode	Mitton	Lemmey	Cosgrave	Annetts	Logie & Son	Pinti	Martin	Sampson	Maddersson	Gordon	Blakeney & Sons	Dutton	Brown	Irvine	Simpson	Smith	Stanford
District	Bindoon	Millendon	Millendon	Mundaring	Sawyer's Valley	Sawyer's Valley	Parkerville	Carmel	Kalamunda	Forrestfield	Forrestfield	Maida Vale	Maida Vale	Gosnells	Kelmscott	Armadale	Armadale	Keysbrook	Pinjarra	Harvey	Harvey
Variety	VALENCIA																				
Colour	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe
Size, inches	2¾	2¾ to 3	2¾ to 3	2½ to 2¾	2½ to 2¾	2½ to 2¾	2½ to 2¾	2½ to 2¾	2½	2¼ to 2½	2¼ to 2½	2½	2¾ to 3	2½	2¾	2½	2½ to 2¾	2½	2½	2½	2½ to 2¾
Taste	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet
Weight of 16 fruits, grams	2690	3516	3402	2778	2552	2665	2778	2580	2155	2013	1928	2268	3345	2353	2637	2466	2552	2480	2210	2438	2510
Volume of juice, ml.	1260	1800	1840	1240	1140	1400	1320	1200	915	1040	980	1190	1675	1150	1420	1150	1220	1140	1160	1220	1240
Per cent. juice v/w.	46·8	51·2	54·1	44·6	44·7	52·5	47·5	46·5	42·5	51·7	50·8	52·5	50·1	48·9	53·8	46·6	47·8	46·0	52·5	50·0	49·4
Analysis of juice strained through linen 45 threads to the inch.																					
Specific gravity 15·5°C.	1·042	1·046	1·036	1·038	1·039	1·038	1·038	1·037	1·033	1·042	1·033	1·046	1·039	1·044	1·038	1·037	1·038	1·032	1·038	1·042	1·037
Equivalent to °Brix	10·4	11·5	9·0	9·5	9·8	9·5	9·5	9·3	8·3	10·5	8·3	11·5	9·8	10·9	9·5	9·3	9·5	8·0	9·5	10·5	9·3
Acidity (ml. N/10 soda per 10 ml. juice)	22·6	21·1	16·0	19·0	20·8	22·0	21·1	16·2	15·2	14·8	14·2	20·2	14·0	22·5	13·2	15·2	14·4	17·6	17·2	19·9	14·3
Vitamin C (mgm. ascorbic acid per 100 ml.)	84	78	61	71	66	69	69	66	57	57	61	66	48	69	57	64	61	69	59	67	63
Sugars, as invert sugar, per cent. w/v.	7·7	9·5	7·1	7·4	7·7	8·1	7·7	6·8	6·9	8·6	6·6	9·3	7·7	8·6	8·3	7·5	7·7	5·7	8·0	8·7	7·9

DATE OF COLLECTION—21st OCTOBER, 1946.

Grower	Ogden	Sandow	Perich	Newman Bros.	Goode	Mitton	Lemmey	Cosgrave	Gordon	Blakeney and Sons	Dutton	Brown	Irvine	Simpson	Smith	Stanford	Doyle	Payne	Tichbon	Gemmell
District	Bindoon	Bindoon	Millendon	Millendon	Mundaring	Sawyer's Valley	Sawyer's Valley	Parkerville	Gosnells	Kelmscott	Armadale	Armadale	Keysbrook	Pinjarra	Harvey	Harvey	Capel	Capel	Argyle	Donnybrook
Variety	VALENCIA																			
Colour	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Kipe	Ripe
Size, inches	2¼–2½	2½–2¾	2¾–3	2¾–3	2½–2¾	2½	2½–2¾	2¼	2½	2¼	2¼	2¼–2½	2½	2½	2½	2½	2¼	2¼	2¼	2–2¼
Taste	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet
Weight of 16 fruits, grams	2268	2778	3203	3232	2694	2410	2778	2694	2211	2523	2296	2325	2552	2467	2467	2580	2126	2126	2240	1956
Volume of juice, ml.	1020	1260	1600	1670	1220	1080	1360	1190	1040	1400	1120	1160	1220	1200	1200	1300	1020	1020	1080	900
% juice, v/w.	45·0	45·3	50·0	51·7	45·3	44·8	49·0	44·2	47·0	55·5	48·8	49·9	47·8	48·6	48·6	50·4	48·0	48·0	48·2	46·0
Analysis of juice strained through linen 45 threads to the inch.																				
Specific gravity 15·5°C.	1·044	1·040	1·043	1·037	1·034	1·041	1·041	1·038	1·046	1·040	1·037	1·038	1·037	1·037	1·041	1·035	1·040	1·040	1·038	1·038
Equivalent to °Brix	11·0	10·0	10·8	9·3	8·5	10·2	10·2	9·5	11·5	10·0	9·3	9·5	9·3	9·3	10·3	8·8	10·0	10·0	9·5	9·5
Acidity (ml. N/10 soda per 10 ml. juice)	19·9	21·6	20·9	16·5	16·4	22·6	19·8	19·5	22·8	13·9	14·1	14·4	13·5	14·1	20·5	13·4	20·9	21·0	20·3	19·7
Vitamin C (mgm. ascorbic acid per 100 ml.)	64	73	72	58	64	65	69	62	67	55	58	58	64	53	65	60	73	65	65	67
Sugars as invert sugar, % w/v.	8·7	7·9	8·6	7·2	7·0	8·2	8·3	7·9	8·8	8·3	7·5	8·4	6·0	8·1	8·7	7·5	8·0	8·0	7·0	7·4

DATE OF COLLECTION—4th NOVEMBER, 1946.

Grower	Ogden	Sandow	Perich	Newman Bros.	Goode	Mitton	Lemmey	Cosgrave	Annetts	Logie and Son	Pinti	Martin	Sampson	Madderson	Gordon	Blakeney and Sons	Dutton	Brown	Irvine	Simpson	Smith	Stanford	Doyle	Payne	Tichbon	Gemmell
District	Bindoon	Bindoon	Millendon	Millendon	Mundaring	Sawyer's	Sawyer's	Parkerville	Carmel	Kalamunda	Forestfield	Forestfield	Maida Vale	Maida Vale	Gosnells	Kelmscott	Armadale	Armadale	Keysbrook	Pinjarra	Harvey	Harvey	Capel	Capel	Argyle	Donnybrook
Variety	VALENCIA																									
Colour	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Slightly Green	Ripe	Slightly Green	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe	Ripe
Size, inches	2¼–2½	2½	2¾	2¾–3	2¾	2½	2½–2¾	2½–2¾	2½	2¼	2¼	2¼	2¼–2½	2¾	2¼–2½	2½	2¼–2½	2½	2¼–2¾	2½	2½	2½–2¾	2½	2½–2¾	2½–2¾	2½
Taste	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet
Wt. of 16 fruits, grams	2381	2552	2977	3289	2835	2608	2694	2778	2580	2070	2041	2070	2296	2949	2381	2552	2211	2410	2665	2580	2495	2637	2806	2580	2694	2410
Volume of juice, ml.	1080	1260	1560	1860	1180	1200	1320	1300	1300	900	1080	1120	1150	1640	1240	1400	1120	1240	1320	1300	1280	1320	1440	1200	1310	1150
% juice, v/w.	45·4	49·4	52·4	56·5	41·6	46·0	49·0	46·8	50·4	43·5	52·9	54·1	50·0	55·6	52·1	54·9	50·7	51·4	49·5	50·4	51·3	50·0	51·3	46·5	48·6	47·7
Analysis of juice strained through linen 45 threads to the inch																										
Specific gravity 15·5°C.	1·044	1·037	1·042	1·037	1·032	1·041	1·033	1·039	1·037	1·036	1·044	1·037	1·042	1·039	1·047	1·037	1·037	1·038	1·036	1·039	1·044	1·038	1·041	1·041	1·039	1·041
Equivalent to °Brix	11·0	9·3	10·5	9·3	8·0	10·3	8·3	9·8	9·3	9·0	11·0	9·3	10·5	9·8	11·8	9·3	9·3	9·5	9·0	9·8	11·0	9·5	10·3	10·3	9·8	10·3
Acidity (ml. N/10 soda per 10 ml. juice)	20·7	21·5	20·8	16·5	16·0	20·4	17·2	17·9	15·5	14·4	14·5	13·6	17·5	14·3	20·8	12·5	14·1	12·2	15·5	14·6	18·6	12·8	17·5	17·5	18·6	18·6
Vitamin C (mgm. ascorbic acid per 100 ml.)	67	86	78	56	75	64	73	78	69	57	58	62	64	53	75	58	60	58	73	60	71	66	75	67	73	71
Sugars, as invert sugar, % w/v.	8·6	7·8	8·7	7·6	6·3	8·0	7·9	7·9	7·4	7·1	9·0	7·0	8·7	8·0	9·3	7·4	7·3	7·5	6·4	7·5	8·0	7·6	7·7	7·5	7·3	7·8

DATE OF COLLECTION—2nd DECEMBER, 1946.

Grower	Ogden.	Sandow.	Perich.	Newman Bros.	Goode.	Mitton.	Lemmey.	Cosgrave.	Annetts.	Logie & Son.	Pinti.	Martin.	Sampson.	Madderson.	Gordon.	Blakeney & Sons.	Dutton.	Brown.	Irvine.	Simpson.	Smith.	Stanford.	Doyle.	Payne.	Tichbon.	Gemmell.
District	Bindoon.	Bindoon.	Millendon.	Millendon.	Mundaring.	Sawyer's Valley.	Sawyer's Valley.	Parkerville.	Carmel.	Kalamunda.	Forest-Field.	Forestfield.	Maida Vale.	Maida Vale.	Gosnells.	Kelmscott.	Armadale.	Armadale.	Keysbrook.	Pinjarra.	Harvey.	Harvey.	Capel.	Capel.	Argyle.	Donnybrook.
Variety	VALENCIA																									
Colour	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.
Size, inches	2¾ Sweet.	2½–2¾ Sweet.	2¾ Sweet.	2¾–3 Sweet.	2½–2¾ Sweet.	2½–2¾ Sweet.	2½–2¾ Sweet.	2½–2¾ Sweet.	2½ Sweet.	2¼–2½ Sweet.	2¼–2½ Sweet.	2¼–2½ Sweet.	1¾–2¼ Sweet.	2¾ Sweet.	2½ Sweet.	2½ Sweet.	2½ Sweet.	2½ Sweet.	2½–2¾ Sweet.	2½ Sweet.	2½ Sweet.	2¾ Sweet.	2½–2¾ Sweet.	2½ Sweet.	2½ Sweet.	2¼–2½ Sweet.
Taste																										
Weight of 16 fruits, grams	3062	2438	3034	3345	2665	2608	2510	2850	2381	1984	1810	2041	1332	3062	2353	2410	2410	2438	2665	2467	2325	3034	2560	2296	2381	2070
Volume of juice, ml.	1460	1120	1460	1740	1185	1210	1240	1280	1120	895	920	1080	640	1600	1200	1260	1160	1200	1260	1220	1160	1580	1280	1080	1080	920
Per cent. juice, v/w.	47·7	45·9	48·1	52·0	44·5	46·4	49·4	44·9	47·0	45·1	50·8	52·9	48·0	52·3	51·0	52·3	48·1	49·2	47·3	49·4	49·9	52·1	50·0	47·0	45·4	44·4
Analysis of juice strained through linen 45 threads to the inch.																										
Specific gravity, 15·5°C.	1·036	1·046	1·047	1·036	1·038	1·041	1·042	1·043	1·037	1·039	1·044	1·033	1·049	1·039	1·046	1·038	1·034	1·037	1·034	1·042	1·046	1·040	1·037	1·042	1·038	1·040
Equivalent to °Brix	9·0	11·5	11·8	9·0	9·5	10·3	10·5	10·8	9·3	9·8	11·0	8·3	12·0	9·8	11·5	9·5	8·5	9·3	8·5	10·5	11·5	10·5	9·3	10·5	9·5	10·0
Acidity (ml. N/10 soda per 10 ml. juice)	14·2	21·0	20·5	15·7	16·8	18·0	16·5	18·4	15·6	12·4	12·7	10·9	21·6	12·2	19·6	10·9	12·6	12·9	15·3	16·4	19·0	12·0	15·7	18·6	18·4	19·3
Vitamin C (mgm. ascorbic acid per 100 ml.)	61	76	73	53	68	64	61	68	65	53	59	56	59	40	65	50	109	51	68	59	65	53	65	65	66	70
Sugars, as invert sugar, per cent. w/v.	6·2	7·6	8·9	7·4	6·8	6·6	7·4	8·4	7·1	7·6	9·0	6·2	8·8	7·6	9·2	8·3	7·4	7·5	7·0	8·3	9·4	8·0	7·7	8·6	7·7	8·0

DATE OF COLLECTION—6th JANUARY, 1947.

Grower	Ogden.	Perich.	Newman Bros.	Goode.	Mitton.	Lemmey.	Cosgrave.	Annetts.	Logie & Sons.	Pinti.	Martin.	Sampson.	Maddersson.	Gordon.	Blakeney & Sons.	Dutton.	Brown.	Irvine.	Simpson.	Doyle.	Payne.	Tichbon.	Gemmell.
District	Bindoon.	Millendon.	Millendon.	Mundaring.	Sawyer's Valley.	Sawyer's Valley.	Parkerville.	Carmel.	Kalamunda.	Forestfield.	Forrestfield.	Maida Vale.	Maida Vale.	Gosnells.	Kelmscott.	Armadale.	Armadale.	Keysbrook.	Pinjarra.	Capel.	Capel.	Argyle.	Donnybrook.
Variety	VALENCIA																						
Colour	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.	Ripe.
Size, inches	2½–2¾	2½	2½–2¾	2½–2¾	2½	2½–2¾	2½	2½	2¼	2¼–2½	2–2½	2	3	2¼–2½	2½–2¾	2¼–2½	2¼–2½	2½–2¾	2½–2¾	2¾	2½–2¾	2¼–2¾	2¼
Taste	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.	Sweet.
Weight of 16 fruits, grams	2806	2098	2864	2778	2495	2608	2495	2381	1673	1810	1956	1360	3357	1984	2665	2381	2381	2665	2552	3006	2552	2722	1700
Volume of juice, ml.	1220	1100	1560	1160	1140	1300	1240	1160	700	860	980	720	1920	1040	1420	1180	1120	1300	1280	1600	1280	1600	840
Per cent. juice, v/w.	43·5	52·4	54·5	41·8	45·7	49·8	49·7	48·7	41·8	47·5	50·1	52·9	52·5	52·4	53·3	49·5	47·0	48·8	50·1	53·2	50·2	53·2	50·2
Analysis of juice strained through 45 threads to the inch.																							
Specific gravity, 15·5°C.	1·039	1·050	1·036	1·033	1·034	1·035	1·037	1·037	1·032	1·042	1·031	1·033	1·036	1·043	1·036	1·040	1·034	1·037	1·043	1·038	1·041	1·035	1·038
Equivalent to °Brix	9·8	12·5	9·0	8·3	8·5	8·3	9·3	9·3	8·0	10·5	7·8	9·8	9·0	10·8	9·0	10·0	8·5	9·3	10·8	9·5	10·3	8·8	9·5
Acidity (ml. N/10 soda per 10 ml. juice)	14·7	17·4	12·5	14·2	14·6	11·5	14·2	13·9	12·9	10·5	10·6	13·6	10·1	13·0	10·2	11·8	11·2	11·2	13·7	13·1	14·8	13·3	15·0
Vitamin C (mgm. ascorbic acid per 100 ml.)	60	71	52	66	55	53	59	64	49	52	50	59	39	59	53	53	48	62	60	57	53	57	55
Sugars, as invert sugar, per cent. w/v.	8·3	10·9	7·4	6·8	7·6	7·1	8·1	8·1	7·2	9·5	6·7	8·3	6·9	8·9	8·0	8·6	7·7	7·5	8·9	7·6	8·4	7·2	8·1

ANALYSIS OF COMPOSITE SAMPLES OF ORANGES FROM EACH COLLECTION BULKED IN PROPORTION TO YIELD OF JUICE.

Variety.	Washington Navel.							Valencias						
Date of collection	6·5·46	20·5·46	3·6·46	17·6·46	1·7·46	29·7·46	26·8·46	9·9·46	23·9·46	7·10·46	21·10·46	4·11·46	2·12·46	6·1·47
Total sugars (calculated as invert sugar % w/v.)	8·5	9·3	8·8	9·0	7·0	7·7	8·4	7·5	7·2	7·9	7·8	7·6	7·9	7·8
Invert sugar % w/v.	4·5	4·6	4·5	4·4	4·3	4·5	4·6	3·3	3·3	3·5	3·7	3·8	4·0	4·0
Sucrose % w/v.	3·8	4·4	4·0	4·4	2·6	3·1	3·6	4·0	3·7	4·1	4·0	3·7	3·8	3·6
Ash % w/v.	0·34	0·34	0·36	0·32	0·37	0·35	0·33	0·32	0·32	0·33	0·35	0·35	0·37	0·34
Phosphoric Anhydride (P_2O_5)% w/v.	0·043	0·036	0·039	0·033	0·032	0·031	0·039	0·033	0·036	0·037	0·033	0·033	0·038	0·035
Alkalinity of ash (mls. N/10 HCl per 100 mls. juice)	47·2	37·0	33·2	44·5	43·6	42·4	32·4	45·0	34·0	33·6	33·2	46·8	46·8	46·9
Formol titration (mls. N/10 NaOH per 100 mls. juice)	12·5	14·5	14·0	15·3	12·5	13·0	15·0	12·2	14·0	14·5	13·0	14·0	17·5	16·2

AGRICULTURAL WATER SUPPLIES AND FORESTRY DIVISION.

Annual Report for the Year Ended 31st December, 1946.

By A. J. Hoare, A.A.C.I., Senior Agricultural Chemist and Research Officer.

SOILS.

Of the 568 samples received, 559 were submitted by the Department of Agriculture from the following districts:—Coogee, Lake Saidie, Many Peaks, Kimberleys, Kojonup, Bokal, Rosedale, Congelin, Dattening, Avondale, West Beverley, Boyup Brook, Dinninup, Dwalganup, Kulikup, Muradup, Perenjori, Bowgada, Morawa, Gutha, Pindar, Beatty, Southern Cross, Welbungin, Beneubbin, Lake Brown, Mukinbudin, Chandler, Yilgarn, Ghooli, Bodallin, Hines Hill, Lake Grace, and Beverley.

A number of soils was received (86) from Many Peaks, about 28 miles east of Albany, and within two to six miles of the coast; this area was intended for settlement by ex-servicemen. The major part of the chemical work has been completed.

Soil investigations in association with research into breeding problems of sheep (Dystokia), accounted for 257 samples of soil being submitted for mechanical and chemical analyses. About 50 of these have been completed .

Soil samples representing soil conditions in the Kimberleys totalled 93, but it was not possible to do any work on these during the year.

In connection with the examination of soils associated with the growth of Pituri (Duboisia Hopwoodii), a drug plant, samples were collected between Perenjori and Pindar, also from the north-eastern wheatbelt and submitted for mechanical and chemical analyses; these also had to be left over until the next year.

Samples from Hines Hill were taken from a cultivation experiment on salt land.

Soils taken from swamp and sandy country at Coogee were in connection with the study of fertiliser requirements of cabbages. This work has been completed.

Potatoes growing on a property at Lake Saidie had a tendency to yellow and the leaves were generally small. Soil samples were collected and submitted for analysis. These have been completed.

Soil samples were sent in by the Engineer, Goldfields Water Supply, from Ora Banda, taken from alongside the fibrolite water mains. These were examined for reaction, soluble salts and sulphate.

The Engineer for the North-West submitted six soils from Broome for reaction, soluble salts, sulphates and an opinion as to any damaging effect they may have on cast iron, wrought iron, fibro cement or reinforced concrete pipes.

WATERS.

Water samples were received from different parts of the State and totalled 924, of these 263 were submitted by the Department of Works and Labour, and come from the Wellington Dam (monthly samples), Kalgoorlie reticulation, Mt. Charlotte reservoir and Mundaring reservoir (quarterly) for hygienic analysis. Also during the period that the Mundaring reservoir overflowed, daily samples were sent in for salinity test. A series of samples was sent in from the Ord River for silt content. In conjunction with the soil survey at Many Peaks, a water survey was also made and samples were submitted to the laboratory for analysis.

Other samples received from this Department came from Meekatharra, Boyup Brook, Denmark Agricultural College, Cue, Mt. Magnet, Ora Banda, Mt. Barker, Northampton, Narra Tarra, Nannup, Nanga Brook, Pingelly and Broome.

Officers from the Geological Survey Department were engaged in finding a better water supply for Port Hedland. They submitted 31 samples in all. Samples from Northampton and Millura Station were also sent in by this department.

Samples were also received from the Forests, Education, Agricultural, Health, Main Roads Board, Industries and Lands Departments, also the State Electricity Commission.

The survey of the waters from rivers and streams in the South-West was continued during the year and samples (83) were collected in March, July, September and December. Water samples from farmers, graziers, market gardeners, etc., totalled 515, and as in previous years a number of these waters, 16 per cent., were too saline to be used for any purpose.

COPPER STATUS OF SUBTERRANEAN CLOVER.

This investigation was continued during the year, and 67 samples were received from Westdale, Narrogin, Beverley, Merredin, Byford, Keysbrook, West Brookton, Williams, Arthur River, Wagin, Kojonup, Muradup, Jingalup, Boyup Brook, Qualeup, Dinninup, Kulikup, Harvey and Walliston for the determination of copper, manganese, zinc, nitrogen, phosphorus, calcium and potassium.

IRRIGATED PASTURE.

A large number of samples (181) of pasture from fertiliser experiment plots (rate and time of superphosphate application) cut at different times of the year, were analysed for nitrogen, phosphorus, calcium and dry weight. These pasture plots were at Harvey and Waroona.

Samples (168) of pasture, grain, straw and cocky chaff from different varieties of wheat and oats collected from the rate of super, and residual super. experiments, conducted at different Agricultural Research Stations were analysed for their feeding value, also calcium and phosphorus.

Fifty samples of wheaten hay grown at Merredin Research Station and taken from the hay curing loss experiment, were analysed for crude protein, ash, calcium and phosphorus. Twenty-five of these samples were as cut and 25 after curing.

Fourteen samples of hay, cocky chaff and grain from the Merredin 1945 Hay v. Grain Experiment were analysed for crude protein, ash, calcium, magnesium, phosphorus and potash.

DIE-BACK IN FLAX.

In connection with the investigations of die-back in flax, and its control by the use of zinc sulphate mixed with the fertiliser, a number of samples (11) were submitted for analysis. This included nitrogen, phosphorus, potash, calcium, magnesium, copper, manganese, zinc and iron.

LEAVES AND PRUNINGS.

The final sampling of the leaves of grape vines involved in the investigation of the nutrition of grape vines in the Upper Swan area was completed in December. These vines were subjected to the following treatments. (1) No fertiliser; (2) super and zinc swab; (3) super; (4) blood and bone; (5) nitrogen, phosphate, potassium, and magnesium; (6) same as (5) plus minor elements. The leaves were to be examined for nitrogen, phosphorus, potassium, calcium, magnesium, total ash, copper, zinc and manganese.

Vine prunings from the vines were collected in July and examined as for the leaves.

Samples of apple leaves (42) in connection with the investigation of seasonal drifts of minerals in the leaves were collected at Mt. Barker, Bridgetown and Donnybrook for analysis. These were examined for calcium, magnesium, phosphorus, potassium, nitrogen, copper, manganese and zinc.

Tomato leaves were examined from fertiliser experiments carried out at Balcatta. These plots were subjected to the following treatments:—(a) Blood and bone; (b) blood and bone, super., sulphate of potash; (c) super., sulphate of ammonia and sulphate of potash; (d) same as "c"; (e) same as "b"; (f) same as "c"; (g) same as "c"; (h) blood and bone and super.; (j) super. and sulphate of ammonia.

Treatment (e), (f), (g), included bluestone (copper). These leaves were examined for nitrogen, calcium, magnesium, phosphorus and potassium.

POTATO TUBERS.

Fertiliser experiments were carried out at Pickering Brook with potatoes; 10 treatments were used and tubers from each treatment were submitted for the determination of nitrogen, calcium, magnesium, phosphorus, chlorine, potassium, copper, manganese and zinc.

SPECTOGRAPHIC EXAMINATIONS.

All spectrographic work for the chemical laboratories is carried out in this division. Ten samples were examined during the year.

Six of these were sections of columbium stainless steel tubing, a welded joint and the welding rod used. Very few differences were detected in the samples examined. The balance of the samples were super-phosphate made from Nauru phosphate rock (pre-war) and Egyptian and North African rock (war period). The examination confirmed the results found by chemical analysis.

FERTILISER.

In connection with a trial on the composting of straw at Balcatta, a sample of the straw was submitted for analysis. This straw contained 0.41% nitrogen, 0.015% phosphorus, 0.77% potassium calculated on a dry basis.

A sample of horse manure that was to be used in conjunction with the straw compost, contained 0.76% nitrogen, 0.47% phosphorus, 0.88% potassium, 59.28% silica (sand) and 1.68% moisture. Loss on drying at 90-95°C. 65.2%.

Cormorant guano from Shark Bay gave the following figures:—

	On dry basis
	%
Phosphoric oxide, P_2O_5	12.55
Calcium oxide, CaO	12.51
Nitrogen, N	16.21
Potash, K_2O	3.06

In order to determine the contribution to the general fertilising, which may be made by horse manure itself, when used on vines, a sample was examined and gave the following figures:—

	%
Moisture	3.09
Nitrogen, N	1.32
Phosphorus, P	.37
Potash, K	1.43
Calcium, Ca	.71
Magnesium, Mg	.20
Silica (insol. in HCl)	29.30
	Parts per million
Copper, Cu	11.6
Manganese, Mn	119.
Zinc, Zn	74.

Loss on drying at 90-95°C. 56.7%.

In connection with the occurrence of "die-back" in flax, due to zinc deficiency, the question arose as to the comparative zinc content of the superphosphates available in the last few years, made from Egyptian and North African as compared with that made from Nauru rock. Samples were received and gave the following figures:—

	Zinc (parts per million)	
	Water soluble.	Total.
1. Old Super 23%— made about 1940	463	561
2. Super 18%— made in 1946	88	218
3. Super 19%— made in 1946	138	241
4. Super 23%— pre-war	364	467

Total copper in all samples was 25-30 parts per million.

A sample of guano from Gingin, on analysis gave the following figures:—

	%
Nitrogen, N	1.08
Phosphoric oxide, P_2O_5	20.94

Figures on samples as received.

MEATMEAL AND POULTRY FOOD.

Three samples of meatmeal and two of poultry mash were received for analysis.

Samples marked "Bone Meal," on analysis was found to consist principally of calcium carbonate. The figures obtained were, protein 9.60%; phosphoric oxide, P_2O_5 0.61%; and calcium carbonate, $CaCO_3$ 85.2%. On inquiry this sample was found to be crushed egg shell.

Three samples of material for use in poultry rations, comprised, two of Wyndham blood and bone and a mixture of Midland meatmeal and Wyndham blood and bone.

WHEAT AND FLOUR.

A sample of the 1945-6 seasons f.a.q. wheat and two samples of flour milled from it were received. One flour was milled in the Brabender stone mill and the other on a roller system. The following figures were obtained.

	Wheat	Flour (Brabender)	Flour (Roller System)
	%	%	%
Moisture (1hr. at 130°C.)	13.43	14.77	14.77
Crude Protein	8.98 (Nx5.83)	7.70 (Nx5.70)	7.52 (Nx5.70)
Ash	1.23	0.40	0.43
Wet Gluten		20.50	20.26
Dry Gluten		7.33	6.99
Maltose (Kent Jones)		1.92	1.39

MISCELLANEOUS SAMPLES.

A sample of iron oxide to be used in stock lick manufacture, contained 216 parts per million of cobalt. Dried potato waste from the Donnybrook dehydration plant, collected with a view to its value as a stock food, gave the following analysis:—

	On dry basis
	%
Crude Protein (Nx6.25)	5.44
Crude Fibre	1.89
Phosphorus, P	.12
Calcium, Ca	trace

A "salt" crust forming on the soil surface near homestead garden of Abydos Experimental Station, on analysis gave the following figures:—

	%
Total soluble salts	52.30
Moisture (105°C.)	15.73

	Percentage Composition of Water Soluble Salts.
Bicarbonate, HCO_3	13.12
Carbonate, CO_3	38.28
Chlorine, Cl	5.70
Sulphate, SO_4	1.12
Nitrate, NO_3	1.70
Calcium, Ca	0.08
Magnesium, Mg	trace
Sodium, Na	38.28
Potassium, K	1.24
Water and undetermined matter	0.48

AGRICULTURE, WATER SUPPLIES AND FORESTRY DIVISION.

SOURCE AND DESCRIPTION OF SAMPLES RECEIVED DURING THE YEAR 1946.

Agricultural Division, 1946.	Department of Agriculture.	Department of Works and Labour.	Public Health Department.	Department of Industrial Development.	Departmental. (Government Chemical Laboratories).	Education Department.	Metropolitan Water Supply, Sewerage and Drainage Department.	Government Geologist.	Fibrolite Pipe Investigation Committee.	Irrigation Water Committee.	Lands and Surveys Department.	Department of Native Affairs.	Free.	Pay—Public.	Pay—Local Governing Bodies.	Pay—Forests Department.	Pay—Rural and Industries Bank.	Pay—Main Roads Department.	Pay—State Electricity Commission.	TOTAL.
Water	14	263	4	2	3	1	36	37	1	23	2	2	8	515	3	2	3	1	4	924
Fodders—																				
Pastures	428	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	428
Sub-Clover	60	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	60
Meatmeal	3	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	6
Bonemeal	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1
Poultry Mash	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	2
Lupins	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Dried Potato Waste....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Ocean Water	....	....		....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Soils—																				
Farm Soils	556	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	559
Soil from Pipelines	....	6	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	9
Salt Crust from Soil	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Grain and Cereals—																				
Wheat	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Flour	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Fruits—																				
Apple Leaves	42	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	42
Vine Leaves	168	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	168
Vegetables—																				
Potatoes	10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10
Tomato Leaves	18	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	18
Fertilisers—																				
Manure	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Straw for Compost	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Chandler Potash	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Guano	1	....	....	1	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	3
Superphosphate	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Blood and Bone	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1
Flax	11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	11
Stainless Steel Weld	....	....	....	....	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Iron Oxide	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1
Deposit (from Pipes)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1
Scum (from Pipes)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1
	1327	269	4	3	12	1	36	37	4	23	2	5	8	524	3	2	3	1	6	2270

MINERALOGY, MINERAL TECHNOLOGY AND GEOCHEMISTRY DIVISION

ANNUAL REPORT FOR THE YEAR ENDED 31st DECEMBER, 1946.

By J. N. A. Grace, A.W.A.S.M., A.A.C.I.

Work Carried out by the Division:

ALLOYS AND METALS

Stainless Steel.

At the Perth Royal Hospital welded stainless steel tubing is being used for some of the services, including the hot water system. Samples of the various sizes of tubing, and of a welding rod, were analysed during 1945, the results being published in the annual report for that year. The tubes and welding rod were found to comply with the American A.S.T.M. specification for weldable stainless steel—niobium stabilised—18-8, type 347, grade 6.

The installation of the hot water system is proceeding and several welded sections of 1in. diameter tubing were forwarded to this laboratory for chemical analysis to detect any alteration in composition of the welded steel. In most cases a good agreement with the earlier analyses was obtained. One welded tube however was found harder to cut on the lathe during the preparation of the sample for analysis, and the analytical figures did not conform to the American Type 347. Titanium replaced niobium as a stabilising agent. Investigation disclosed that this batch of tubes included a number of English weldable stainless steel tubes—titanium stabilised—18-8, Type F.D.P. 321. The result of welding the two types, using niobium stabilised welding rod is now being examined.

Analyses of the two types of steel, and of a welding rod were as follows:—

	English tube Titanium Stabilised Type 321.	American tube Niobium Stabilised Type 347.	American Welding Rod Type 347.
Chromium, Cr	18.60	18.29	17.80
Nickel, Ni	9.06	11.24	11.50
Manganese, Mn	0.66	1.40	1.29
Silicon, Si	0.71	0.47	0.70
Carbon, C	0.16	0.09	0.06
Niobium, Nb	0.16	0.80	0.75
Titanium, Ti	0.62	——	——

Phosphor-Bronze.

Said to have been found in a forge on an old mining property, several small pieces of yellow metal when examined were found to consist of phosphor-bronze. The pieces of metal contained no gold.

Brass.

Two samples of stone with small yellow markings which were forwarded for gold assay were found to carry no gold. The yellow markings consisted of brass, possibly from boot sprigs.

CLAY—CERAMICS—REFRACTORIES.

Clay.

A soft white clay from Avon Loc. 10138, Brookton, was examined for its possible value in the ceramic industry. The clay contained 0.53% of common salt. More than 0.25% is deleterious on burning. The clay therefore would require weathering or washing before it could be used for any fine work. Preliminary burning tests were made after washing out the salt. This was a fine grained semi-ball clay, smooth to work in the plastic state, and setting to a fairly strong air dry body. The clay burned to a good white colour with moderate shrinkage up to 1150°C., above that temperature shrinkage increased rapidly and the colour was creamy white. It should be a useful clay for mixing with other clays in the manufacture of all kinds of white-ware.

Two clays from the Clackline Firebrick Quarry were examined. These were taken from the north-west corner of No. 2 pit. 0.74% of salt was present and burning tests were therefore made on the washed clays. Both clays were moderately soft, fine grained, and nearly white in colour. They were fairly smooth to work in the plastic state, and dried to a fairly strong body. Incipient vitrification of the burnt clay occurred at 1150°C. in one sample, and at 1350°C. in the other. The latter clay still had the high porosity of 22.98% at 1350°C. The clays were too highly coloured when burnt to be used in the manufacture of white-ware, but would be suitable for use in the production of refractories.

A white clay from 20 miles north-east of Wongan Hills consisted of halloysite and kaolin; no quartz was detected. This clay may be of value in the manufacture of white-ware, but the sample was too small for preliminary burning tests.

Clay, Building Foundations.

In connection with the proposed Government Office site—Government House Grounds—a sample of clay taken at a depth of 16 feet from the surface was examined in accordance with A.S.T.M. Tentative Standard Methods D421-38T.

The results of these physical tests were as follows:—

Loss on Air drying at 80°F.	Material +40 mesh (Discarded)	On Air Dry sample Loss at 110°C.	Absolute Specific Gravity	Lower Plastic Limit	Lower Liquid Limit	Shrinkage Limit
%	%	%				
16·55	Nil.	3·00	2·68	18·49	40·28	15·49

Earthenware Pipes.

Determination of porosity and reagent attack were made of earthenware pipe to be used at the Royal Perth Hospital. Glazed and unglazed pipes were tested.

A.S.T.M. Standards C13-44T, and C200-44T for clay and sewer pipes require—

	Per cent.
Maximum attack by normal strength acid in 48 hours immersion	0.25
Maximum porosity allowable ..	8.0

Both glazed and unglazed pipes were found to be reasonably resistant to the attach of weak (normal) acids and alkalies. Porosity was rather high, being just on the 8% maximum allowable.

NATURAL MINERAL PIGMENTS.

Red Oxide.

Two samples of soft red schistose rock from the Weld Range were forwarded by the Geological Survey Branch for determination of their value as natural pigments. Both were an excellent grade of "Red Oxide" of the "Spanish Red" type.

Red Ochre.

Samples of ochre from Ninghan Locations 55 and 367, about halfway between Dalwallinu and Pithara contained insufficient ferric oxide to be classed as "oxides." Several were "Red Ochres" of good quality. Poor grade ochres from several localities were examined for their possible pigment value.

Yellow Ochre and Sienna.

The "Yellow Ochres" and "Siennas" examined were of poor quality lacking sufficient ferric oxide content to give opaque pigments.

FUEL.

Coal—Ewington.

A number of bores were put down, at sites selected by the Geological Survey Branch, near the north east corner of M.L. 324 at Ewington, Collie, to examine the possibilities of obtaining shallow coal suitable for open-cut working. A seam of coal varying in thickness from 3 ft. 6 in. to 9 ft. 2in. was intercepted in 6 of the 11 bores. The 9 ft. 2 in. coal seam included two sandstone bands. Several smaller coal seams were encountered. Analyses of coal from the main seam are given below. No estimate could be made of the moisture content of the original coal owing to the condition of the samples when received, or of the extent the constitution of the coal had been changed.

Analysis of Ewington Coal on Air Dry Sample.

	Bore No. 3 54′ 11″ to 56′ 11″	Bore No. 3 56′ 11″ to 58′ 11″	Bore No. 3 58′ 11″ to 60′ 11″	Bore No. 5 43′ 5″ to 45′ 6″	Bore No. 6 22′ 11″ to 23′ 9″
	%	%	%	%	%
Proximate Analysis.					
Moisture	9·47	11·69	11·75	13·54	15·86
Volatile hydrocarbons	25·41	26·18	24·53	22·84	25·40
Fixed carbon	54·40	53·40	49·40	47·68	49·52
Ash	10·72	8·73	14·32	15·94	9·22
Calorific Value B.T.U.	10405	10453	9448	8929	9576
Ratio, fixed carbon to volatile hydrocarbons	2·14 : 1	2·04 : 1	2·01 : 1	2·09 : 1	1·95 : 1

Coal—Collie.

During the recent survey of the Collie Coalfield samples of coal were collected by the Geological Survey Branch from the various mines and forwarded to this Laboratory for analysis. Collie coal is of the hydrous sub-bituminous type and the freshly broken coal rapidly loses water when exposed. To retain the original water content of the coal seams the samples were broken from freshly worked faces where possible, and all samples were stored in air tight containers. Moisture content was determined on the samples as soon as they were received at the Laboratory.

Coal samples were taken at the following mines:—

Black Diamond Lease	Proprietary
Cardiff	Stockton
Co-operative	Wallsend
Griffin	Wyvern

The total water present in these coal samples, and proximate analysis figures, have been completed.

METALLIC ORES.

Arsenic.

A specimen of sulphide ore from the Comet G.M. at Marble Bar consisted of irregular masses of arsenical pyrite with small inclusions of gold, veinlets of limonite and haematite, and a gangue of quartz and fuchsite, Nickel and cobalt were suggested by the colour, but analysis showed only very small amounts of these elements to be present.

Nickel, Ni, 0.21 per cent.
Cobalt, Co, 0.08 per cent.

A sample from Ninghan Station, near Delaney Wells, consisted mainly of arsenopyrite with some quartz and a little chalcopyrite.

If the locality is correct a new locality for arsenopyrite is five miles north of Northam. A specimen received from this locality consisted of arsenopyrite with a little limonite.

Dr. F. A. Moss donated to the mineral collection a fine specimen carrying plentiful arsenopyrite in bladed crystals and a little pyrrhotite, from the Big Bell G.M. at Big Bell, Murchison District.

Antimony.

Three samples of antimony ore from P.A. No. 612 about 26 miles east of Nullagine and approximately one and a half miles east of the "Billjim" mine were assayed for antimony and gold.

	No. 1.	No. 2.	No. 3.
Antimony, Sb (per cent.)	22.51	25.28	62.08
	No. 1.	No. 2.	No. 3.
Gold, Au (per ton)	6dwt. 0gr.	8dwt. 5gr.	14gr.

Nos. 1 and 2 were mainly oxidised ore, No. 3 consisted largely of stibnite.

Stibnite associated with fairly coarse muscovite and a little pyrite composed the metallic minerals of one specimen from the Big Bell G.M., donated by Dr. F. A. Moss. A second specimen consisted of quartz with coarse crystals of stibnite and some pyrite.

Beryllium.

Two new beryllium minerals were identified from the Londonderry Felspar Quarry, 13 miles south-southwest by road from Coolgardie. One was named Bowleyite, in honour of Mr. H. Bowley, the Director and Government Mineralogist, and the other Duplexite, after Mr. S. Duplex, the manager of the quarry who first drew attention to this mineral.

Bowleyite is a hydrous beryllium calcium aluminium silicate $3(BeCa)O.2Al_2O_3.3SiO_2.2H_2O$ containing small amounts of lithium and a ratio of BeO : CaO of 1 : 1. It occurs as brownish white flat compact waxy looking layers and in wedge shaped micaceous aggregates in pegmatite associated with beryl, quartz and albite.

Duplexite is a hydrous aluminium beryllium calcium silicate $Al_2O_3.4BeO.6CaO.14SiO_2.2H_2O$. It occurs as fan shaped crystalline aggregates sometimes forming almost complete rosettes, and in well crystallised squarish plates in pegmatite associated with Bowleyite, quartz, albite and beryl.

These minerals have been described in a paper presented at the December meeting of the Royal Society of Western Australia and will be shortly published in its journal.

A specimen of unusual rose coloured beryl obtained by the Government Geologist from the Felspar Quarry, Londonderry, contained beryllium oxide, BeO 12.47 per cent. It is proposed to make a complete analysis of this specimen at a later date.

Collections of white and greenish beryl, all iron-stained, were received from one and a half and two miles south of Spargoville.

Iorn Ore

Twenty-three samples of iron ore collected in connection wtih the Geological Survey of the Murchison were analysed at this laboratory. Analytical results obtained were as follows:—

Lab. No.	Locality and Survey Marks.	Result of Analysis.					
		Iron, Fe %	Silica, SiO_2 %	Water, $H_2O\pm$ %	Titania, TiO_2 %	Phosphorus, P %	Sulphur, S %
5955 M67, ...	Iron Ore, Tallering	63·27	7·23	1·62	0·01	0·13	0·04
5956 M68, ...	Iron Ore, Tallering	62·34	8·82	1·39	0·01	0·15	0·05
5957 M69	Iron Ore, Tallering	59·96	12·87	0·94	trace	0·19	0·03
5958 M70A	Iron Ore, Tallering	64·90	4·41	0·96	trace	0·10	0·06
5959 M70B	Iron Ore, Tallering	68·66	0·43	0·38	0·03	0·09	0·08
5960 M77	Iron Ore, Twin Peaks... ...	65·34	2·08	1·22	0·03	0·43	0·04
5961 M115	Iron Ore, Weld Range ...	63·69	1·78	5·17	0·02	0·27	0·08
5962 M116	Iron Ore, Weld Range ...	62·72	2·35	5·98	0·02	0·18	0·06
5963 M117	Iron Ore, Weld Range ...	62·02	2·45	5·87	0·04	0·31	0·09
5964 M118	Iron Ore, Weld Range	62·59	3·85	2·05	0·02	0·15	0·11
5965 M119	Iron Ore, Weld Range ...	57·34	4·62	10·63	0·05	0·27	0·07
5966 M120	Iron Ore, Weld Range	57·47	4·58	10·35	0·02	0·09	0·02
5967 M121	Iron Ore, Weld Range ...	66·30	2·08	1·06	0·03	0·11	0·05
5968 M122	Iron Ore, Weld Range ...	62·58	4·47	3·41	0·03	0·16	0·09
5969 M123	Iron Ore, Weld Range ...	60·73	6·07	2·83	0·10	0·22	0·14
5970 M139	Iron Ore, Weld Range	66·28	2·49	1·00	0·05	0·11	trace
5971 M140	Iron Ore, Weld Range	66·44	1·89	1·17	0·03	0·08	trace
5972 M141	Iron Ore, Weld Range ...	63·57	4·29	2·22	0·05	0·07	0·02
5973 M142	Iron Ore, Weld Range	56·49	15·68	2·47	trace	0·07	0·05
5974 M143	Iron Ore, Weld Range ...	64·38	2·11	4·32	trace	0·12	0·02
5975 M144	Iron Ore, Weld Range ...	67·77	0·48	0·69	0·02	0·28	trace
5976 M145	Iron Ore, Weld Range ...	63·13	4·24	2·60	0·02	0·20	0·08
5977 M146	Iron Ore, Weld Range	64·31	3·22	2·51	trace	0·24	0·02

Bismuth.

Bismutite was the main mineral present in two small samples from Melville, via Yalgoo. In appearance one piece was earthy, banded white, yellow and grey. Associated minerals were quartz, felspar, and limonite. A small specimen consisting of bismutite with a little quartz and limonite came from the Gascoyne district.

Copper.

Prospectors' samples of oxidised copper ore from the Galena District close to the Grand Junction of the Murchison River, and from P.A. 748P in the Peak Hill District both carried about 10 per cent. copper.

Ore from Copper Hills, three miles east of Gabinintha, and slag from an old slag dump assayed:—

	Copper ore.	Slag.
Copper, Cu (per cent.)	16.79	2.14
Gold, Au (per ton)	trace	5gr.

Gold.

During the year about 300 samples were assayed for their gold contents. A considerable number of these were umpire assays of tailings from parcels of ore crushed at the various State batteries.

Approximately 100 free gold assays were made for prospectors. The samples were received from a wide range of localities.

Gold-bearing ores from the Hopetoun Gold Mines, Middle Creek District, 15 miles east of Nullagine were assayed for gold and other metals. The complex nature of these ores was shown by the following assay results:

	Bulk of deposit on surface	Yellow oxide	Small shaft	Crosscut	Oxide ore south of copper shaft	Ore south of copper shaft
	%	%	%	%	%	%
Copper, Cu.	4·04	0·38	2·16	3·74	0·18	20·36
Lead, Pb.	3·19	5·49	7·44	3·38	4·93	1·66
Antimony, Sb.	3·39	13·76	10·82	3·21	5·49	1·36
Arsenic, As.	2·38	2·59	2·10	2·54	1·80	3·79
Zinc, Zn.	...	...	...	Appreciable	...	Present
Gold, Au (per ton)	11 dwts. 0 grains	4 ozs. 5 dwts. 5 grains	19 dwts. 14 grains	5 dwts. 19 grains	2 ozs. 19 dwts. 0 grains	1 oz. 4 dwts. 0 grains
Silver, Ag. (per ton)	6 ozs. 0 dwt. 0 grains	9 ozs. 1 dwt. 5 grains	20 ozs. 18 dwts. 14 grains	8 ozs. 13 dwts. 10 grains	13 ozs. 11 dwts. 10 grains	6 ozs. 0 dwt. 10 grains

Determination of the heavy mineral content of these samples showed that three consisted mainly of fine antimony ochre, probably stibiconite. All contained an appreciable amount of minute pale yellow crystals of a mineral of the jarosite group containing lead and arsenic. The zinc minerals smithsonite and calamine occurred in notable amounts in two samples, and malachite formed a large proportion of No. 6. Other minerals recognised were haematite, mimetite, and free gold.

From Bakers new find, P.A. No. 5874, 6 miles south west of Coolgardie, Mr. R. S. Matheson of the Geological Survey obtained three gold crystals which were forwarded to this Laboratory with the suggestion that they might be of secondary origin replacing some other mineral such as martite. The crystal with the smoothest faces was selected for goniometric measurement. This and one of the other crystals were found to be octahedra twinned on the (III). The third crystal was a simple octahedron. This is the normal crystal habit of gold and martite, and no additional forms which might serve to differentiate one from the other were developed.

Lead.

Lead ore is known to occur in the Kimberley, Pilbara, Ashburton-Gascoyne, Northampton, and South West Districts of this State. Production depends on an economic price. Over 400,000 tons of ore have been produced from the Northampton District.

Following the recent rise in the price of lead interest is again being revived in prospecting for commercial ore of this metal, particularly in the Northampton District. A party has taken over Lease 205 and some 40 samples from the old Surprise Mine at Galena were assayed at this Laboratory. At least one trial shipment of ore has already left the State.

A small piece of galena was forwarded from Meanthence Station near Marble Bar. A sample from 5-6 miles east of Narambeen consisted of galena with a lateritic coating. Quartz with small bright patches of galena came from 3 miles south of Jarrahdale. A specimen of white massive cerussite was received from the Onslow District.

The accessory minerals present in a large lump of galena from Victoria Loc. 119—3½ miles west of Nabawa, submitted by the Geological Survey Branch, were sphalerite (about 4 per cent.), quartz, chalcedony, altered felspar, colourless garnet, brown hydro-mica, and pyrite.

Mercury.

Some years ago three small waterworn pieces of cinnabar were found when prospecting for gold about 4 miles south of Marble Bar. This is the only reported find of mercury minerals in the State. A sample suspected of containing mercury came from 70 miles north of Port Hedland. The sample contained no mercury.

Molybdenum.

Using the recently installed Fagengren flotation machine a concentrate of over 90 per cent. molybdenite was obtained from local molybdenite ore containing pyrite and other gangue minerals. Pyrite was depressed during flotation fairly completely. The sulphide concentrate was roasted at between 400° and 500°C. yielding an oxide containing about 95 per cent. molybdenum oxide, MoO_3 soluble in ammonia. The work was carried out at the request of the Department of Agriculture, who required the molybdenum oxide for experimental use in trace element work in soils.

Sulphur.

In this State there are no deposits of volcanic sulphur. Imports were restricted. Requirements of sulphur for the manufacture of acids and superphosphate are obtained from the large pyritic lode in the Iron King Mine at Norseman. Extension of this lode was recently prospected by diamond drilling. Bore core samples examined at this laboratory show that in some areas the sulphide present is pyrite, other core sections are a mixture of pyrite and pyrrhotite.

Tantalum, Niobium and Tin.

During the period January 15 to 17, Dr. D. Carroll and Mr. H. P. Rowledge visited Greenbushes to examine deposits at the Vulcan and Joice's leases. A copy of their report on this investigation is included as appendix I. A magnetic separator unit was recently put into operation on the Vulcan leases to treat the concentrates obtained by sluicing, etc. Various products from this

unit have been examined at this laboratory to give assistance in obtaining the best conditions of operation. Five lots, comprising nearly 10 tons, of cassiterite concentrate were sampled, assayed, and re-bagged for shipment to the Eastern States. Cassiterite present in these lots ranged from 89.76 to 93.59 per cent., equivalent to metallic tin 70.70 to 73.72 per cent.

Two samples of mixed columbite and tantalite came from the "Two Sisters," five miles west of Moolyella. Associated minerals present were felspar, quartz, limonite, haematite, kaolin, ilmenite and monazite. Single crystals of columbite with well developed faces were received from four miles west of Spargo's Reward and one and a half miles south of Spargoville. Cassiterite with small amounts of monazite, haematite, limonite, and garnet come from due north of Tulga Station homestead.

Tellurium.

The presence of tellurides was suspected in a sample showing free gold obtained at a depth of approximately 150 feet in a winze at the south end of No. 9 level in the Butterfly Mine at Norseman. Tellurides found were hessite with smaller amounts of petzite. A small patch of yellowish mineral was noted. The colour and softness indicated a gold telluride, possibly calaverite. Altaite hessite and sylvanite have been reported by Dr. Stillwell from the Phoenix Mine, which is situated about half a mile to the north of the Butterfly Mine.

Small amounts of tellurium, less than 0.002 per cent. were found in gold-bearing (91 dwt. per ton) flotation concentrates from the Big Bell G.M., Big Bell, Murchison District. This is the first report of the presence of tellurium from this area.

Zinc.

Residues (mostly zinc oxide) from the galvanising tanks of a local firm were assayed for their zinc contents. The Agricultural Department proposed using these residues in soil deficiency experiments at Pardelup. Zinc found ranged from 56 to 62 per cent.

Uranium.

An interesting specimen containing uranium minerals was received from a locality given as 30 miles north-east of Wodgina. The specimen consisted mainly of tantalite or columbite intergrown with altered felspar, a brown glassy mineral, and patches of soft bright yellow earthy material. In addition there was a large brown crystal of albite at one end. The brown glassy mineral contained phosphorus, silicon, thorium, and uranium. Under the microscope the mineral appeared as uneven grains, colourless to pale yellow, non-pleochroic, micro-crystalline in part. Some grains showed minute rosettes indicating spherulitic structure. Birefringence was weak, some grains being almost isotropic. Refractive index variable but mostly between 1.68-1.69. Specific gravity was greater than 4.2. It was probably auerlite, but insufficient pure mineral was present for definite identification. The yellow earthy material consisted of alteration products of both felspar and glassy mineral.

OTHER ECONOMIC MINERALS AND ORES.

Calcite.

Soft white material which crumbles readily between the fingers, locality stated as 140 miles north of Meekatharra, was found to consist almost entirely of minute rhombohedral crystals of calcite which vary in size from 0.01 to 0.03 mm. in diameter. It might find use as a soft abrasive in the preparation of soft polishes.

Chalk and Marl.

A moderately soft, pale buff coloured chalk from One Tree Hill at Gingin consisted mainly of fine calcite, with some quartz, fragments of mollusca, foraminfera, kaolin, and organic matter. It contained 6.46 per cent. of siliceous acid insoluble matter, and 48.95 per cent. of lime equivalent to 87.36 per cent. calcium carbonate. Owing to the colour it would be unsuitable as a raw material for the manufacture of "whiting," and of use as an inert filler only when a good white colour was not essential. Glazier's putty prepared from this sample, particularly after levigation and wet screening, was very plastic and smooth to work but considerably darker in colour than putty prepared from English whiting.

Marl from a lake near Mandurah which the Main Roads Board proposed to use had the following composition:—

	Per cent.
Silica, SiO_2	10.40
Alumina, Al_2O_3	0.30
Ferric oxide, Fe_2O_3	0.55
Magnesia, MgO	13.92
Lime, CaO	33.59
Carbon dioxide, CO_2	32.07
Water H_2O+	4.64
Water, H_2O-	2.94
Water soluble salts (dried 200°C)	0.20

Limestone.

Partial analysis of a sample of siliceous limestone from Lake Muir, about 45 miles from Manjimup gave:

	Per Cent.
Siliceous acid insoluble	9.49
Lime, CaO	48.65
Magnesia, MgO	0.77
Carbon dioxide, CO_2	38.64

Limestone of this grade would yield a good builder's or agricultural lime on burning. Subsequent investigation by the Geological Survey Branch showed the deposit to be of no commercial value.

Heavy Sands.

Samples from concentrations of black sand on several beaches along the south-west coast were examined. A fine grained beach sand from Dillon Bay between Bremner and Pallingup Estuary consisted mainly of ilmenite (about 85 per cent.) and zircon. Black sand from Cheyne Bay consisted largely of ilmenite with some nigrene, zircon, garnet, and small amounts of other minerals. Sand of a similar composition came from between Cape Riche and Bremner Bay. Garnetiferous sand from Witcheliffe contained about 64 per cent. of almandine garnet and 23 per cent. of ilmenite, with a little quartz and zircon and traces of rutile, hornblende and epidote. A representative sample of the deposit which was obtained later had the following mineral composition:—Shell fragments 89.1 per cent., quartz 6.0 per cent., garnet 2.7 per cent., ilmenite 2.0 per cent., zircon 0.2 per cent.

Talc.

A finely foliated compact grey talc-antigorite rock from P.A. 612H, Cubur Station, Upper Murchison, when finely powdered was of white colour with a faint greenish tinge. This talc would probably be of marketable grade in the cosmetic industry. It would be of no value for use in block form as a refractory.

Talc samples were received from the following localities:—3 miles east of Grass Valley, G.M.L. 2939, Burbanks Road, and Mt. Taylor.

The following analysis was made of crushed talc from Mt. Monger.

	Per cent.
Silicia, SiO_2	59.28
Alumina, Al_2O_3	1.05
Ferric oxide, Fe_2O_3	0.49
Ferrous oxide, FeO	2.26
Manganese oxide, MnO	0.02
Lime, CaO	nil
Magnesia, MgO	30.23
Potash, K_2O	0.03
Soda, Na_2O	0.05
Water (Hygroscopic), H_2O- ..	0.32
Water (Combined), H_2O+ ..	5.64
Phosphorus pentoxide, P_2O_5 ..	0.01
Titanium dioxide, TiO_2	0.07
Carbon dioxide, CO_2	0.02
Chromic oxide, Cr_2O_3	0.17
Vanadic oxide, V_2O_5	nil
	99.64

Analyst: J. D. Hayton.

This talc was being exported as a filler, etc. for rubber.

Potash.

Assistance was given to the State Alunite Works at Chandler in the interpretation of the results of experimental work. Various salts of potash, soda, and magnesia, present usually as mixtures were determined by optical means. In some cases it was necessary to separate mixtures of salt crystals by centrifuging in media of carefully controlled gravity, in which the various salts were insoluble and unaltered in composition or crystal form.

A complete analysis was made of leached calcine from the State (W.A.) Alunite Works, Chandler. The sample was taken from conveyor belt to residue dump. Results, on moisture free basis, were as follows:

	Per cent.
Silica, SiO_2	31.80
Alumina, Al_2O_3	43.89
Ferric oxide, Fe_2O_3	3.04
Manganese oxide, MnO	nil
Magnesia, MgO	1.01
Lime, CaO	nil
Soda, Na_2O	3.08
Potash, K_2O	6.45
Titanium dioxide, TiO_2	0.33
Phosphorus Pentoxide, P_2O_5 ..	0.09
Sulphuric oxide, SO_3	8.01
Water (Combined), H_2O+ ..	2.19
Carbin dioxide, CO_2	0.06
Barium oxide, BaO	nil
Chromic oxide, Cr_2O_3	trace
Vanadic oxide, V_2O_3	nil
Chlorine, Cl	0.03
Zirconium dioxide, ZrO_2 ..	nil
	99.98

Water Soluble.

	Per cent.
Silica, SiO_2	0.09
Alumina, Al_2O_3	0.03
Magnesia, MgO	0.85
Soda, Na_2O	1.62
Potash, K_2O	2.82
Sulphuric oxide, SO_3	6.18
Chlorine, Cl	0.03

Analyst, J. D. Hayton.

General.

Groups of rock and mineral specimens from the Coolgardie and Murchison Divisions were received from the Geological Survey Branch. These type samples were collected in the field in connection with the Geological Survey of these areas. Details of some of these samples have been included elsewhere in this report. The minerals present in about 50 rocks were determined microscopically from prepared thin sections.

Biotite.

Biotite from the Kojonup-Beverley district was analysed during the previous year for possible correlation of known mineral deficiencies with the soil developed on certain types of rock. The work was continued this year with the analysis of biotite from "sound" and "unsound" sheep breeding properties in the Boyup Brook-Muradup District. The biotite was separated from granite by careful crushing and gravity separation using heavy solution media. The analyses were as follows:—

Bag No.	536	554	538	638	618
Locality	Abel and Co. Boyup Brook	Sexton Muradup	Dwalganup	Rodgers north of Boyup Brook	H. Haggerty Muradup
	%	%	%	%	%
Silica SiO_2	37·57	38·61	37·07	40·97	35·50
Alumina Al_2O_3	16·22	14·45	16·63	16·75	17·39*
Ferric oxide, Fe_2O_3	4·46	4·02	3·66	3·83	0·92
Ferrous oxide, FeO	15·68	17·10	18·73	16·50	17·56
Manganese oxide, MnO	0·35	0·41	0·17	0·41	0·30
Magnesia MgO	7·48	9·15	6·27	5·48	8·72
Lime, CaO	1·65	2·03	1·23	2·73	1·57
Soda, Na_2O	0·69	0·89	0·62	1·13	0·85
Potash, K_2O	8·44	7·59	8·42	7·11	5·10
Lithia, Li_2O	nil	nil	nil	nil	0·02
Titanium dioxide, TiO_2	1·79	1·75	2·42	1·71	2·52
Phosphorus pentoxide, P_2O_5	1·21	0·11	0·24	0·08	0·94
Fluorine, F	0·37	0·60	0·27	0·41	n.d.
Water (hygroscopic) H_2O-	0·46	0·40	0·60	0·13	0·72
Water (combined), H_2O+	3·55	3·36	3·69	3·16	6·20†
Barium oxide, BaO	0·03	nil	0·17	0·03	0·09
Iron sulphide, FeS_2	0·06	0·07	0·06	0·02	n.d.
Chromic oxide, Cr_2O_3	0·07	0·01	nil	0·02	n.d.
Vanadic oxide, V_2O_3	0·01	0·03	0·04	0·01	n.d.
Zirconium oxide, ZrO_2	nil	nil	Trace	nil	n.d.
	100·09	100·58	100·29	100·48	98·40
Less O = F	0·16	0·24	0·11	0·17	....
	99·93	100·34	100·18	100·31	....
Analyst	V. N. Young	V. N. Young	J. D. Hayton	V. N. Young	V. N. Young

* includes Cr_2O_3 and V_2O_3 (n.d.). † includes F (n.d.). n.d. denotes "not determined."

A type sample of dolerite rock from Lewis' property at Muradup was also selected for analysis in connection with the incidence of sheep breeding problems.

	Per cent.
Silica, SiO_2	50.40
Alumina, Al_2O_3	14.08
Ferric oxide, Fe_2O_3	2.37
Ferrous oxide, FeO	9.00
Manganese oxide, MnO	0.18
Magnesia, MgO	7.41
Lime, CaO	11.42
Soda, Na_2O	1.72
Potash, K_2O	0.18
Water (Hygroscopic) H_2O- ..	0.03
Water (combined), H_2O+ ..	1.57
Titanium dioxide, TiO_2	1.07
Carbon dioxide, CO_2	0.02
Phosphorus pentoxide, P_2O_5 ..	0.19
Iron sulphide, FeS	0.01
Chromic oxide, Cr_2O_3	0.03
Vanadic oxide, V_2O_5	0.07
Barium oxide, BaO	0.01
Nickel oxide, NiO	0.02
Cobalt oxide, CoO	nil
	99.78

Analyst: N. K. Jones.

MISCELLANEOUS.

A crumbly white efflorescence from a peat swamp on Vanascos property at Wanneroo consisted of thenardite (about 44 per cent.) epsomite, halite, gypsum, sponge-spicules, diatoms, and organic matter.

A sample from the Opthalmia Range contained quartz fragments, pieces of grey banded rock and white columnar masses of bloedite and halite with a little epsomite. This is the first recorded occurrence of bloedite in this State.

A black scaly corrosion product from a Fremantle gas meter contained 37.5 per cent. sulphur present mainly as sulphides of copper and zinc with a little tin sulphide. A small amount of basic blue copper carbonate was present.

For use at State batteries, the Superintendent of State Batteries forwarded 12 centigram balance riders for comparison with National Physical Standard riders.

INVESTIGATION INTO THE CAUSES OF FAILURE IN FIBROLITE PRESSURE PIPES.

This investigation has been carried on throughout the year by Mr. LeMesurier and a final report on causes of failure in the metropolitan area submitted to the Committee.

Examination of samples of Sutton fibrolite pipe from Sydney and Melbourne showed that in pipe from Sydney, where the water supply has a total hardness and sulphate content of approximately half that of Perth, loss of lime is somewhat higher, and sulphate attack less than in Perth, while in pipe from Melbourne where the water supply is very soft and low in sulphate, loss of lime was considerably greater and there was no appreciable sulphate attack.

Tests carried out by the Melbourne and Metropolitan Board of Works on Sutton pipe laid in 1931 show that after 13 years' service pipe possess greater strength than after two and three years' service in spite of considerable progressive loss of lime and this fact, together with the absence of multiple longitudinal surface cracks which are a feature of deteriorated pipe in the Perth metropolitan area, suggest that internal sulphate attack is the cause of failure in Perth. In connection with the investigation an examination was made of water supply and fibrolite mains in the Goldfields area. The results show that water supply increases in alkalinity with increasing distance from Mundaring Weir, owing to lime dissolved from the cement lining of the 30in. main, and that internal deterioration of fibrolite pipes decreases with increasing alkalinity.

Pipes taken from the Ora Banda main laid in 1933 which carries water with an initial pH of 9.0 to 9.2 show little evidence of internal deterioration.

Prior to 1945 few bursts occurred in fibrolite pipe in the Goldfields area; however, during 1945 eleven bursts were reported from the Ora Banda main and about the same number in 1946. The majority of bursts occur in a two-mile section of the line running through salt lake and Kopi dune country and it is suspected that failure is due to the action of water soluble salts in the soil in this area.

In September, Mr. Wilson, District Engineer, Goldfields Water Supply, Kalgoorlie, submitted 21 samples of soil in connection with tests on pipes from this section and in December, Mr. LeMesurier visited Kalgoorlie and with Mr. Wilson collected a further 37 soil samples from sites of test pipes and bursts.

It is proposed to carry out an examination of the soil samples collected and of selected test and burst pipes in order to correlate, if possible, the effect of soil conditions on life of pipes.

In connection with the main investigation analyses were made of 15 samples of tested cement from the Swan Portland Cement Coy., Rivervale, and two samples failed to pass the B.S.S. in respect to insoluble residue. As a result it has been decided to carry out a more regular check on the chemical composition of tested cement.

APPENDIX.

REPORT ON A MINERAL EXAMINATION OF SAMPLES.

From the Vulcan and Joice's Leases at Greenbushes.

By H. P. Rowledge, A.W.A.S.M., A.A.C.I., Mineralogist and Research Officer.

During the period January 15 to 17, Dr. Carroll and I visited Greenbushes and examined the deposits at the Vulcan and Joice's leases and collected a number of samples with a view to ascertaining the minerals associated with cassiterite and those likely to interfere with the magnetic separation of the concentrates.

Vulcan Lease.

At the Vulcan lease two samples of the material being mined were taken at two positions at the bottom of the open-cut and concentrated at the mine. Samples were taken at the surface of hard laterite capping and softer material underlying the capping about 10 yards from the north edge of the open-cut, the mining of which will cause an extension of the cut in a northerly direction. Other samples taken consisted of bagged mine concentrates ready for magnetic separation, rejects from the Willoughby concentrator, material lying in the first compartment of the sluice and every other second compartment (seven samples). It was considered that an examination of these products would give a complete picture of the mineral associations of the cassiterite at this lease.

The minerals recognised other than the common pegmatite minerals were cassiterite, columbite, tourmaline, magnetite, hematite, limonite, ilmenite, beryl and only traces of zircon and possibly staurolite. Of these the only non-magnetic ones were beryl and zircon and they were present in such small quantities as to be unlikely to be present with non-magnetic cassiterite to any appreciable extent.

An examination of Mine Concentrate Lab. No. 298/46 C563 gave the following results:—

Grading Test.

	Per cent.
+10	5.7
—10 +30	32.4
—30 +60	30.6
—60 +90	26.7
—90	4.6
	100.0

+10 Mesh.—Consisted of 93% of crystalline cassiterite, the largest fragment being 5/16in. in size, a little intergrown with columbite and 7% of magnetite and limonite.

—10 +30 Mesh.—Mainly cassiterite with some columbite and a little tourmaline.

—30 +60 Mesh.—As above.

—60 +90 Mesh.—Mainly cassiterite with approximately 30% columbite and some tourmaline.

—90 Mesh.—Cassiterite, columbite and a little tourmaline.

The concentrate as collected was crushed to pass a 60 mesh sieve and magnetically separated in the laboratory as follows:—

2 Amps Magnetics: 3.1% limonite, magnetite with some tourmaline and a little cassiterite and columbite. No ilmenite was recognised.

8 Amps: Treatment of non-magnetics of the 2-amp treatment.

Magnetics, 32.6%. Columbite with some tourmaline and cassiterite.

SnO_2 21.2%.

Non-magnetics, 64.3%. Cassiterite with a little quartz columbite and very little tourmaline.

SnO_2 89.8%.

The SnO_2 in the original concentrates as collected amounted to 66.4% which yielded a concentrate by magnetic separation under laboratory conditions of 89.8% SnO_2. This amounts to 57.7% SnO_2 of the original concentrates.

The concentrates, Lab. Nos. 306-7, C569 and C570 obtained from the bottom of the open-cut represents similar material to that mined to obtain the concentrates described above. They were magnetically separated and examined, C569 giving 75% non-magnetics consisting of cassiterite with traces of zircon and limonite, magnetics 25% consisting of tourmaline, columbite with a little magnetite, hematite and limonite. The non-magnetics in C570 amounted to 73%, being mainly cassiterite and a little quartz. The magnetics amounted to 27% approximately being tourmaline, columbite with a little magnetite hematite.

The sample collected from about 10 yards north of the open-cut Lab. No. 304, C560 about one foot under a six inch hard laterite capping consisted mainly of friable kaolin and limonite with hard limonite pebbles and some tourmaline. When panned off a concentrate was obtained containing tourmaline, magnetite, limonite, cassiterite, columbite, ilmenite, rutile, beryl, zircon. The hard laterite capping, Lab. No. 305, C559 itself, contained cassiterite as well as tourmaline, magnetite, columbite.

The samples of rejects from the Willoughby and various compartments of the sluice representing various stages of the concentration of considerable tonnages were examined to see if further mineral associations of the deposit could be detected.

The Willoughby rejects Lab. No. 301, C568, consisted mainly of tourmaline with approximately 10% cassiterite and smaller amounts of the minerals listed above. The casserite was mostly in the fines, —60 mesh.

The sluice samples Lab. Nos. 302, 308-314, C561, C600-605, C594, did not contain any other minerals than those previously recognised. Of interest was the presence of some larger fragments up to ½in. long of white frosty beryl not showing any crystalline form and with the R.I. of rosterite 1.59. Small specimens showing crystalline form and pale green in colour were picked up by Dr. Carroll on the surface of an old dump.

Conclusions.

No minerals were recognised that are likely to interfere to any extent with the magnetic separation of a well cleaned concentrate. Small amounts of zircon were noticed in some of the samples and if encountered in the future to any extent it would be associated with the cassiterite in the non-magnetic fraction. No non-magnetic tantalum minerals such as microlite or stibio-tantalite were recognised. Only traces of antimony were detected in the concentrates.

The sample taken from the top of several opened bags of mines concentrates awaiting magnetic separation was shown to be amenable to magnetic separation under laboratory conditions.

Joice's Leases.

Joice's leases have been opened up and prospected at a number of places and four of the main workings were examined and samples collected. Samples were also obtained of bagged mine concentrates obtained by Freeman and rejects from the Willoughby concentrator which had been subjected to the same treatment to those of the Vulcan products.

The most southerly of the workings was a cut in sandy soil said to go about 1½ to 2 lbs. of cassiterite per yard. The sample, Lab. No. 315, C562 collected here consisted of yellow quartz soil containing pebbles of magnetite and limonite with small amounts of cassiterite, tourmaline, columbite, ilmenite, staurolite and zircon, all water worn.

Lab. No. 316, C609, was collected from workings to the north west of C562 which Freeman has worked and obtained the concentrates sample C564. The sample which was taken from the bottom of the cut consisted of clay containing much limonite with some ilmenite, leucoxene and small amounts of cassiterite with very little magnetite, zircon, staurolite and rutile.

Further to the north west again, sample Lab. No. 318, C606 was collected from the "Terrace" which was worked by Joice and from which the parcel of concentrates forwarded in November, 1944, was said to have come. A sample, Lab. No. 319, C598 was taken from this cut. When concentrated it was shown to contain cassiterite, columbite with some tourmaline, zircon and small amounts of rutile, leucoxene, stibiotantalite and staurolite. Lab. No. 318, C606 was shown to be conglomerate and quartzose pebbles containing black tourmaline and some magnetite pebbles. No cassiterite, columbite or ilmenite was recognised.

About 50 yards further west, Freeman has put in three long cuts with the bulldozer about 50 yards apart. A sample Lab. No. 320, C599 was taken from the most northerly of these cuts, the concentrate of which was shown to consist mainly of cassiterite with small amounts of zircon, columbite, ilmenite, rutile, staurolite and tourmaline with a little stibiotantalite.

The mine concentrates Lab. No. 299, C564 obtained by Freeman from the workings mentioned above, Lab. No. 316, C609 was examined as follows:

Grading Test.

		Per cent.
+10		9.1
—10	+30	43.1
—30	+60	32.0
—60	+90	15.3
—90		.5
		100.0

A number of the grains of all sizes are rounded and coated with limonite.

+10 mesh: Mainly cassiterite with a few rounded grains of limonite and magnetite.

—10 +30 mesh: Mainly cassiterite with a little columbite, limonite and magnetite.

—30 +60 mesh: Mainly cassiterite with some zircon, columbite, rutile, magnetite, limonite, ilmenite and tourmaline.

—60 +90 mesh: Cassiterite with some zircon and tantalo-columbite, rutile and a little magnetite, limonite, ilmenite and tourmaline.

—90 mesh: Cassiterite with appreciable amounts of zircon and a little tourmaline and ilmenite.

The sample of concentrates as collected was crushed to pass a 60 mesh sieve and magnetically separated in the laboratory as follows:

2 amps Magnetics: Magnetite and limonite.

8 amps: treatment of the 2 amps non magnetic product.

Magnetics: Approx. 10 per cent. Columbite, rutile, ilmenite, tourmaline and cassiterite.

SnO_2 approx. 15 per cent.

Non-magnetics: Approx. 90 per cent. Cassiterite with some zircon.

SnO_2 83.3 per cent.

The SnO_2 in the concentrates as collected amounted to 79.4 per cent. with traces of Sb. This was raised to only 83.3 per cent. SnO_2 when subjected to magnetic separation in the laboratory.

The Willoughby rejects Lab. No. 303, C608 consisted largely of zircon, ilmenite and cassiterite (the latter being mostly —60 mesh) with small amounts of columbite, magnetite, leucoxene, rutile and very little ceylonite, stibiomicrolite, stibiotantalite, staurolite and garnet.

SnO_2 41.5 with traces of Sb.

Conclusions.

The presence of appreciable amounts of zircon and small amounts of stibiotantalite and stibiomicrolite will interfere with the magnetic separation. The sample taken from the tops of several opened bags of mine concentrates when subjected to magnetic separation under laboratory conditions did not yield a product as high grade in SnO_2 (83.3 per cent.) as the Vulcan concentrates (89.8 per cent. SnO_2) although the concentrates as collected contained a greater amount of SnO_2 (79.4 per cent.) as against 66.4 per cent. at the Vulcan.

The grading tests show the mine concentrates to be coarser in particle size than that of the Vulcan.

Joice's total	..	+60	84.2%
Vulcan total	..	+60	68.7%

Most of the zircon present in the concentrates is —60 mesh as is the cassiterite in the Willoughby rejects. The SnO_2 in the latter is high 41.5%. This points to the fact that in an attempt to wash the light coloured zircon away by concentration some of the finer grade minerals are lost including appreciable amounts of cassiterite.

MINERALOGY, MINERAL TECHNOLOGY AND GEOCHEMISTRY DIVISION.

Source and Description of Samples Received During the Year 1946.

	Pay.	Free.	State Batteries.	Departmental, Director Govt. Chemical Laboratories.	Under Secretary for Mines.	State Mining Engineer.	Geological Survey.	Explosives Branch.	Department of Industrial Development.	Department of Agriculture.	Department of Works and Labour.	Fibrolite Pipe Investigation Committee.	Main Roads Department.	Chief Inspector of Factories.	State (W.A.) Alunite Industry.	Coal Panel.	Pay—Mechanical and Plant Engineer.	Pay—State Engineering Works.	TOTAL.
Alloys and Metals—																			
Manganese Steel	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Phospho Bronze	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1
Stainless Steel Tubing	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Stainless Steel Weld and Rod	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	2	....	3
	....	....	....	....	....	....	....	....	....	....	5	....	....	....	....	....	....	....	5
Ceramics (including Refractories)—																			
Clays—Miscellaneous	....	15	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	16
Clay—White	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Clay—Kaolin	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Natural Mineral Pigments—																			
Oxides and Ochres	2	3	....	....	1	....	14	....	....	....	....	....	....	....	....	....	....	....	20
Fuels—																			
Bituminous Coal	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Brown Coal	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Coal	....	....	....	....	....	....	105	....	1	....	....	....	....	....	....	....	....	....	106
Coke	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1
Indian Coal	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Metallic Ores—																			
Aluminium Ore	....	1	....	7	....	....	2	....	....	....	....	....	....	....	....	....	....	....	10
Arsenic	....	3	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Antimony	....	....	....	2	....	....	3	....	....	....	....	....	....	....	....	....	....	....	5
Beryllium	....	13	....	3	....	....	2	....	....	....	....	....	....	....	....	....	....	....	18
Bismuth	....	2	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	3
Copper Ore	....	3	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	4
Copper Slag	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Gold Tailings	45	....	42	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	87
Gold Umpire	1	....	56	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	57
Gold Ore	13	97	....	....	5	9	....	1	....	....	....	....	....	....	....	....	....	....	125
Gold Concentrate	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	2
Iron Ore	....	12	....	....	....	....	26	....	....	....	....	....	....	....	....	....	....	....	38
Iron Sulphide Ore	....	4	....	....	....	....	8	....	....	....	....	....	....	....	....	....	....	....	12
Iron Titanium Ore	....	1	....	....	....	1	1	....	....	....	....	....	....	....	....	....	....	....	3
Lead Ore	37	4	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	42
Manganese Ore	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Mercury	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Molybdenum	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Niobium Ore	....	5	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	7
Nickel	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	2
Silver	....	9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9
Tantalum Ore	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Tantalum Concentrate	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Tin Ore	....	2	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	4
Tin Concentrate	8	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12
Tin/Tantalum Ore	....	....	....	24	....	....	....	....	....	....	....	....	....	....	....	....	....	....	24
Tin/Tantalum Concentrate	....	9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9
Tellurium	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Tungsten	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1
Uranium	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Zinc	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1

MINERALOGY, MINERAL TECHNOLOGY AND GEOCHEMISTRY DIVISION.

Source and Description of Samples Received During the Year 1946.—*continued.*

	Pay.	Free.	State Batteries.	Departmental, Director Govt. Chemical Laboratories.	Under Secretary for Mines.	State Mining Engineer.	Geological Survey.	Explosives Branch.	Department of Industrial Development.	Department of Agriculture.	Department of Works and Labour.	Fibrolite Pipe Investigation Committee.	Main Roads Department.	Chief Inspector of Factories.	State (W.A.) Alunite Industry.	Coal Panel.	Pay—Mechanical and Plant Engineer.	Pay—State Engineering Works	TOTAL.
Other Economic Ores and Minerals—																			
Asbestos	....	1	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	4
Andalusite	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Apatite	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1
Barite	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Chalk and Marl	....	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	2
Calcite	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	2
Dolomite	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Felspar	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1
Gypsum	....	2	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	3
Graphite	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	1
Heavy Sand	1	3	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	7
Limestone	1	3	....	....	....	....	2	....	....	3	....	....	....	....	....	....	....	....	9
Laterite	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Magnesite	1	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	2
Mica	....	7	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	8
Opal	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Potash Salts	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	....	....	....	6
Rare Earth Minerals	....	3	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Talc	1	3	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	7
Topaz	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1
Tourmaline	....	5	....	2	....	....	1	....	....	....	....	....	....	....	....	....	....	....	8
Vermiculite	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1
Minerals and Rocks for Complete Analysis—																			
Alunite Residues	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Beryllium	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Biotite	....	....	....	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Bowleyite	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Duplexite	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Dolerite	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Miscellaneous—																			
Actinolite	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	2
Alexandrolite	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1
Balance Riders	....	....	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12
Corrosion Deposit	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Caustic Lime	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Cement	....	....	....	....	....	....	....	....	....	....	....	15	....	....	....	....	....	....	15
Concrete	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Epidote	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	2
Efflorescence	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1
Earthenware Pipes	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Fibrolite Pipes	....	....	....	....	....	....	....	....	....	....	3	108	....	....	....	....	....	....	108
Fibrolite	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	2
French Chalk	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Glauconite Sand (Industrial Hazard)	....	....	....	....	....	....	....	1	....	....	....	....	....	1	....	....	....	....	1
Hornblende	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Mudstone	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Nontronite	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	3
Pyrite (Replacing Wood)	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Quartz and Chalcedony	....	25	....	....	....	2	2	....	....	....	....	....	....	....	....	....	....	....	29
Rocks—Miscellaneous	1	8	....	....	....	....	50	....	....	1	....	....	....	....	....	....	....	....	60
Sand—Building	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	1
Soils—Pipeline	....	....	....	....	....	....	....	....	....	....	....	4	....	....	....	....	....	....	4
Sand—Coal Bores	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	3
Unclassified Determinations	....	11	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	15
Water	....	....	....	....	....	....	....	....	....	....	....	23	....	....	....	....	....	....	23
Zinc Galvanising Waste	2	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	3
	116	278	112	60	5	8	266	1	3	6	10	153	2	1	6	1	2	1	1,031

SOIL MINERALOGY AND SEDIMENTARY PETROLOGY DIVISION.

Annual Report for the Year Ended 31st December, 1946.

By Dorothy Carroll, Ph.D., B.A., B.Sc.

This division was established in 1944 with the appointment of a soil mineralogist, the staff being increased in 1945 by a chemist and a laboratory assistant. The division was established because it was clearly seen that this State had need of the information to be obtained from the mineralogical approach to the study of soils. The value of mineralogical studies in the modern approach to soil science is conveyed by the following quotation from a recent publication by the University of Missouri: "The soil science of the present day seeks to express as far as possible, in quantitative form, the fact that soils are derived from geological materials, which were later subjected to a small group of definable factors leading to the development of soil profiles. . . . . It is evident, therefore, that the recognition of parent materials and the measurement of the changes which have taken place within them are experimental problems of the highest importance.

The work of this division is to investigate, as opportunity offers, firstly the agricultural soils of the State; and secondly, sedimentary petrological problems such as the correlation of various coal and oil-field strata, silting of rivers and harbours, coarse material carried by rivers and streams, wind erosion of soils, movement of beach sands, and numerous allied subjects including the industrial applications of sedimentary petrology which are many. To date, only the first of these objectives has been attempted.

Because of the peculiar geological conditions and geological history of southern Western Australia, soil mineralogy has assumed considerable importance, because it is necessary to supplement information obtained in the field and chemically, by mineralogy to define the parent materials of the soils. Soils comprising over

75% of the agricultural soils of the State have arisen from the weathering of underlying rocks; in other words, the soils are sedentary or residual. This means that the crop grown on them, and the animals pastured thereon, have to be maintained on the chemical elements the soils can supply. Some rocks, and hence some soils, have an abundant supply of chemical elements required by the plants; other rocks and other soils have been found to be deficient in one or more elements. Examples of such deficiencies are cobalt at Denmark, and copper at Margaret River.

Soil mineralogy therefore, as far as this division and Western Australian soils are concerned, has to make provision for a number of types of investigation which are considered fundamental to a knowledge of, and a use of, the soils of this State. These are:—

1. Relationship of soil to underlying rock.

2. Mineralogical changes taking place between the original minerals of the parent rock and those of the resulting soil.

3. Geochemical assessment of minor and major chemical elements in rocks producing the agricultural soils of this State.

4. The soil-forming processes, and particularly the relationship between fossil soils such as laterites and soils forming under the present climatic conditions.

5. The types of clay minerals formed from different parent materials and affecting base-exchange and other qualities of soils.

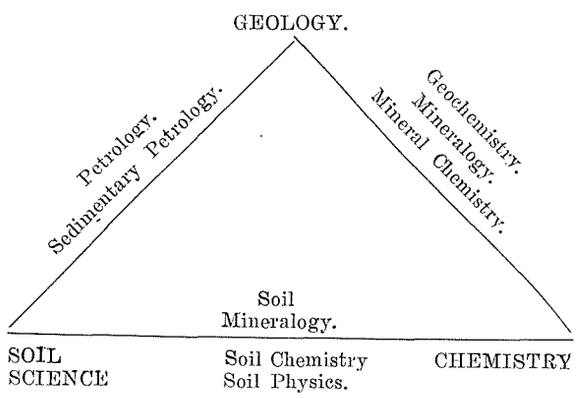
6. The characterisation of soil types by mineralogical examination to assist in the classification and description of the State's soils for all time.

7. Enquiries from both a reconnaissance and a geochemical point of view into areas affected by minor element deficiencies.

8. Enquiries into mineralogical soil types of areas affected by any particular disease, e.g. sheep infertility, with a view to giving essential background information.

These, then, are the major lines of investigation, interest, and attack on the soils of Western Australia envisaged by the establishment of the Division of Soil Mineralogy and Sedimentary Petrology within the chemical laboratories.

The relationship of soil mineralogy to geology, chemistry, and soil science is shown in the following diagram.



Soil mineralogy as a specialised branch of sedimentary petrology, itself a specialisation of petrology, makes use of geological, chemical, and soil science methods of technique in order to obtain the required information, but it has, through the influence of soil physicists and chemists, made very important contributions to mineralogy, one striking example being our knowledge of the clay minerals.

No standard methods of examination of soils for mineral content have so far been established anywhere, but with more interest in this subject, now that the value of its results are appreciated, standard methods will be evolved. One of the functions of this division is to establish such methods on a sound and practical basis.

Details of the work undertaken by this division in 1946 and the source of the samples examined is given in Table IV. at the end of this report.

LABORATORIES, EQUIPMENT, ETC.

The work of this Division continues to be seriously hampered by lack of space, and this in turn is one of the reasons why acquisition of staff is not possible. The number of samples and the types of investigation that can be handled efficiently are rather small as shown in Table IV.

There are two main activities: Mineralogical examination, and chemical analysis. The analytical work has had to done in the Mineral Division, which has necessitated Mr. Jones, the chemist attached to Soil Mineralogy, having to share the equipment and come under the supervision of the Head of the Mineral Division, a rather difficult matter when the method of approach to soil problems is essentially different from that of pure mineral chemistry. An additional laboratory is on loan in the Assay Block and is used for the preparation of samples and preliminary work. At times, the soil mechanical analysis laboratory has been borrowed from the Agricultural Division. Much time and energy is thus wasted in organising the work into parts to be done in each different place, and at one time during the year the same batch of fifty samples was being treated in three widely separated laboratories at the one time.

The Division is practically devoid of "tools of trade" except for a standard set of Tyler sieves and a Rotap Shaker which, arriving in January, was not connected to the electricity supply until the middle of the year, an unnecessary delay not helpful to organisation of this Division.

During the latter part of the year plans were prepared for a new laboratory, approximately 40 x 100 feet to face Hay Street. It is only when this new labratory is erected and equipped that conditions will be at all satisfactory so far as this Division is concerned.

FIELD WORK.

Very little field work was done during the year, only one visit to Greenbushes and one to Clackline to collect samples being undertaken. Lack of transport is the main difficulty, and the field activities of this Division are seriously curtailed for this reason. Any work with soils requires field work, and the time is past when the charity of other Government Departments should be accepted. The acquisition or use of a suitable utility or car is essential to the complete organisation of this Division.

PUBLICATIONS.

During the year a paper on the mineralogy of soils from the Ord River valley was prepared for publication. It has been accepted by the Journal of Sedimentary Petrology in America. Details of chemical and mineralogical work on laterite profiles at Wongan Hills, Greenbushes, and Rocky Gully have been prepared as a paper by Mr. Jones and myself for "Soil Science." The analysis will also be used by Professor J. A. Prescott, Waite Institute, South Australia, in the chapter on "Laterite" in his forthcoming book on Australian Soils. A paper on "Soils and Geology in South-Western Australia was prepared and read at the Congress of the A.N.Z.A.A.S. in Adelaide last August. It will be published in abstract form in the Proceedings, and it is hoped to publish it more or less completely elsewhere.

SCIENCE CONGRESS.

I attended the Science Congress officially and was able later to visit the South Australian School of Mines, Mines Department, Waite Institute, Barr Smith Library, etc., etc. I made many valuable contacts and

discussed various aspects of soils mineralogy and geology with scientists all over Australia. I attended an excursion to the South-East of South Australia the chief objective of which was an examination of soil types, drainage patterns, and country affected by "coasty disease." At Robe the C.S.I.R. have an experiment with sheep which cannot live without cobalt, but require copper in addition if satisfactory wool is to be grown. The country is unattractive calcareous dune sands and tertiary limestones reminiscent of that between Fremantle and Mandurah. The fertility of the country is much increased near Millicent and Mt. Gambier where falls of volcanic ash have built up the limestone soils. Other places visited in the company of geologists were Victor Harbour and Hallett's Cove. I spent some considerable time at the Waite Institute discussing various aspects of soil work. Soil mineralogy is not part of the soil work here, a matter difficult to understand when this subject is an integral part of such institutions as the Bureau of Soils of the United States Department of Agriculture. The approach to a knowledge of soils through mineralogy is the logical one if soil science is to be more than the mere field classification of soil types.

INVESTIGATIONS.

From Table IV. it will be seen that a large number of samples were received from certain definite areas. The following brief account indicates some of the salient features of the work.

Many Peaks Soil Survey.

Sixty-five samples of soil from this survey, which was undertaken to provide information prior to opening up the district for new settlers, were examined in this division. The soils were all presumably derived from fine-grained siliceous sediments of Miocene age known as the Plantagenet Beds. Sieving tests using Tyler standard sieves giving the Wentworth scale of grade terms were made of the sand fractions (coarse and fine) from the mechanical analyses of this suite of soils. Each sample was shaken mechanically in a Rotap for fifteen minutes. Considerable time was spent in standardising the procedure. The figures obtained were plotted as frequency curves and as histograms, the latter giving the clearest and most easily interpreted results (see accompanying figure). From the sieving tests alone it can be shown that the soils are all derived from the same types of sedimentary material, but on the surface there has been some admixture of sand from elsewhere. In general, their surface soils have coarser, more poorly graded sand than those at depth near the parent material. Of the soil types mapped in the field the Carinyah, Waychinicup, Boulongup, Many Peaks, Brown Forest, Tarnup, Moulyup, Pleasant View are all quite similar in their sand features. The Corimup Sand differs from these considerably and is a coarse, moderately well-graded sand throughout the profile. The King Creek loam and sandy loam appear to contain a considerable amount of sand similar to the Corimup Sand, but it is possible that all the coarser sand is from a different source, the Corimup being sorted from this by wind action. The coarser sand has not come from the Plantagenet Beds which are extremely fine grained, water-laid sediments, the depth at which they were laid down precludes the possibility of the addition of coarse sand grains. The small admixture of lateritic pebbles and brown to black buckshot in many of the soils indicates the break-down of a lateritic cover. The degree of roundness of the quartz in a number of the samples was estimated, and in general it was fund that only the coarsest grains were at all well-rounded, a sharp break in degree of roundness occurring between the 60 and 115 mesh Tyler (i.e., grains between 0.24 and 0.12 mm. diameter). It is probable that all the finest sand has been derived from the Plantagenet Beds, whereas the coarser comes from elsewhere.

The results of this piece of work indicate that where a sedimentary rock is the parent material of a suite of soils very useful information can be obtained by grading with a standard set of sieves. It was not possible to treat the samples statistically as there were insufficient samples of each soil type.

Boyup Brook—Muradup Soils.

In November, 1945, 33 soil samples and 19 rock samples were collected from farms in this district regarded as sound and unsound with respect to sheep infertility problems. The following notes were made by Dr. L. J. H. Teakle and myself as a result of a somewhat rapid reconnaissance of this area.

The old peneplain, capped by laterite, has been deeply dissected by the Blackwod River and the properties inspected were nearly all in this or adjacent valleys. The soils developed from the country rocks generally indicate their parentage by colour and by clay content. Geologically the area consists of granite intruded by dolerite dykes. There are also areas of the older gneissic series which contain occasional bands of basic hornblende gneiss.

The soil groups may be segregated into three main types:—

1. Grey soils, formed largely from granites and gneisses.

2. Brown soils, formed from dolerite, diorite, or basic gneiss.

3. Soils largely influenced by lateritic gravel; those of the higher ground where laterite profiles are in process of truncation.

Inspection of nine farms in this district suggests that sheep infertility troubles are most severe where acidic rocks of granitic or gneissic type are predominant, and where there is a very large proportion of grey light-textured soils. Where there is a larger proportion of dolerite and heavier soils, less trouble has been reported. No geological maps are available, and if serious attention is to be paid to the soil and geological aspects of this problem, then such maps should be provided.

The mineralogical examination of soils and rocks confirmed the impression formed in the field that there is a close relationship between rocks and soils.

The following tabulation gives an indication of the variation in heavy residue of the fine sand of soils with granitic and doleritic parent rocks respectively:—

Heavy residue, per cent. by weight in – 90 grade.												Average.
Granitic origin	1	7	3	3	8	3	1	1	7	1		3·6
Doleritic origin	16	42	10	21	7	28	40	17	13	30		22·4

The soils in general showed a small variety of heavy minerals with conspicuous magnetite, ilmenite, amphiboles, epidote, and zoisite in those derived from basic rocks; and magnetite, zircon, rutile, the principal minerals of those from granites and gneisses. A sprinkling of tourmaline, kyanite, and staurolite was sometimes present also in the latter. The light fractions of soils from both types of parent material are rich in felspar. Orthoclase and microcline are characteristic of the granitic rocks, whereas plagioclase is common to the soils derived from dolerites. Altered augite and amphibole are conspicuous in some samples.

These soils provide a very interesting illustration of the relationship between sedentary soils and rocks, and it is hoped that the results can be used in detail for publication elsewhere.

The rocks of the area associated with the soils were crushed, the heavy residue obtained, and examined as for the soils. The information obtained indicates the quantity of weatherable minerals, and includes, in the heavy fraction the amount of ferromagnesian minerals available for contribution to soil formation. In addition pure crops of biotite were separated from a number of samples of granite for complete chemical analysis (analyses given in Mineral Division Report. A dolerite typical of the dykes occurring in the district has also been analysed. It contains conspicuous amounts of V, Cr., and Ni., but no Co or Cu.

Soils From Other Areas Connected With Sheep Infertility Investigations.

Soils from 13 sites selected by the Department of Agriculture from which sub. clover samples would be collected for test of potency in producing infertility were examined. The districts from which the soils came are:—New Norcia, Moora, Beverley, Narrogin, Kojonup, Wandering, and represent conditions on seven properties. A "heavy" and a "light" soil was collected from each property, with one exception. The soils were rather similar to those from the Boyup Brook-Muradup districts. The percentage of heavy residue indicated, in most instances, whether the soils were derived from basic or acid rocks. There are considerable variations in the number and species of heavy minerals present, particularly with regard to amphibole and epidote. A little hypersthene is recorded as an unusual constituent of three of the samples. The presence, in some samples, of garnet, andalusite, staurolite, and corundum, indicates that the granitic rocks are actually gneisses at a fairly low grade of metamorphism. The minerals in the light fractions also give useful information on the parentage of these soils, and the presence of altered amphibole and micaceous grains, both probably to be regarded as varieties of clay minerals, is significant of soils derived from the more basic rocks. Felspars are nearly always present.

Rocky Gully Soil Survey.

Early in the year the survey by the C.S.I.R. and State Department of Agriculture was completed on the Rocky Gully area about 50 miles west of Mt. Barker. A number of soils were submitted for mineralogical examination, as following the establishment of this Division, it was decided to obtain as much fundamental information as possible from each area surveyed in detail. The samples comprised 30 soils and 10 rocks typical of the area.

The soils were classified as follows by the surveyors:—
Rocky Gully, sand and loam.
Bangalup, gravelly sandy loam.
Frankland, sand.
Kent, sand.
Quindabellup, sand.
Camballup, sand.
Valley Complex.

The Rocky Gully soil has been derived from a basic band in the gneisses of the area and the fine sand contains amphibole, epidote, and zoisite, and has a rather large amount of heavy residue, but not nearly so much as that expected from a more basic rock, e.g., a dolerite.

The Bangalup gravelly sandy loam is a soil derived from, or is part of laterite profiles which are the remains of the original capping of the old peneplain surface. The soil is apparently derived from a number of different rock types. Both the heavy residue and light fraction now only contain minerals most resistant to the leaching processes of laterisation, e.g., zircon, spinel, sillimanite, andalusite, monazite, corundum, rutile, and iron ores in the heavy residues, and quartz in the light fraction. The presence of pale green spinel is interesting as it indicates a definite zone of the meta-sediments, similar to that identified in the Manjimup-Pemberton district. There are several varieties of gneisses and granites in the area, and in general, the heavy mineral content of these is greater than that found in granitic rocks from some other localities. Biotite and amphibole are often both present.

The Sands.—These are very similar mineralogically to the sandy surface soils of the Bangalup type. The sands were graded with standard Tyler sieves in the Rotap in order to provide information concerning the mechanical composition of sands of similar type, and the figures obtained indicate the usual distribution for relatively unsorted sands.

Valley Complex.—This soil shows some of the mineralogical features of both the Rocky Gully type and the Bangalup type. Mineralogically the soils of Rocky Gully show that they have been derived from the rocks of the area, and the sands are probably to be accounted for by the removal of sandy soils from above the laterite capping which has largely disintegrated.

Laterite Profiles.

Laterite is of wide-spread occurrence in Western Australia and is of importance in two distinct ways: the more aluminous varieties are potential bauxites; and secondly, soils of lateritic origin are liable to be infertile and to be a limiting factor in land utilisation. It is with the latter aspect in view that chemical and mineralogical examinations were made of three laterite profiles developed on granitic rocks.

In this State although there are numerous analyses of hard laterite capping there has been no information about the changes which take place between the parent rock and the surface laterite capping. Incidentally it is recognised that he laterites are ancient soil profiles which were formed when the climate was hotter and moister than it is at present. The profiles from which the samples were obtained are located at Wongan Hills, Greenbushes, and Rocky Gully. The sites were selected to represent high-level laterite developed on acid rocks. The chemical composition is shown in the following tabulation.

ANALYSES OF LATERITES FROM WONGAN HILLS, GREENBUSHES, AND ROCKY GULLY.

Site	WONGAN HILLS.					GREENBUSHES.				ROCKY GULLY.			
Sample No.	4693/45	4694/45	4695/45	4696/45	4697/45	342/46	343/46	344/46	345/46	3676/46	3677/46	3678/46	3679/46
Depth (inches)	Surface*	12	57	84	120	0–24*	24–60	60–96	Below 96	3–16*	22–40	57–75	75–120
	%	%	%	%	%	%	%	%	%	%	%	%	%
SiO_2 (Total)	45·7	44·5	46·2	46·0	52·5	28·2	58·0	45·4	52·6	58·7	43·6	48·5	60·0
SiO_2 (Free)	20·6	18·3	19·0	22·1	24·9	24·7	48·9	28·7	32·5	50·9	34·5	18·2	42·6
SiO_2 (Combined)	25·1	26·2	27·2	23·9	27·6	3·5	9·1	16·7	20·1	7·8	9·1	30·3	17·4
Al_2O_3 (Total)	26·6	29·3	30·9	29·2	25·1	38·7	25·3	35·3	23·3	8·2	33·6	31·1	26·4
Al_2O_3 (5% NaOH sol.)	8·0	10·3	6·3	6·8	6·5	13·7	19·3	10·2	3·4	10·4	17·5	6·0	4·7
H_2O+	10·59	11·59	12·05	11·46	9·56	8·13	12·06	12·63	10·59	6·70	14·50	11·84	8·86
H_2O-	1·10	1·43	1·34	1·66	1·22	3·88	0·63	0·93	0·92	2·41	1·56	1·89	1·23
Fe_2O_3	14·4	11·9	8·3	9·5	10·2	17·6	3·9	3·8	1·5	10·7	4·7	4·2	1·8
TiO_2	0·64	0·63	0·68	0·78	0·66	1·31	0·62	0·34	0·20	1·84	1·31	1·98	1·21
MnO	0·011	0·007	0·005	0·012	0·003	0·015	trace	0·030	0·012	0·038	0·015	0·077	0·021
CaO	nil or trace	nil or trace	nil or trace	nil or trace	nil or trace	nil or trace	nil or trace	nil or trace	nil or trace	nil or trace	nil or trace	0·13	0·05
MgO	nil or trace	nil or trace	nil or trace	nil or trace	nil or trace	0·14†	0·07	0·14	0·09	nil or trace	nil or trace	0·17	0·10
P_2O_5	trace	trace	trace	trace	trace	0·04	0·20	0·09	0·16	0·02	0·11	0·06	0·04

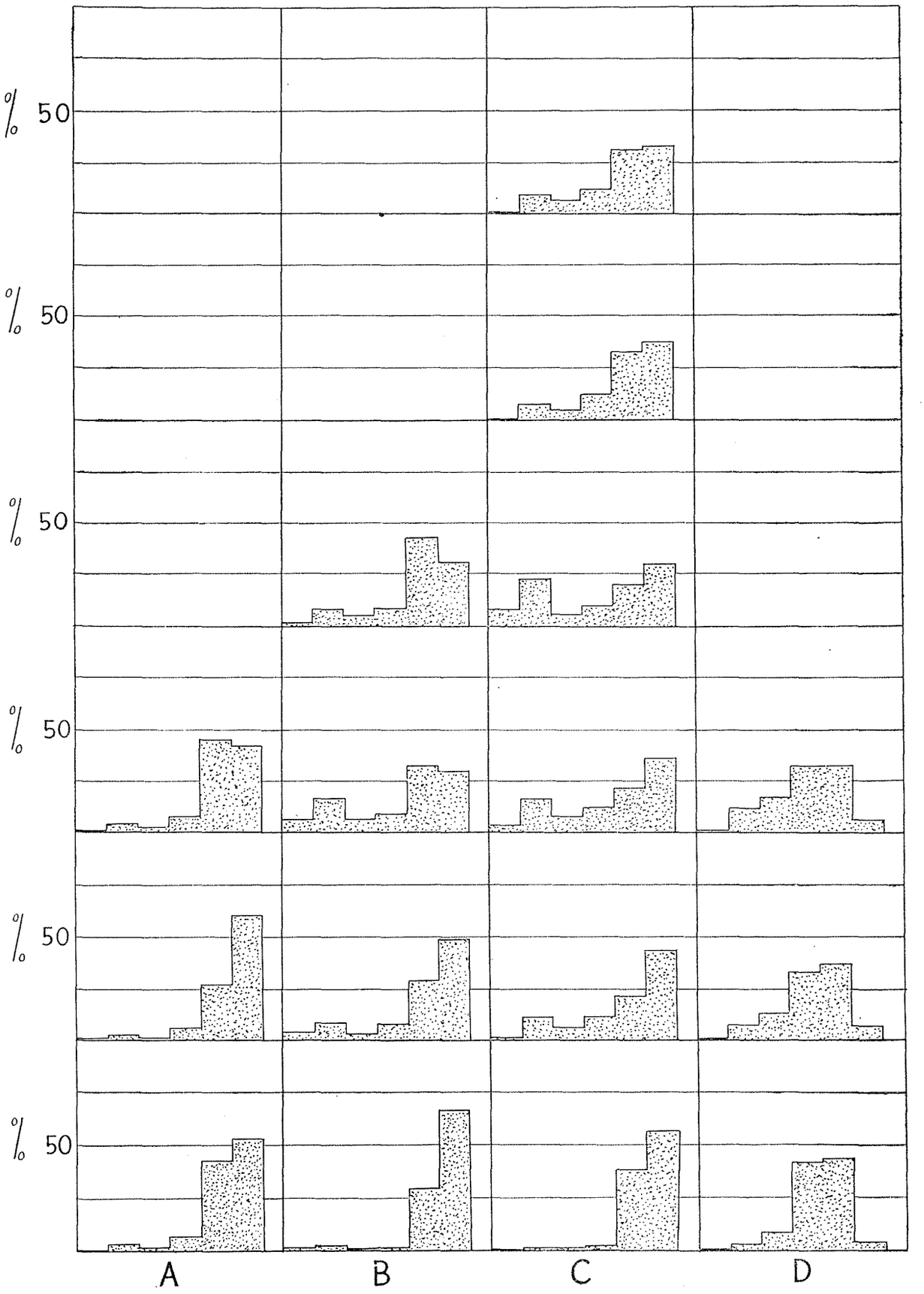
* Decemented pisolites from which sandy soil has been removed by sieving.
† MgO in this profile is due to the presence of tourmaline.
Analyst: N. K. Jones.

The profiles differ considerably in mineral composition, a few of the important features being:—

Wongan Hills.—50-60% kaolinite, 20-22% quartz, 8-13% gibbsite down to a depth of 84 inches. The iron is present as turgite (an intimate mixture of goethite and hematite). The profile shows little differentiation and represents a deep horizon of lithomarge

- HISTOGRAM -

Showing grading of coarse and fine sand fractions of Soils from the Many Peaks area.



capped by massive laterite. It shows little evidence of truncation.

Greenbushes.—8-42% kaolin, 25-49% quartz, 43% diaspore in the pisolites; ; 26 and 9% gibbsite in the lithomarge samples; iron in the pisolites is magnetite and hematite, with some turgite. Tourmaline is conspicuous as a resistant mineral from the parent rock. This is a truncated profile without a capping of massive laterite.

Rocky Gully.—17-64% kaolinite, 18-51% quartz, 17% diaspore in the pisolites, and 38% gibbsite in the lithomarge horizon. Iron in the pisolites is magnetite and there is a considerable quantity of ilmenite throughout the profile.

There are a number of points of mineralogical interest details of which will appear in a paper which has been prepared for publication.

Soils from the Manjimup-Pemberton District.

Over 30 soils collected some time ago from copper-deficient and sound properties were examined mineralogically to provide a background for any future soil work in this area. The soils yielded a most interesting series of heavy residues showing a strong influence from rocks which had suffered high-grade metamorphism whereby such minerals as kyanite, sillimanite, staurolite, and pale green spinel were formed, in addition to interesting rutile and polyvarietal zircon. Very few of the soils showed any influence of basic rocks, and in fact the district itself appeared to be deficient in basic gneisses and in dolerite dykes. The light fractions consisted essentially of quartz with only occasional grains of felspar.

Dune and Beach Sands.

A number of dune and beach sands from the Denmark and Albany areas were examined with a view to giving information of a mineralogical character concerning such sands in the State. The Denmark samples were from active dunes and from fairly recent sediments, the latter being the source of much of the sandy country at low levels in the district.

Mineral Slide Collection.

Since the inception of this Division mounts of heavy residues and thin sections of rocks have been made and kept to provide a permanent reference to our knowledge of the soils and rocks of the areas examined. The slides now number nearly 800; they are catalogued and card-indexed under localities. This collection represents the nucleus of our knowledge of soil mineralogy in Western Australia.

In conclusion I would like to place on record the loyalty and interest displayed in the work of this division by Messrs. N. K. Jones and C. E. Thomas, each of whom carried out his duties in a thoroughly satisfactory manner under exacting and somewhat difficult conditions.

I regret that the attitudes of the Mines Department towards providing reasonable facilities for undertaking soil mineralogy, and that of the Public Service Commissioner towards adequate remuneration have compelled me to send in my resignation.

Grading of Coarse and Fine Sand Fractions of Soils From the Many Peaks Area.

A.—*Carinyah loamy sand profile*—0-4in.; 10-18in.; 40-56in. (at base of diagram).

B.—*Waychinicup loamy sand profile*—0-3in.; 3-7in.; 7-20in.; 39-60in. (at base of diagram).

C.—*King Creek loamy sand profile*—0-4in.; 4-9in.; 9-18in.; 18-36in.; 54-63in.; 90-120in. (at base of diagram).

D.—*Corimup sand profile*—0-7in.; 16-48in.; 48-72in. (at base of diagram).

The histograms represent weight per cent. of each grade. Reading from left to right in each series of profile samples, the gradings are:— —9 +16; —16 +32; —32 +60; —60 +115; —115 +250; and —250

The mesh openings in mm. of the sieves are:—9, 1.98; 16, 0.99; 32, 0.49; 60, 0.24; 115, 0.12; 250, 0.06; —250, = 0.06 to 0.02 mm. (lower limit of fine sand).

Tyler standard sieves, mechanically shaken for 15 minutes in a Ro-tap.

SOIL MINERALOGY DIVISION.

Source and Description of Samples Received during 1946.

Samples Received.	Deptl. Director Govt. Chemical Laboratories.	Dept. of Agriculture.	Total.
Soils—			
Many Peaks Survey	....	2	2
Manjimup-Pemberton District	31	....	31
Rocky Gully Survey	....	30	30
Sheep-Breeding Problems	....	33	33
Laterite	5	....	5
Sands—			
Beach Sand—Frenchman's Bay	1	....	1
Dune Sand—Wilsons Inlet	1	....	1
Rocks—			
Sheep-Breeding Problems	....	21	21
Soft Sandstone—Denmark	4	....	4
Rocky Gully Survey	....	10	10
	42	96	138

NOTE.—Also further work on 78 samples registered in Agricultural Division.

DIVISION VIII.

Annual Report of the Chief Inspector of Explosives for the Year 1946.

The Under Secretary for Mines:

I have the honour to submit for the information of the Hon. Minister for Mines, in compliance with Section 45 of the Explosives Act, 1895, my report on the working of the Branch for the year 1946.

The quantity of explosives imported into the State during the year is shown in Table No. 1, and Table No. 2 gives a comparison of the quantities imported during the past five years.

TABLE No. 1.

Importation of Explosives into Western Australia during 1946.

Gelignite	3,038,950 lb.
Gelatine Dynamite	297,500 lb.
Permitted Explosives	472,750 lb.
Blasting Powder	15,000 lb.
Total	3,844,200 lb.
Detonators: Number	2,543,500
Fuse: Yards	4,318,533

The following table shows the number of Licenses issued during the year—

Magazines on Government Reserves ..	50
Magazines used by Government Departments and on private property ..	115
Store Licenses, Mode A	77
Fireworks Licenses	9
Importation Licenses	2

During the year inspections were made of licensed premises and inquiries made with a view to ascertaining whether the requirements of the Act and Regulations were being complied with. As a result of these inspections and inquiries it was found necessary to have the undermentioned explosives destroyed—

Date.	Place.	Kind and Quantity.	Reason for destruction.
Feb.	Beverley	1 lb. Gelignite	Absorption of Moisture.
Feb.	Wagin	10 lbs. Gelignite	Absorption of Moisture.
Oct.	Mt. Hawthorn	3 plugs Gelignite— 8 Detonators	Brought in by Police.

TABLE No. 2.

Explosives.	1942	1943	1944	1945	1946
	lbs.	lbs.	lbs.	lbs.	lbs.
Gelignite	2,219,900	2,230,800	1,481,500	1,634,850	3,038,950
Gelatine Dynamite	60,750	139,850	154,800	235,300	297,500
Permitted Explosives	115,500	265,900	160,000	945,250	472,750
Powder (Blasting and Pellet)	23,950	67,500	11,150	15,000	15,000
Detonators: No.	1,740,000	1,933,000	1,300,000	1,814,000	2,543,500
Fuse: Yards	2,822,400	3,861,600	1,864,800	3,768,000	4,318,533

The quantity of explosives used in the different classes of industry for the years 1945 and 1946 is given hereunder—

	1945 lbs. used	1946 lbs. used
Gold Mining	2,212,550	2,903,300
Coal Mining	226,300	237,100
Agriculture	8,500	11,250
Quarrying	62,550	82,800
Mining and base metals	142,250	24,000
Government Departments	40,000	58,600
Miscellaneous	11,800	53,900
Totals	2,703,950	3,370,950

Since the cessation of hostilities last year a definite revival of mining is indicated by the increased importation of explosives and it would appear that there is going to be a steady increase in the years to come. The indications are that we will shortly be up to our maximum importation, which was in 1940.

The following tests were made during the year for the purpose of determining the suitability for use, and the chemical stability of explosives—

Explosives	1,583
Fuse	333

In 1940 the Commonwealth Government made certain regulations under the powers given them by National Security Regulations, for the purpose of controlling the transport, storage, use and possession of explosives. This Department was asked to administer these regulations, which it has done during the years of war, but we ceased doing this work in May, 1946.

The regulations, as framed by the Commonwealth made it necessary for altering entirely our method of storage as no explosives were allowed to be stored where ample protection could not be provided, which meant closing all the magazines on unguarded magazine reserves. The administration of these regulations involved a terrific amount of work for the staff, for which they received no extra compensation and I should here like to record my appreciation for the very loyal way in which they did this work.

We are now back to controlling explosives entirely under our own Explosives Act and Regulations and, therefore, are reverting to normal work and procedure

The revenue of the Department naturally decreased considerably during the war years, but it is anticipated that we will get back to a more normal condition in the coming year.

We have experienced great difficulty at times in continuance of supplies of explosives from lack of shipping and other causes and these difficulties do not appear to be entirely overcome yet, but it is hoped that more normal conditions will be brought about during 1947.

I have had preliminary discussions with Nobel's Explosives Company's manager, with regard to a reasonable reserve being kept in this State. As an outcome of these discussions it is proposed to build more magazines at Kalgoorlie and, with the accommodation then available, to have at least five months' supply in the State and always three months' supply in the magazines at Kalgoorlie, as this is considered necessary to take care of any emergency through any cause whatsoever which may arise both in the State as a whole, and particularly in that area where our principal goldmining is being done.

T. N. KIRTON,
Chief Inspector of Explosives.

24th March, 1947.

Division IX.

Report of the Chairman, Miner's Phthisis Board, and Superintendent, Mine Workers' Relief Act.

The Under Secretary for Mines:

I have the honour to submit, for the information of the Honourable Minister for Mines, my report on this Branch of the Mines Department for the year 1946.

Under arrangements similar to previous years the Commonwealth Health Department continued the periodical examination of mine workers, the work being continuously carried on by the Health Laboratory at Kalgoorlie and by a mobile laboratory which visits the mining centres in the various goldfields. The goldfields not visited during the year were the Ashburton, Gascoyne, Kimberley, Phillips River, Pilbara, West Kimberley and West Pilbara, which with the exception of the Pilbara Goldfield are all remote and contain few mine workers.

MINE WORKERS' RELIEF ACT.

Examinations under the Mine Workers' Relief Act during the year totalled 5,606 compared with 3,334 for the previous year, the increased number being due to many mine workers discharged from the services returning to their former occupation.

The results of the examinations for 1946 together with those for the previous years are shown in the tables annexed hereto. A graph is also attached illustrating the trend of the examinations since their inception. In explanation of these figures, I desire to make the following comments:—

Normal, etc.—These number 5,294 or 94.43 per cent. of the men examined, and include men having first class lives or suffering from pneumoconiosis only—the figure for the previous year was 92.16 per cent.

Early Silicosis.—These number 261, an increase of 41 compared with the previous year. Of these 89 were new cases and 172 were reported previously, the figures for 1945 being 54 and 166 respectively. Early silicotics represent 4.66 per cent. of the men examined, the percentage for the previous year being 6.60.

Advanced Silicosis.—Of the 39 cases reported 36 were men who advanced from early silicosis during the year; one from normal, and the other two had previously been reported, but continued in their employment. Advanced silicotics represent 0.70 per cent. of the men examined, compared with 1.08 per cent. for the previous year.

Silicosis plus Tuberculosis.—Six cases were reported compared with five for the previous year, and represent 0.11 per cent. of the men examined.

Tuberculosis only.—Six cases were reported compared with two for the previous year, and represent 0.11 per cent. of the men examined. Of these four were men who had been discharged from the services and found upon examination to be suffering from tuberculosis, and consequently ineligible for compensation under the Act.

MINES REGULATION ACT.

Examinations under the Mines Regulation Act totalled 1,345. This was in addition to the 5,606 examined under the Mine Workers' Relief Act. These examinations show an increase of 237 compared with the previous year.

The 1,345 men comprise 782 new applicants and 563 re-examinees for the Initial Certificate.

Particulars of the examinations are as follows:—

NEW APPLICANTS.

Normal	729
Pneumoconiosis	25
Silicosis Early	—
Silicosis Advanced	—
Query Tuberculosis	9
Tuberculosis	1
Pneumoconiosis plus Query Tuberculosis	—
Pneumoconiosis plus Tuberculosis	—
Silicosis Early, plus Query Tuberculosis	—
Silicosis Early, plus Tuberculosis	—
Silicosis Advanced, plus Query Tuberculosis	—
Silicosis Advanced, plus Tuberculosis	—
Other Conditions	18
	782

Of the above applicants for admission to the industry 729 received the Initial Certificate (Form 2), five received Re-Admission Certificates (Form 6), 46 received Special Certificates (Form 9), one received a Rejection Certificate (Form 4) and one received a Prohibition Certificate (Form 10). Thus of 782 applicants, 729 were eligible for employment anywhere on a mine, 51 were eligible for surface employment and two were not eligible for any employment on a mine. There is, however, no information available as to the number of these new applicants who actually entered the industry.

RE-EXAMINATIONS.

Normal	334
Pneumoconiosis	115
Silicosis Early	14
Silicosis Advanced	2
Query Tuberculosis	31
Tuberculosis	6
Pneumoconiosis, plus Query Tuberculosis	16
Pneumoconiosis, plus Tuberculosis	1
Silicosis Early, plus Query Tuberculosis	5
Silicosis Early, plus Tuberculosis	2
Silicosis Advanced, plus Query Tuberculosis	—
Silicosis Advanced, plus Tuberculosis	—
Other Conditions	37
	563

These men had previously been examined and some were engaged in the industry prior to this examination —334 received the Initial Certificate (Form 2), two received Temporary Rejection Certificates (Form 3), six received Rejection Certificates (Form 4), 48 received Re-Admission Certificates (Form 6), 167 received Special Certificates (Form 9) and two received Prohibition Certificates (Form 13).

Thus of the 563 men examined, 334 were eligible for employment anywhere on a mine—215 were eligible for surface employment and 14 were not eligible for any employment.

Grouping the two sets of figures discloses that the following certificates were issued under the Mines Regulation Act:—

Initial Certificate (Form 2)	1063
Temporary Rejection Certificate (Form 3) ..	2
Rejection Certificate (Form 4)	7
Re-Admission Certificate (Form 6)	53
Special Certificate (Form 9)	213
Prohibition Certificate (Form 10)	4
Prohibition Certificate (Form 13)	3
	1345

The percentage of men of normal health to the number examined was 79.1 compared with 74.90 for the previous year.

MINERS' PHTHISIS ACT.

The amount of compensation paid during the year totalled £31,555 5s. 8d. compared with £33,190 9s. 7d. for the previous year, the reduction being due to the deaths of beneficiaries and the attainment of the age of 16 years by some of the dependant children.

The number of beneficiaries under the Act on the 31st December, 1946, was 256, being 40 ex-miners and 216 widows.

J. THOMAS,
Superintendent,
Mine Workers' Relief Act.

14th April, 1947.

TABLE SHOWING RESULTS OF PERIODICAL EXAMINATION OF MINE WORKERS FROM INCEPTION OF EXAMINATIONS (1925) TO 31st DECEMBER, 1946.

First Examination (1925–26).

		Per cent.
Normal, etc.	3,239	80·5
Silicosis Early	459	11·4
Silicosis Advanced	183	4·5
Silicosis plus Tuberculosis	131	3·3
Tuberculosis only	11	·3
Total number of men examined	4,023	100·0

Second Examination (1927).

			Per cent.
Normal, etc.—			
Previously reported as normal, etc.	2,290		
New cases (*i.e.*, cases examined for the first time)	826		
		3,116	83·6
Silicosis Early—			
Previously reported as early	348		
New cases	33		
		381	10·2
Silicosis Advanced—			
Previously reported as Advanced	85		
New cases	8		
		93	2·5
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	13		
Previously reported as Silicosis Early	27		
Previously reported as Silicosis Advanced	62		
New cases	26		
		128	3·4
Tuberculosis only		10	·3
Total number of men examined		3,728	100·0

PERIODICAL EXAMINATION OF MINE WORKERS—*continued.*

Third Examination (1928).

			Per cent.
Normal, etc.—			
Previously reported as Normal, etc.	2,738		
New cases	239		
		2,977	85·5
Silicosis Early—			
Previously reported as Normal, etc.	47		
Previously reported as Silicosis Early	303		
New cases	12		
		362	10·4
Silicosis Advanced—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	16		
Previously reported as Silicosis Advanced	79		
New cases	2		
		98	2·8
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	10		
Previously reported as Silicosis Early	14		
Previously reported as Silicosis Advanced	10		
New cases	8		
		42	1·2
Tuberculosis only—			
Previously reported as Normal, etc.	3		
New cases	1		
		4	·1
Total number of men examined		3,483	100·0

Fourth Examination (1929).

			Per cent.
Normal, etc.—			
Previously reported as Normal, etc.	2,099		
New cases	21		
		2,120	81·9
Silicosis Early—			
Previously reported as Normal, etc.	100		
Previously reported as Silicosis Early	224		
New cases	2		
		326	12·6
Silicosis Advanced—			
Previously reported as Silicosis Early	34		
Previously reported as Silicosis Advanced	60		
		94	3·6
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	8		
Previously reported as Silicosis Early	14		
Previously reported as Silicosis Advanced	19		
		41	1·6
Tuberculosis only—			
Previously reported as Normal, etc.		7	·3
Total number of men examined		2,588	100·0

Fifth Examination (1930).

			Per cent.
Normal, etc.—			
Previously reported as Normal, etc.	2,751		
New cases	34		
		2,785	81·9
Silicosis Early—			
Previously reported as Normal, etc.	133		
Previously reported as Silicosis Early	247		
New cases	3		
		383	11·3
Silicosis Advanced—			
Previously reported as Silicosis Early	22		
Previously reported as Silicosis Advanced	43		
New cases	2		
		67	2·0
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	6		
Previously reported as Silicosis Early	60		
Previously reported as Silicosis Advanced	46		
New cases	2		
		114	3·3
Tuberculosis only—			
Previously reported as Normal, etc.	47		
New cases	3		
		50	1·5
Total number of men examined		3,399	100·0

Sixth Examination (1931).

			Per cent.
Normal, etc.—			
Previously reported as Normal, etc.	2,530		84·0
Silicosis Early —			
Previously reported as Normal, etc.	94		
Previously reported as Silicosis Early	252		
		346	11·5
Silicosis Advanced—			
Previously reported as Silicosis Early	18		
Previously reported as Silicosis Advanced	35		
		53	1·8
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	4		
Previously reported as Silicosis Early	35		
Previously reported as Silicosis Advanced	19		
		58	1·9
Tuberculosis only—			
Previously reported as Normal, etc.		25	·8
Total number of men examined		3,012	100·0

PERIODICAL EXAMINATION OF MINE WORKERS—*continued.*

Seventh Examination (1932).

			Per cent.
Normal, etc.		3,835 =	89·5
Silicosis Early—			
Previously reported as Normal, etc.	35		
Previously reported as Silicosis Early	338		
		373 =	8·7
Silicosis Advanced—			
Previously reported as Silicosis Early	6		
Previously reported as Silicosis Advanced	47		
		53 =	1·2
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	3		
Previously reported as Silicosis Early	9		
Previously reported as Silicosis Advanced	4		
		16 =	·4
Tuberculosis only—			
Previously reported as Normal, etc.		8 =	·2
Total number of men examined		4,285 =	100·0

Eighth Examination (1933).

			Per cent.
Normal, etc.		2,920 =	86·5
Silicosis Early—			
Previously reported as Normal, etc.	57		
Previously reported as Silicosis Early	322		
		379 =	11·2
Silicosis Advanced—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	15		
Previously reported as Silicosis Advanced	44		
		60 =	1·8
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	2		
Previously reported as Silicosis Early	9		
Previously reported as Silicosis Advanced	4		
		15 =	·4
Tuberculosis only—			
Previously reported as Normal, etc.		3 =	·1
Total number of men examined		3,377 =	100·0

Ninth Examination (1934).

			Per cent.
Normal, etc.		5,140 =	92·4
Silicosis Early—			
Previously reported as Normal, etc.	54		
Previously reported as Silicosis Early	315		
		369 =	6·6
Silicosis Advanced—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	24		
Previously reported as Silicosis Advanced	12		
		37 =	·7
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	6		
Previously reported as Silicosis Advanced	6		
		12 =	·2
Tuberculosis only—			
Previously reported as Normal, etc.		5 =	·1
Total number of men examined		5,563 =	100·0

Tenth Examination (1935).

			Per cent.
Normal, etc.		4,437 =	92·3
Silicosis Early—			
Previously reported as Normal, etc.	35		
Previously reported as Silicosis Early	303		
		338 =	7·0
Silicosis Advanced—			
Previously reported as Silicosis Early	24		
Previously reported as Silicosis Advanced	2		
		26 =	·6
Silicosis plus Tuberculosis—			
Previously reported as Silicosis Early		5 =	·1
Tuberculosis only—			
Previously reported as Normal, etc.		2 =	·0
Total number of men examined		4,808 =	100·0

Eleventh Examination (1936).

			Per cent.
Normal, etc.		6,972 =	94·7
Silicosis Early—			
Previously reported as Normal, etc.	29		
Previously reported as Silicosis Early	323		
		352 =	4·8

(Note.—Of the 352 cases of Early Silicosis reported, 23 were already suffering from Early Silicosis and 4 from Pneumoconiosis when re-admitted to the industry on the Re-Admission Certificate under Regulation 7 of the Mines Regulation Act, 1906).

Silicosis Advanced—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	15		
Previously reported as Silicosis Advanced	4		
		20 =	·3
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	3		
Previously reported as Silicosis Early	8		
		11 =	·1
Tuberculosis only		8 =	·1
Total number of men examined		7,363 =	100·0

PERIODICAL EXAMINATION OF MINE WORKERS—*continued*

Twelfth Examination (1937).

			Per cent.
Normal, etc.		7,487 =	95·4
Silicosis Early—			
Previously reported as Normal, etc.	15		
Previously reported as Silicosis Early	319		
		334 =	4·3

(Note.—Of the 334 cases of Early Silicosis reported, 37 were already suffering from Early Silicosis when re-admitted to the industry on the Re-Admission Certificate under Regulation 7 of the Mines Regulation Act, 1906).

Silicosis Advanced—			
Previously reported as Silicosis Early	14		
Previously reported as Silicosis Advanced	4		
		18 =	·2
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	10		
		11 =	·1
Tuberculosis only		2 =	·0
Total number of men examined		7,852 =	100·0

Thirteenth Examination (1938).

			Per cent.
Normal, etc.		6,833 =	95·68
Silicosis Early—			
Previously reported as Normal, etc.	13		
Previously reported as Silicosis Early	266		
		279 =	3·91

(Note.—Of the 279 cases of Silicosis Early reported, 32 were already suffering from Early Silicosis and 4 from Pneumoconiosis when re-admitted to the industry on Re-admission Certificates under Regulation 7 of the Mines Regulation Act, 1906).

Silicosis Advanced—			
Previously reported as Normal, etc.			
Previously reported as Silicosis Early	15		
Previously reported as Silicosis Advanced	2		
		17 =	.24
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	8		
Previously reported as Silicosis Advanced			
		9 =	·13
Tuberculosis only—			
Previously reported as Normal, etc.		3 =	·04
Total number of men examined		7,141 =	100·00

Fourteenth Examination (1939).

			Per cent.
Normal, etc.		6,670 =	95·63
Silicosis Early—			
Previously reported as Normal, etc.	18		
Previously reported as Silicosis Early	264		
		282 =	4·04

(Note.—Of the 282 cases of Early Silicosis reported 28 were already suffering from Early Silicosis and one from Pneumoconiosis when re-admitted to the industry on Re-Admission Certificates under Regulation 7 of the Mines Regulation Act, 1906).

Silicosis Advanced—			
Previously reported as Normal, etc.			
Previously reported as Silicosis Early	7		
Previously reported as Silicosis Advanced	3		
		10 =	·14
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	9		
Previously reported as Silicosis Advanced	1		
		11 =	·16
Tuberculosis only—			
Previously reported as Normal, etc.		2 =	·03
Total number of men examined		6,975 =	100·00

Fifteenth Examination (1940.)

			Per cent.
Normal, etc.		7,023 =	96·218
Silicosis Early—			
Previously reported as Normal, etc.	12		
Previously reported as Silicosis Early	245		
		257 =	3·521

(Note.—Of the 257 cases of Early Silicosis reported, 23 were suffering from Early Silicosis and 12 from Pneumoconiosis when re-admitted to the industry on Re-Admission Certificates under Regulation 7 of the Mines Regulation Act, 1906).

Silicosis Advanced—			
Previously reported as Normal, etc.			
Previously reported as Silicosis Early	10		
Previously reported as Silicosis Advanced	1		
		11 =	·151
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.			
Previously reported as Silicosis Early	4		
Previously reported as Silicosis Advanced			
		4 =	·055
Tuberculosis only—			
Previously reported as Normal, etc.		4 =	·055
Total number of men examined		7,299 =	100·000

PERIODICAL EXAMINATION OF MINE WORKERS—*continued.*

Sixteenth Examination (1941).

			Per cent.
Normal, etc.		6,840 =	95·785
Silicosis Early—			
Previously reported as Normal, etc.	32		
Previously reported as Silicosis Early	248		
		280 =	3·921
Silicosis Advanced—			
Previously reported as Normal, etc.	....		
Previously reported as Silicosis Early	11		
Previously reported as Silicosis Advanced	3		
		14 =	·196
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	....		
Previously reported as Silicosis Early	....		
Previously reported as Silicosis Advanced	....		
Tuberculosis only—			
Previously reported as Normal, etc.		7 =	·098
Total number of men examined		7,141 =	100·000

Seventeenth Examination (1942).

			Per cent.
Normal, etc.		5,469 =	93·905
Silicosis Early—			
Previously reported as Normal, etc.	61		
Previously reported as Silicosis Early	264		
		325 =	5·580
Silicosis Advanced—			
Previously reported as Normal, etc.	....		
Previously reported as Silicosis Early	20		
Previously reported as Silicosis Advanced	5		
		25 =	0·430
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	....		
Previously reported as Silicosis Early	2		
Previously reported as Silicosis Advanced	....		
		2 =	0·034
Tuberculosis only—			
Previously reported as Normal, etc.		3 =	0·051
Total number of men examined		5,824 =	100·000

Eighteenth Examination (1943).

			Per cent.
Normal, etc.		3,932 =	91·47
Silicosis Early—			
Previously reported as Normal, etc.	63		
Previously reported as Silicosis Early	262		
		325 =	7·57
Silicosis Advanced—			
Previously reported as Normal, etc.	....		
Previously reported as Silicosis Early	25		
Previously reported as Silicosis Advanced	7		
		32 =	0·75
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	....		
Previously reported as Silicosis Early	5		
Previously reported as Silicosis Advanced	....		
		5 =	0·12
Tuberculosis only—			
Previously reported as Normal, etc.		4 =	0·09
Total number of men examined		4,298 =	100·0

PERIODICAL EXAMINATION OF MINE WORKERS—*continued.*

Nineteenth Examination (1944).

			Per cent.
Normal, etc.		4,079 =	91·51
Silicosis Early—			
Previously reported as Normal, etc.	70		
Previously reported as Silicosis Early	270		
		340 =	7·45
Silicosis Advanced—			
Previously reported as Normal, etc.	....		
Previously reported as Silicosis Early	21		
Previously reported as Silicosis Advanced	14		
		35 =	0·76
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	7		
Previously reported as Silicosis Advanced	....		
		8 =	0·15
Tuberculosis only—			
Previously reported as Normal, etc.		6 =	0·13
Total number of men examined		4,468 =	100·00

Twentieth Examination (1945).

			Per cent.
Normal, etc.		3,071 =	92·11
Silicosis Early—			
Previously reported as Normal, etc.	54		
Previously reported as Silicosis Early	166		
		220 =	6·60
Silicosis Advanced—			
Previously reported as Normal, etc.	....		
Previously reported as Silicosis Early	26		
Previouly reported as Silicosis Advanced	10		
		36 =	1·08
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	3		
Previously reported as Silicosis Early	2		
Previously reported as Silicosis Advanced	....		
		5 =	0·15
Tuberculosis only—			
Previously reported as Normal, etc.		2 =	0·06
Total number of men examined		3,334 =	100·00

Twenty-first Examination (1946).

			Per cent.
Normal, etc.		5,294 =	94·43
Silicosis Early.—			
Previously reported as normal, etc.....	89		
Previously reported as Silicosis Early	172	261 =	4·66
Silicosis Advanced—			
Peviously reported as normal, etc.....	1		
Previously reported as Silicosis Early	36		
Previously reported as Silicosis Advanced	2		
		39 =	0·69
Silicosis plus Tuberculosis.—			
Previously reported as normal, etc.....	3		
Previously reported as Silicosis Early	1		
Previously reported as Silicosis Advanced	2		
		6 =	0·11
Tuberculosis Only.—			
Previously reported as normal, etc.....	6		
		6 =	0 11
Total number of men examined		5,606 =	100·00

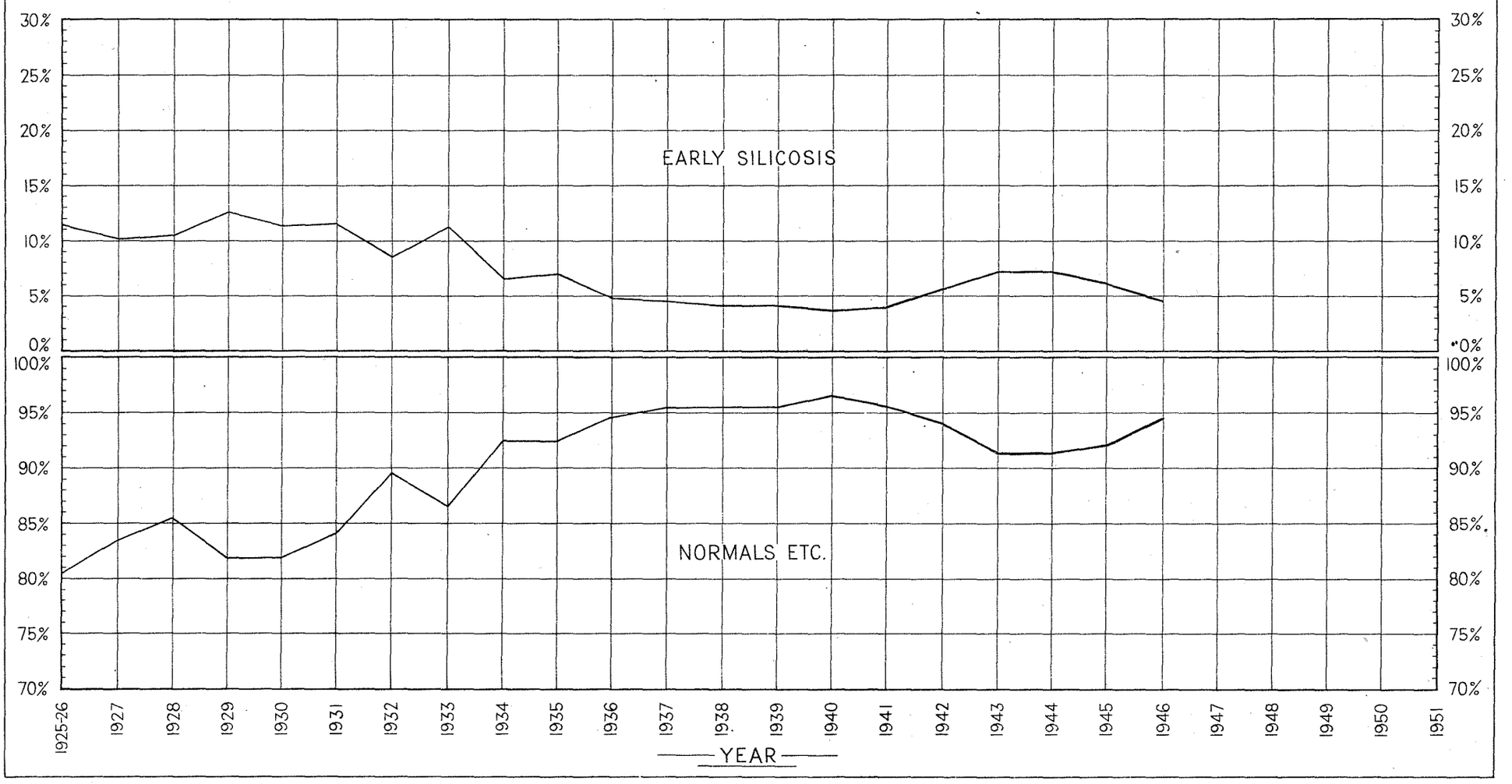
Men employed in the outlying districts were not examined during 1929 or 1931 ; only those employed in Kalgoorlie and surrounding districts being examined. The increase in numbers diagnosed as Early Silicosis and Tuberculosis in 1930 was due to the improved plant and radiographic technique.

Only new miners and those whose previous diagnosis warranted review were examined in the outlying districts during 1933.

PERIODICAL EXAMINATION OF MINE WORKERS

GRAPH No.1

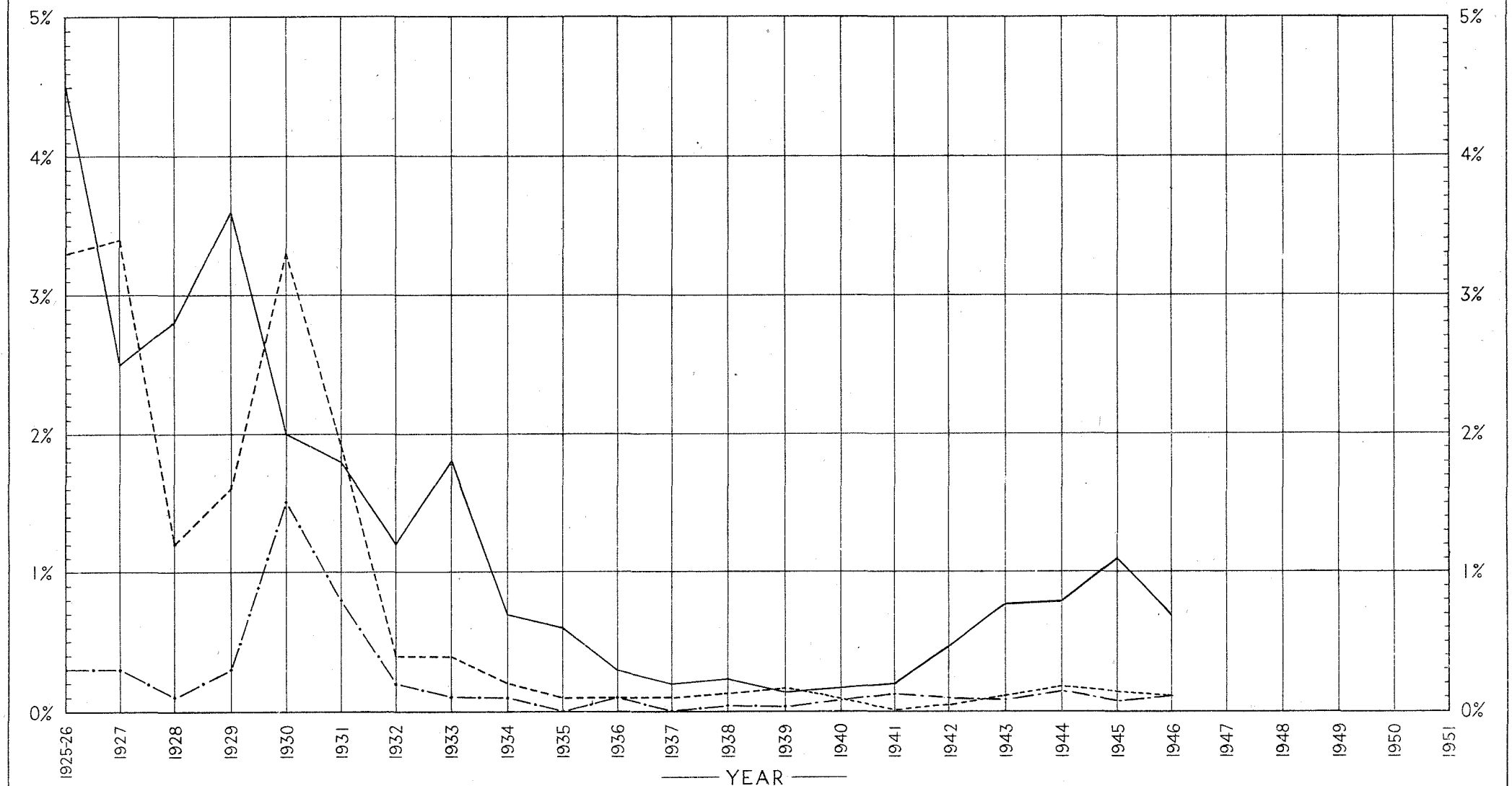
Showing Percentages of Normals and Early Silicotics, from 1925-26 onwards



PERIODICAL EXAMINATION OF MINE WORKERS

GRAPH No. 2

Showing Percentages of Silicosis Advanced, Silicosis plus Tuberculosis and Tuberculosis only, from 1925-26 onwards



Silicosis Advanced ———— *Silicosis Plus Tuberculosis* - - - - - - - - *Tuberculosis Only* ·—·—·—·—·

Mining Statistics to 31st December, 1946.

TABLE OF CONTENTS.

TABLE I.

PRODUCTION OF GOLD AND SILVER FROM ALL SOURCES, SHOWING IN FINE OUNCES THE OUTPUT AS REPORTED TO THE MINES DEPARTMENT DURING 1946, AND THE TOTAL PRODUCTION TO DATE.

(*Note.*—Lease numbers in brackets indicate that the holding was *voided* during the year.)

(*Note.*—* denotes mainly derived from treatment of tailings.)

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Kimberley Goldfield.												
Brockman ...	109	Mt. Bradley	...	...	...	...	...	...	...	193·00	50·94	...
		Voided leases	...	...	...	...	...	...	...	1,352·75	1,404·40	...
		Sundry claims	...	...	...	...	...	7·62	7·62	2,484·00	1,871·92	...
Halls Creek ...	...	Voided leases	...	...	...	...	...	...	...	423·00	477·76	...
		Sundry claims	...	...	...	...	...	27·73	...	204·55	159·68	...
Mt. Dockrell ...	95	Irish Lass	...	...	...	...	...	9·17	13·66	341·00	266·75	...
		Voided leases	...	...	...	...	...	...	...	832·70	939·34	93·00
		Sundry claims	...	...	...	...	...	...	20·03	160·00	89·64	...
Ruby Creek ...	98	Goliath	...	...	...	...	...	...	...	120·70	103·72	...
	97	Ruby Queen	...	...	...	...	...	...	...	2,799·25	1,556·85	...
	100	St. Lawrence	...	...	...	...	...	...	...	10·00	11·32	...
	96	West & Left	...	...	...	...	...	...	...	10·00	5·30	...
		Voided leases	...	...	...	...	...	...	16·05	12,761·50	9,499·48	...
		Sundry claims	...	...	...	...	...	...	...	273·25	177·27	...
The Mary ...	...	Voided leases	...	...	...	...	...	...	...	399·00	210·03	...
		Sundry claims	...	...	...	...	...	...	...	46·85	53·66	...
The Panton ...	...	Voided leases	...	...	...	...	...	...	...	34·70	138·70	...
		Sundry claims	...	...	...	...	...	...	...	6·15	18·01	...
	From Goldfield generally :—											
	Reported by Banks and Gold Dealers		167·92	65·55	...	...	...	8,055·98	150·62	·75	1·54	...
	Totals		**167·92**	**65·55**	...	...	...	**8,100·50**	**207·98**	**22,453·15**	**17,036·31**	**93·00**
Pilbara Goldfield.												
MARBLE BAR DISTRICT.												
Bamboo Creek ...	856	Bulletin	...	...	84·00	35·10	...	...	8·36	3,156·00	999·41	...
	850	Federation	...	...	130·50	90·97	...	...	...	1,411·00	927·24	...
	866, 901 ...	Greater Bonnie Doon (1935), Limited ...	...	...	...	...	...	...	...	2,530·00	1,043·86	...
	866	(Bonnie Doon)	...	...	...	...	...	...	...	204·00	78·03	...
	707	Kitchener	...	...	108·00	41·62	...	...	...	9,789·50	13,674·29	...

	1010	Mickey	...	...	324·00	84·08	...	...	...	1,624·00	436·07	...
	1075	Queen	...	...	50·00	52·37	...	...	...	50·00	52·37	...
	740, 794, 878	Mt. Prophecy Leases	...	...	80·00	46·82	...	...	...	8,170·50	8,309·61	...
	740	(Mt. Prophecy)	...	...	...	...	...	...	1·11	1,040·50	1,898·07	...
	794	(Perseverance)	...	...	...	...	...	...	...	290·50	584·21	...
	817	Prince Charlie	...	...	183·50	74·04	...	...	3·68	2,246·00	3,160·26	...
	924	True Blue	...	...	157·50	1·88	...	...	...	1,979·25	83·71	...
		Voided leases	...	...	...	...	...	13·54	550·72	18,375·85	25,744·37	...
		Sundry claims	...	...	99·00	50·25	...	8·97	307·83	4,974·85	2,975·31	...
Boodalyerri ...	...	Voided leases	...	...	...	...	...	...	292·07	120·25	587·86	...
		Sundry claims	...	...	...	...	...	...	7·16	...	...	...
Lalla Rookh ...	...	Voided leases	...	...	...	...	...	...	4·78	3,612·00	4,696·33	574·01
		Sundry claims	...	...	...	...	...	...	...	7,943·00	7,675·09	...
Marble Bar ...	927, etc. ...	Comet Gold Mines, Limited	...	...	12,075·00	7,698·05	...	...	...	103,843·19	92,978·56	...
		Prior to tranfer to present holders			...	...	...	...	...	2,195·75	1,235·42	...
	1063	General	...	...	65·50	90·54	...	...	...	210·25	442·00	...
	912	Homeward Bound	...	...	363·25	245·77	...	...	...	5,671·25	2,818·34	...
	1078	Outward Bound East	...	...	17·55	20·96	...	...	...	17·55	20·96	...
	1050	Stray Shot	...	...	7·25	2·45	...	...	...	92·50	76·28	...
	(929)	Tassy Queen	...	...	77·25	36·14	...	...	...	77·25	36·14	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	3,851·75	2,188·25	...
		Voided leases	...	...	...	...	...	...	199·09	36,072·25	37,909·14	...
		Sundry claims	...	...	291·40	236·16	...	67·08	251·77	19,508·79	12,364·22	...
North Pole ...	1040	Normay	...	...	...	...	...	...	...	69·00	31·07	...
		Voided leases	...	...	...	...	...	...	...	548·00	400·52	...
		Sundry claims	...	...	...	...	...	...	...	549·75	286·38	...
North Shaw ...	...	Voided leases	...	...	...	...	...	7·53	...	1,072·45	996·29	...
		Sundry claims	...	...	...	...	...	2·84	567·06	179·75	121·72	...
Pilgangoora ...	...	Voided leases	...	...	...	...	...	16·65	...	2,255·00	403·60	...
		Sundry claims	...	...	...	...	...	161·08	8·13	481·60	146·39	...
Sharks	...	Edelweis	...	...	...	...	...	...	...	195·50	139·38	...
		Voided leases	...	...	...	...	...	1·43	...	1,525·25	1,811·70	...
		Sundry claims	...	...	1·75	7·65	...	162·10	41·42	1,078·75	1,606·32	...
Talga	...	Voided leases	...	...	...	...	...	...	93·15	1,799·00	1,760·68	...
		Sundry claims	...	...	8·00	1·76	...	64·70	85·18	1,975·90	1,499·86	...
Tambourah ...	...	Voided leases	...	...	...	...	...	...	73·90	1,576·50	1,882·29	...
		Sundry claims	...	...	...	...	...	89·52	294·75	3,742·25	2,689·78	...
Warrawoona ...	...	Voided leases	...	...	...	...	...	...	16·99	12,748·80	18,830·50	...
		Sundry claims	...	...	14·50	9·29	...	70·98	623·67	6,157·54	4,204·63	...
Western Shaw ...	...	Voided leases	...	...	...	...	...	...	...	1,222·50	957·80	...
		Sundry claims	...	...	...	...	...	22·34	67·47	71·50	81·49	...
Wyman's Well ...	1002, 1003 ...	Copenhagen Leases	...	...	...	...	...	...	...	785·75	39·29	...
	1002	(Copenhagen)	...	...	...	...	...	...	...	1,046·75	42·87	...
	1013	Trump	...	...	240·50	43·34	...	...	...	2,422·75	443·89	...
		Voided leases	...	...	...	...	...	...	42·86	1,144·79	1,176·28	...
		Sundry claims	...	...	56·25	24·96	...	1·14	51·52	2,427·36	1,218·61	...

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

PILBARA GOLDFIELD—*continued.*

MARBLE BAR DISTRICT—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Yandacoogina ...	...	Voided leases	...	...	...	...	...	...	140·76	3,159·20	6,218·83	...
		Sundry claims	...	...	8·75	11·95	...	4·32	239·89	574·50	642·82	...
		From District generally :—										
		Sundry Parcels treated at :										
		Bamboo Creek State Battery	...	...	...	*260·95	...	...	...	40·00	*9,849·79	*181·04
		Marble Bar State Battery	...	...	...	*410·55	...	...	...	12·00	*9,614·37	...
		Ironclad Battery	...	...	...	...	...	...	...	...	*237·71	...
		The Great North Western Gold Co., Ltd. ...	...	...	...	*2·98	...	...	...	...	*270·05	...
		Various Works	...	...	...	...	...	...	...	237·95	*1,391·56	...
		Reported by Banks and Gold Dealers	42·58	...	...	...	...	14,094·11	436·76	...	·90	...
		Totals	**42·58**	...	**14,443·45**	**9,580·63**	...	**14,788·33**	**4,410·08**	**288,157·82**	**291,992·77**	**755·05**
		NULLAGINE DISTRICT.										
Eastern Creek ...	276L	Rose	...	...	6·00	7·30	...	...	...	51·50	68·25	...
		Voided leases	...	...	...	...	...	8·96	8·19	5,261·00	9,567·00	11·77
		Sundry claims	...	...	5·50	6·74	...	...	12·74	1,409·10	1,600·71	16·90
Elsie	...	Voided leases	...	...	...	...	...	...	...	586·25	1,675·91	...
		Sundry claims	...	...	...	...	...	...	8·28	58·00	188·08	...
McPhees Creek ...	...	Voided leases	...	...	...	...	...	...	...	113·00	137·92	...
		Sundry claims	...	...	...	...	...	...	...	134·00	197·09	...
Middle Creek ...	279L	All Nations	...	...	108·50	31·05	...	...	...	549·00	177·23	...
	229L	Barton	...	...	76·00	35·10	...	1·22	...	1,419·50	251·06	...
	231L, etc. ...	Blue Spec Leases	...	...	8,844·00	2,139·26	...	...	...	17,101·50	5,493·77	...
	290L	Garibaldi	...	...	112·00	83·42	...	...	...	112·00	83·42	...
	247L	Hopetoun North	...	...	300·50	59·54	...	...	...	513·50	110·97	...
	271L	Hopetoun South Block	...	...	62·00	25·32	...	...	...	62·00	25·32	...
	267L	Little Wonder	...	...	...	...	...	...	...	3,226·00	869·72	...
		Voided leases	...	...	...	...	...	...	...	11,683·15	9,896·69	...
		Sundry claims	...	...	73·50	36·64	...	...	...	4,568·10	2,054·83	...
Mosquito Creek ...	...	Voided leases	...	...	...	...	...	1·07	30·12	8,232·30	12,814·22	...
		Sundry claims	...	12·93	40·00	18·71	...	...	181·64	3,660·94	3,771·31	...
Nullagine	289L	Pauls Leader	...	11·31	9·00	86·22	...	...	11·31	9·00	86·22	...
	270L	Valentine	...	...	17·50	14·90	...	...	...	156·50	81·64	...
		Voided leases	...	...	...	...	...	...	32·79	8,646·25	12,306·39	...
		Sundry claims	...	116·10	42·50	18·47	...	313·02	517·01	5,800·55	10,080·46	...

Twenty Mile Sandy	256L	Bill Jim	...	...	273·00	69·97	...	...	...	1,891·00	1,013·40	...
		Voided leases	...	...	...	...	...	...	3·20	5,221·20	7,971·21	...
		Sundry claims	...	...	36·00	35·92	...	33·10	30·50	7,171·35	5,931·81	...
		From District generally :—										
		Sundry parcels treated at :										
		Twenty Mile Sandy Cyanide Plant	...	...	...	*26·54	...	...	...	...	1,312·82*	...
		Various Works	...	...	...	...	...	...	...	112·50	*6,340·55	...
		Reported by Banks and Gold Dealers	32·73	...	...	...	...	9,331·40	97·45	...	27·17	...
		Totals	**32·73**	**140·34**	**10,006·00**	**2,695·10**	...	**9,688·77**	**933·23**	**87,749·19**	**94,135·17**	**28·67**

Ashburton Goldfield.

Belvedere	...	Voided leases	...	...	...	...	...	...	9·88	1,560·00	435·86	176·48
Dead Finish ...	47	Star of the West	...	...	...	...	...	...	...	448·50	293·64	...
		Voided leases	...	...	...	...	...	...	...	281·50	279·51	...
		Sundry Claims	...	...	...	...	...	...	11·89	78·75	235·31	...
Melrose	...	Voided leases	...	...	...	...	...	...	...	2,704·00	840·26	213·11
		Sundry Claims	...	...	...	...	...	12·41	21·88	562·00	262·78	6·40
Mt. Edith ...	...	Sundry Claims	...	...	...	...	...	...	...	5·00	3·97	...
Mt. Mortimer ...	...	Sundry Claims	...	...	...	...	...	364·63	315·64	44·50	40·25	74·47
Maroo	...	Voided leases	...	...	...	...	...	...	...	...	...	7,713·22
		From Goldfields generally :—										
		Reported by Banks and Gold Dealers	2·42	50·80	...	...	...	8,880·52	120·11	...	7·12	...
		Totals	**2·42**	**50·80**	...	...	...	**9,257·56**	**479·40**	**5,684·25**	**2,398·70**	**8,183·68**

Gascoyne Goldfield.

Bangemall ...	...	Voided leases	...	...	...	...	...	...	6·22	350·70	313·82	...
		Sundry claims	...	...	...	...	...	88·97	33·55	36·30	203·47	...
		From Goldfields generally :—										
		Reported by Banks and Gold dealers	15·92	...	...	...	...	604·47	1·80	...	...	...
		Totals	**15·92**	...	...	...	...	**693·44**	**41·57**	**387·00**	**517·29**	...

Peak Hill Goldfield.

Egerton	556P	Pegasus	...	...	150·00	404·98	...	...	84·84	1,268·00	2,884·45	
		Voided leases	...	...	...	...	...	60·86	30·91	5,077·25	2,842·45	...
		Sundry Claims	...	...	24·00	12·66	...	235·35	23·51	1,455·77	778·40	...
Horseshoe ...	564P	Labourchere Main Lode	...	...	393·50	92·57	...	...	12·71	498·50	111·22	...
	565P	Nathan Bitter	...	...	245·00	55·69	...	...	...	441·00	106·15	...
		Voided leases	...	...	...	...	...	15·57	1,962·66	2,051·88	2,240·09	2·00
		Sundry Claims	...	...	17·50	18·02	...	20·12	829·58	1,812·05	691·38	...

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

PEAK HILL GOLDFIELD—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Jimblebar ...	... ...	Voided leases	...	...	...	...	...	...	172·75	7,526·25	2,561·95	·58
		Sundry Claims	...	...	...	...	...	13·79	65·95	1,048·05	574·16	...
Mt. Fraser ...	... ...	Voided leases	...	...	...	...	...	...	...	389·50	320·96	...
		Sundry Claims	...	...	...	...	...	88·28	40·61	400·75	341·14	...
Mt. Seabrook ...	... ...	Voided leases	...	...	...	...	...	...	5·05	620·25	428·26	...
		Sundry claims	...	...	41·00	7·29	...	...	...	1,079·10	798·80	...
Peak Hill ...	512P	Atlantic	...	...	332·50	44·77	...	1·69	2·87	4,461·25	560·30	...
	552P	Bobby Dazzler	...	...	...	...	...	·63	...	505·50	258·87	...
	511P	Commercial	...	...	...	...	...	...	...	2,702·75	470·23	...
	448P	Evening Star	...	...	200·00	9·75	...	...	70·17	7,133·00	4,875·69	...
	567P	Miner Bird	...	...	212·00	106·62	...	...	...	273·00	149·59	...
	553P	Morning Star	...	...	180·00	25·73	...	...	4·43	2,654·25	334·56	...
	506P	No. 1 North	...	...	201·00	117·18	...	...	86·47	5,948·20	1,433·77	...
	492P	North Star	...	...	488·00	136·37	...	23·20	69·63	12,842·50	2,003·93	...
		Voided leases	...	...	...	...	...	6·76	850·04	513,042·83	241,783·14	2,285·63
		Sundry claims	...	...	144·00	28·25	...	61·51	275·61	33,936·85	8,890·96	...
Ravelstone ...	... ...	Voided leases	...	...	...	...	...	...	101·64	4,219·85	3,117·68	...
		Sundry claims	...	...	...	...	...	...	...	553·60	283·17	...
Wilgeena	... ...	Voided leases	...	...	...	...	...	...	23·54	128·50	146·79	...
Wilthorpe ...	... ...	Voided leases	...	...	...	...	...	...	...	47·00	20·93	...
		Sundry claims	...	...	...	...	...	...	...	89·00	25·71	...
Yowereena ...	... ...	Voided leases	...	...	...	...	...	...	...	19·50	36·46	...
		Sundry claims	...	...	...	...	...	...	...	117·25	203·16	...
		From Goldfields generally :—										
		Sundry parcels treated at :										
		State Battery, Peak Hill	...	...	...	...	...	...	3·05	15·00	*6,431·91	...
		Australian Machinery and Investment Company	...	...	...	*100·61	...	...	...	...	*1,504·98	...
		Various Works	...	...	...	...	...	...	...	30·00	*5,661·37	23·12
		Reported by Banks and Gold Dealers	...	...	...	...	...	2,846·65	444·36	...	11·43	...
		Totals	...	...	**2,628·50**	**1,160·49**	...	**3,374·41**	**5,160·38**	**612,388·18**	**292,884·04**	**2,311·33**

East Murchison Goldfield.

LAWLERS DISTRICT.

Kathleen Valley ...	1330	Beth Heno	...	...	...	...	...	...	...	548·00	222·80	...
		Voided leases	...	...	...	...	...	...	144·85	78,824·00	48,174·48	...
		Sundry claims	...	...	66·50	33·31	...	14·37	526·03	5,259·00	2,221·08	...

Lawlers	1341	Boomer	...	...	42·00	19·92	...	...	...	480·00	254·31	...
	1336	Caroline East	...	1·79	96·00	19·12	...	...	1·79	213·00	85·07	...
	1236, 1240, etc	Emu Gold Mines Ltd., ...	...	...	28,929·00	6,976·92	...	...	...	306,837·68	75,310·99	452·00
	1236, 1240, 1249	Prior to transfer to present holders	...	...	...	...	...	13·02	...	168·50	1,216·93	...
	1340	Never-can-Tell	...	...	72·00	13·06	...	...	...	119·50	35·98	...
		Voided leases	...	...	...	...	...	...	690·66	1,284,499·72	419,020·56	14,350·93
		Sundry claims	·35	...	183·00	99·82	...	400·21	388·51	16,589·48	9,131·58	268·34
Sir Samuel ...	1333	Vanguard	...	...	...	...	...	...	...	1,462·00	190·98	...
		Voided leases	...	...	...	...	...	...	359·03	273,477·55	141,386·56	10,227·52
		Sundry claims	...	...	72·25	50·41	...	53·89	64·96	7,130·00	4,438·94	...
	From District generally :—											
	Sundry parcels treated at :											
	State Battery, Sir Samuel		...	...	...	*17·60	...	...	...	53·50	*2,328·85	...
	Australian Machinery and Investment Company		...	...	...	...	...	...	...	5·00	*4,288·78	*29·00
	Prior to transfer to present holders		...	...	...	...	...	...	...	...	*1,371·33	*15·64
	Australian Machinery and Investment Company (McPhersons Cyanide Plant)		...	...	...	...	...	2·12	...	12·03	*4,265·25	...
	Great Eastern Mining Syndicate		...	...	...	...	...	...	...	...	*352·19	·12
	Tallon Doon Battery		...	...	...	*17·94	...	...	...	...	*101·50	...
	Vanguard Cyanide Plant		...	...	...	*135·95	...	...	...	4·00	*836·42	...
	Various Works		...	...	...	...	...	...	2·35	1,699·50	*26,067·02	*936·09
	Reported by Banks and Gold Dealers		·28	...	...	...	...	6,375·88	101·09	·05	9·84	...
	Totals		**·63**	**1·79**	**29,460·75**	**7,384·05**	...	**6,859·49**	**2,279·27**	**1,977,382·51**	**813,311·44**	**26,279·64**

WILUNA DISTRICT.

Coles	662J	Black Adder	...	...	...	...	...	...	...	1,108·50	520·33	...
	665J	New Venture	...	...	...	...	...	...	...	63·25	7·71	...
		Voided leases	...	...	...	...	...	...	...	767·25	149·14	...
		Sundry claims	...	·86	...	1·95	...	...	21·03	3,844·50	1,502·00	...
Corboys	671J	Barwidgee	...	...	45·00	15·53	...	...	...	45·00	15·53	...
	435J	Old Toscana	...	...	20·00	7·85	...	5·24	...	949·50	641·63	...
	669J	Vinaurum	...	...	80·00	20·95	...	...	...	616·00	382·00	...
	433J	Waratah	...	...	250·00	47·84	...	...	...	288·00	106·73	...
	433J, etc. ...	(Waratah Leases)	...	...	...	...	...	...	...	1,188·04	568·94	...
	433J, etc. ...	(Waratah Gold Mines Limited, N.L.) ...	...	...	...	...	...	...	...	359·00	587·92	...
		Voided leases	...	...	...	...	...	...	1·25	10,593·25	7,403·59	5·00
		Sundry claims	...	...	420·50	201·11	...	21·58	...	8,263·85	4,795·06	...
Gum Creek ...	...	Voided leases	...	...	...	...	...	20·75	...	1,380·00	595·73	...
	...	Sundry claims	...	...	...	...	...	...	1·36	379·25	120·89	...
Mt. Eureka ...	...	Voided leases	...	...	...	...	...	...	...	142·25	96·36	...
	...	Sundry claims	...	...	...	...	...	...	...	783·75	548·56	...
Mt. Keith... ...	...	Voided leases	...	...	...	...	...	...	44·54	20,259·50	13,551·08	...
	...	Sundry claims	...	...	...	...	...	4·81	227·29	3,862·50	2,480·03	...
New England ...	...	Voided leases	...	...	...	...	...	5·74	95·70	5,336·25	3,471·17	...
	...	Sundry claims	...	...	...	...	...	9·31	5·78	4,534·75	3,111·97	...
Wiluna	631J	Brilliant Reduced	...	...	206·00	24·07	...	...	...	1,962·75	267·42	...
	552J, 664J ...	Coolgardie Brilliant, N.L.	...	...	...	6·41	...	...	...	21,267·00	7,297·61	...
	552J	Prior to transfer to present holders	...	...	...	...	...	...	...	7,257·00	2,202·75	12·40
	607J	Coolgardie Brilliant, N.L....	...	...	...	...	...	...	...	1,140·00	1,152·53	...

TABLE I.—*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 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Wiluna—*Contd.*	607J, etc. ...	(Linden (W.A.) Gold, N.L.)	...	...	...	...	...	...	...	21,619·00	6,024·02	...
	607J	Prior to transfer to present holders	...	...	...	...	...	...	...	1,156·75	655·83	...
	(10J, 37J, etc.)	(Moonlight Wiluna Gold Mines, Ltd.) ...	...	...	...	3,095·00	...	...	...	848,151·83	206,728·40	1,213·00
	...	Prior to transfer to present holders	...	...	...	...	...	...	...	36,975·50	14,174·75	...
	194J, etc. ...	Wiluna Gold Mines, Ltd.	...	...	149,172·00	24,774·62	885·42	...	...	7,341,588·00	1,307,041·10	2,099·41
	...	Prior to transfer to present holders	...	...	...	...	...	...	...	341,730·57	133,457·92	89·32
	673J	W.X.	...	...	1,750·00	108·38	...	...	...	1,750·00	108·38	...
	...	Voided leases	...	...	...	...	...	...	574·76	140,807·75	79,753·12	124·00
	...	Sundry claims	...	...	570·50	94·65	...	105·39	219·08	25,720·55	10,150·70	·33
	From District generally :—											
	Sundry Parcels treated at :											
	State Battery, Wiluna		...	...	45·00	2·12	...	...	...	637·0	*22,160·30	*218·70
	Black Adder Battery		...	...	...	*59·64	...	...	...	...	*154·02	...
	Coolgardie Brilliant Battery		...	...	...	*175·29	...	...	...	...	*175·29	...
	Toscana Cyanide Plant		...	...	...	*62·66	...	...	...	...	*2,508·51	...
	Waratah Cyanide Plant		...	...	...	*32·46	...	...	...	...	*662·18	...
	Various Works		...	...	...	...	...	...	...	...	*1,237·68	*12·68
	Reported by Banks and Gold Dealers...		...	...	...	...	...	49·54	56·58	...	51·48	...
		Totals	...	**·86**	**152,559·00**	**28,730·53**	**885·42**	**222·36**	**1,247·37**	**8,856,078·09**	**1,836,620·36**	**3,774·84**

BLACK RANGE DISTRICT.

Barrambie ...	972B, 976B ...	Sheelite leases	...	...	...	...	...	...	...	616·50	698·11	...
	972B	(Sheelite)	...	...	...	...	...	...	...	105·50	108·88	...
	976B	(Sheelite North)	...	...	...	...	...	...	...	92·75	92·83	...
	...	Voided leases	...	...	...	...	...	...	22·49	17,359·42	16,200·76	125·60
	...	Sundry claims	...	...	...	...	...	5·07	168·10	833·55	915·51	...
Bellchambers ...	...	Voided leases	...	...	...	...	...	...	111·80	3,437·27	1,758·90	...
	...	Sundry claims	...	...	54·00	41·21	...	...	...	673·80	433·72	...
Birrigrin	...	Voided leases	...	...	...	...	...	...	820·68	12,042·93	15,086·09	...
	...	Sundry claims	...	...	...	...	...	...	179·92	2,487·55	1,238·22	...
Curran's Find ...	...	Voided leases	...	...	...	...	...	18·24	222·89	7,252·25	3,116·68	...
	...	Sundry claims	...	...	...	...	...	...	29·38	2,158·75	827·18	...
Errolls	...	Voided leases	...	...	...	...	...	14·17	152·29	14,170·50	9,328·92	...
	...	Sundry claims	...	...	...	...	...	6·53	399·11	964·75	595·45	...

Hancocks	1074B	Apples	...	...	...	...	...	...	443·79	599·75	651·16	...
		Voided leases	...	...	...	...	...	...	6,524·37	32,624·50	33,433·33	55·72
		Sundry claims	...	...	59·75	42·74	...	4·21	142·89	8,386·10	3,194·81	...
Maninga Marley ...	...	Voided leases	...	...	...	...	...	...	195·20	60,833·48	48,494·40	22·55
		Sundry claims	...	...	...	...	...	...	158·16	3,071·40	1,764·28	...
Montague ...	967B, 998B ...	North End Leases	...	...	115·00	7·00	...	...	...	35,487·95	4,878·16	...
		Voided leases	...	...	...	...	...	...	100·17	39,672·65	16,888·02	...
		Sundry claims	...	...	...	...	...	...	71·09	5,018·60	3,147·93	...
Nungarra	...	Voided leases	...	...	...	...	...	25·94	952·34	10,395·75	5,015·04	...
		Sundry claims	...	...	13·00	7·75	...	50·27	1,458·06	7,507·15	2,938·66	...
Sandstone... ...	959B, etc. ...	Atlas Gold Mines, Ltd.	...	...	...	...	...	...	...	959·00	168·60	...
	...	Prior to transfer to present holders	...	...	...	...	...	...	136·06	537·75	686·59	...
	1076B, 1080B ...	Black Range Gold Mines, Limited ...	...	...	...	...	...	...	...	84·00	14·34	...
	1075B	Doolette South	...	...	144·25	260·85	...	...	217·54	1,047·25	1,586·44	...
	958B	Lady Mary	...	...	408·50	303·97	...	...	...	6,585·50	6,117·86	2·28
		Voided leases	...	...	...	...	...	4·75	4,010·09	692,530·07	444,309·77	11,754·22
		Sundry claims	...	...	165·00	56·33	...	44·95	1,421·07	14,907·45	6,705·75	...
Youammi ...	1046B	Camberra	...	...	...	...	...	...	...	1,501·00	443·13	...
	960B, etc. ...	Youanmi Leases	...	...	1·50	107·06	...	...	...	1·50	107·06	...
	960B, etc. ...	(Youanmi Gold Mines, Limited)...	...	...	...	...	...	...	...	370,977·77	96,279·42	5,865·55
	960B	(Youanmi)	...	...	...	...	...	...	...	38·50	3·91	...
		Voided leases	...	...	...	...	...	·36	126·92	358,978·78	176,882·54	4,608·55
		Sundry claims	...	...	...	...	...	1·07	18·79	6,258·55	1,814·66	...
	From District generally :—											
	Sundry Parcels treated at :											
	State Battery, Sandstone		...	...	24·50	*164·65	...	...	...	290·50	*22,664·53	*59·53
	State Battery, Youanmi		...	...	...	...	...	...	...	40·00	*5,461·83	...
	North End Cyanide Plant		...	...	...	*22·15	...	...	...	...	*4,934·14	...
	Various Works		...	...	...	...	...	...	...	37·00	*6,505·69	...
	Reported by Banks and Gold Dealers...		15·30	1·39	...	...	...	1,457·11	52·23	...	20·38	...
	Totals		**15·30**	**1·39**	**985·50**	**1,013·71**	**...**	**1,632·67**	**18,135·43**	**1,720,567·47**	**945,513·68**	**22,494·00**

Murchison Goldfield.

CUE DISTRICT.

Big Bell	2050, etc. ...	Big Bell Mines, Limited	...	...	153,588·00	19,633·01	7,298·28	...	...	2,379,807·00	310,248·53	106,454·93
	2050	(Little Bell)	...	...	...	...	...	...	4·49	579·75	60·95	...
	2219	Pindar	...	...	...	...	...	...	...	65·00	79·35	...
		Voided leases	...	...	...	...	...	...	...	274·75	278·83	...
		Sundry claims	...	...	...	...	...	·39	6·32	359·50	339·41	...
Cuddingwarra ...	...	Voided leases	...	...	...	...	...	10·59	132·46	102,020·41	56,131·93	100·71
		Sundry claims	...	·62	94·00	66·56	...	18·46	366·18	8,314·89	4,871·91	9·00
Cue	2236	Hill View	...	...	260·25	127·49	...	95·96	298·39	928·25	1,013·95	2·48
	2247	Victory	...	...	7·25	5·67	...	...	...	7·25	5·67	...
		Voided leases	...	...	...	...	...	106·75	613·21	287,720·44	220,011·47	66·63
		Sundry claims	...	...	478·50	107·46	...	243·45	894·70	41,775·74	18,978·44	...

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

MURCHISON GOLDFIELD—*continued.*

CUE DISTRICT.—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Eelya	...	Voided leases	...	...	...	...	...	...	8·78	1,069·00	1,811·26	...
	...	Sundry claims	...	41·95	614·00	157·51	...	6·20	143·81	1,568·90	917·21	...
Mindoolah... ...	...	Voided leases	...	...	...	...	...	3·07	2·54	9,380·28	5,672·31	42·97
	...	Sundry claims	...	...	...	...	...	...	29·30	3,002·10	2,180·55	...
Reedy	1977, etc. ...	Triton Gold Mines, N.L.	...	...	...	...	...	...	...	604,070·00	191,041·46	17,791·92
	...	Prior to transfer to present holders	...	...	...	...	...	...	...	16,338·50	7,471·50	5·00
	...	Voided leases	...	...	...	...	...	1·46	214·65	6,552·93	10,128·90	1·22
	...	Sundry claims	...	...	116·50	15·73	...	170·71	120·73	5,056·55	2,267·85	...
Tuckabianna ...	2130	Garibaldi	...	...	...	...	...	...	45·22	298·88	544·36	...
	2237	Gidgie	...	...	191·00	48·01	...	...	...	2,228·40	830·15	...
	2244	Winston	...	122·14	71·00	40·13	...	...	198·46	71·00	40·13	...
	...	Voided leases	...	...	...	...	...	649·70	252·46	12,590·85	6,764·20	...
	...	Sundry claims	...	...	41·75	6·66	...	143·17	480·56	4,264·35	2,496·47	...
Tuckanarra ...	2079	Batchelor	...	...	...	...	...	70·72	75·39	450·25	381·43	...
	...	Voided leases	...	...	...	...	...	14·65	3,435·71	19,034·00	22,436·76	172·77
	...	Sundry claims	...	...	22·00	6·88	...	115·23	769·93	9,851·55	10,196·21	...
Weld Range ...	...	Voided leases	...	...	...	...	...	...	23·64	1,593·75	834·35	...
	...	Sundry claims	...	...	...	...	...	...	3·90	1,203·75	766·13	...
		From District generally :—										
		Sundry Parcels treated at:										
		State Battery, Cue	...	...	22·75	*432·82	...	...	...	76·25	*20,785·87	91·93
		State Battery, Tuckanarra	...	...	...	*11·69	...	...	...	518·50	*5,535·57	...
		Various Works	...	...	...	...	...	...	...	7,158·52	*29,387·81	1,147·77
		Reported by Banks and Gold Dealers...	21·79	...	...	...	...	3,332·12	98·06	...	22·62	...
		Totals	**21·79**	**164·71**	**155,507·00**	**20,659·62**	**7,298·28**	**4,982·63**	**8,218·89**	**3,528,231·29**	**934,533·54**	**125,887·33**

MEEKATHARRA DISTRICT.

Abbotts	...	Voided leases	...	...	...	...	...	...	26·45	36,841·35	38,775·28	...
		Sundry claims	...	...	...	...	...	...	5·29	3,661·27	2,237·83	...
Burnakura ...	1849N	New Alliance	...	...	...	...	...	...	...	132·25	114·39	...
		Voided leases	...	...	...	...	...	...	3,247·59	39,040·45	30,775·77	26·90
		Sundry claims	...	...	207·75	80·88	...	17·03	129·24	2,218·05	1,163·75	1·54

Chesterfield ...	...	Voided leases	...	...	...	...	...	29·02	420·32	6,869·26	7,483·76	·80		
		Sundry claims	...	...	...	...	...	...	42·19	888·55	714·20	...		
Gabanintha ...	1854N	Golden Star	...	...	33·50	4·14	...	...	...	236·75	255·20	...		
	1725N	New Brew	...	...	1,020·75	1,211·88	...	...	...	2,706·35	3,884·28	...		
		Voided leases	...	...	...	...	...	11·79	28·82	23,826·75	14,039·87	815·57		
		Sundry claims	...	11·22	445·00	206·04	...	16·78	158·94	3,942·00	2,406·78	...		
Garden Gully ...	...	Voided leases	...	...	...	...	...	26·36	74·91	30,238·32	21,847·71	1,102·59		
		Sundry claims	...	...	21·00	7·13	...	...	7·51	2,864·69	1,684·36	...		
Gum Creek ...	...	Voided leases	...	...	...	...	...	25·27	91·96	3,893·08	3,819·91	...		
		Sundry claims	...	...	...	...	...	4·37	84·86	727·25	636·85	...		
Holdens	1551N	New Waterloo	...	...	...	...	...	...	·99	1,468·00	918·92	...		
		Voided leases	...	...	...	...	...	...	18·00	16,593·00	6,401·50			
		Sundry claims	...	...	...	...	...	164·95	49·07	425·15	279·25	...		
Jillawarra ...	1871N	Werribie	...	...	99·75	86·46	...	...	128·85	410·50	703·74	...		
		Voided leases	...	...	...	...	...	...	1,134·68	1,499·55	2,801·53	...		
		Sundry claims	...	...	...	...	...	173·02	150·04	374·00	359·59	...		
Meeka Pools ...	...	Voided leases	...	...	...	...	...	...	...	111·58	82·27	...		
		Sundry claims	...	...	...	...	...	...	2·84	233·57	205·38	...		
Meekatharra ...	1861N	Adele May	...	...	...	...	...	...	...	9·00	4·37	...		
	1883N	Coffee Pot	...	...	106·00	37·06	...	...	...	205·00	82·98	...		
	1855N	Commodore	...	...	159·50	31·50	...	...	...	735·25	213·46	...		
	1553N	Consols North	...	...	30·25	91·55	...	...	...	611·25	1,332·65	...		
	1900N.... ...	Danube	...	...	60·25	37·19	...	...	...	60·25	37·19	...		
	814N, 1894N ...	Fenian Leases	...	...	200·00	292·10	...	...	...	329,277·44	260,819·64	...		
	477N	Fenian	...	...	...	...	...	...	...	8,831·75	18,289·22	...		
	1884N	Fortune Teller	...	...	...	...	...	...	7·09	794·00	102·63	...		
	1890N	Gold Jay	...	12·12	49·25	217·06	...	...	12·12	49·25	217·06	...		
	1893N	Halcyon	...	...	609·25	90·00	...	...	·78	1,211·00	206·33	...		
	1888N	Haveluck	...	...	...	...	...	...	...	207·25	48·97	...		
	1559N	Ingliston	...	10·69	61·25	54·55	...	...	491·80	1,766·30	1,574·17	...		
	1542N	Ingliston Alberts	...	...	26·00	29·11	...	...	...	305·50	446·00	...		
	1542N (1566N, 1575N)	(Ingliston Alberts Leases) ...	...	...	...	...	...	...	...	2,983·70	1,283·06	...		
	1895N, etc. ...	Ingliston Consols Extended Leases	...	...	...	...	...	...	...	873,719·47	357,046·42	...		
	475N	Prior to transfer to present holders	...	...	...	...	...	...	...	1,536·25	4,248·25	·30		
	1547N	Lady Central	...	...	...	...	...	...	...	32·75	26·05	...		
	1547N, (1576N)	(Meekatharra Central Gold, N.L.) ...	...	...	...	...	...	...	5·29	4,842·25	2,463·30	...		
	1547N (1576N)	(Lady Central leases)	...	...	...	...	...	...	11·06	2,951·42	5,198·33	...		
	1899N	Marmont	...	...	...	...	...	...	89·33	60,345·20	43,122·06	...		
	1906N	Marmont Extended	...	...	...	...	...	...	...	1,667·95	1,562·40	...		
	580N (888N) ...	(Marmont Extended leases) ...	...	...	...	...	...	...	...	152·00	129·61	...		
	1577N	Mopoke	...	...	...	...	...	...	12·47	1,338·25	820·16	...		
	1860N	New Gwalia	...	...	101·25	61·55	...	...	...	523·00	122·83	...		
	1800N	Peter Pan	...	...	...	...	...	...	...	948·00	90·78	...		
	1571N	Phar Lap	...	...	775·00	304·88	...	...	...	7,420·75	4,680·90	...		
	1529N, etc. ...	Prohibition Gold Mining Co., N.L. (In Liquidation)	...	...	...	167·86	...	...	...	24,844·25	4,799·42	11·83		
	1529N	Prior to transfer to present holders	...	...	...	...	...	...	...	29,422·00	4,971·30	...		
		Voided leases	...	...	...	...	...	3·88	1,316·68	391,976·73	217,860·94	2,454·74		
		Sundry claims	...	...	549·75	206·57	...	229·71	577·31	22,964·95	9,211·32	...		
Mistletoe	...	Voided leases	...	...	...	...	...	4·15	1,000·24	417·00	486·21	...		
		Sundry claims	...	...	...	...	...	119·14	71·85	19·75	2·03	...		

TABLE I.—*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 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Mt. Maitland ...	...	Voided leases	...	...	...	...	...	...	...	88·00	80·11	...
		Sundry claims	...	...	...	...	...	...	...	420·75	240·86	...
Munara Gully ...	...	Voided leases	...	...	...	...	...	...	...	13,283·50	6,559·93	...
		Sundry claims	...	...	...	...	...	...	34·23	1,009·75	373·74	...
Nannine	1872N	Blue Pedro	...	...	...	...	...	...	...	7,003·75	1,650·12	...
	1580N	Caledonian	...	2·18	...	...	...	...	2·18	1,025·10	492·74	...
	(1879N) ...	Called Back	...	...	10·75	6·99	...	...	29·96	15·00	41·35	...
		Voided leases	...	...	...	...	...	37·25	7?6·62	113,287·32	72,331·89	167·45
		Sundry claims	...	...	...	...	...	116·99	1,248·76	6,007·68	4,647·29	...
Quinns	...	Voided leases	...	...	...	...	...	7·30	1,186·50	33,356·91	13,464·37	90·70
		Sundry claims	...	...	12·50	1·67	...	15·07	1,289·65	3,841·67	2,718·33	...
Ruby Well ...	...	Voided leases	...	...	...	...	...	...	43·46	7,461·00	4,046·70	...
		Sundry claims	...	...	...	...	...	1,015·87	409·39	520·25	629·60	...
Stake Well ...	...	Voided leases	...	...	...	...	...	...	200·12	21,362·00	9,566·18	...
		Sundry claims	...	...	...	...	...	31·91	34·73	1,003·60	584·54	...
Star of the East...	...	Voided leases	...	...	...	...	...	...	...	27,244·00	20,305·40	...
		Sundry claims	...	...	...	...	...	...	...	127·62	94·97	...
Yaloginda ...	1853N	Bluebird	...	...	...	...	...	...	...	4,002·00	1,219·21	...
	1898N	Rocklee	...	...	28·75	22·47	...	...	...	72·00	41·37	...
		Voided leases	...	...	...	...	...	19·03	1,972·23	28,103·54	14,567·99	8·68
		Sundry claims	...	...	140·25	97·38	...	61·89	647·51	10,134·42	4,700·65	...
		From District generally :—										
		Sundry Parcels treated at :										
		State Battery, Meekatharra	...	...	20·00	*449·04	...	...	...	88·50	*23,613·19	*19·00
		Various Works	...	...	...	...	...	...	...	172·75	*6,729·60	*342·17
		Reported by Banks and Gold Dealers	14·07	...	...	...	...	12,118·81	178·80	13·50	22·00	...
		Totals	**14·07**	**36·21**	**4,767·75**	**3,795·06**	...	**14,249·59**	**17,472·71**	**2,231,015·24**	**1,271,814·27**	**5,042·27**
		DAY DAWN DISTRICT.										
Day Dawn ...	652D	Creme D'Or	...	...	19·25	28·05	...	...	...	225·00	167·62	...
	(661D)	Klondike West	...	...	45·75	11·78	...	...	20·56	45·75	11·78	...
	573D	Mountain View	...	...	1,423·00	4,883·17	...	...	94·05	8,138·53	19,828·65	...

	576D	New Fingall	...	...	268·50	167·94	...	6·12	6·84	3,230·00	1,226·01	...
		Voided leases	...	...	...	...	...	160·64	806·09	1,921,658·86	1,225,373·29	169,210·44
		Sundry claims	...	...	106·50	19·36	...	96·42	508·85	12,537·51	6,176·44	...
Lake Austin ...	...	Voided leases	...	...	...	...	...	613·00	3,079·62	36,872·20	51,050·49	...
		Sundry claims	...	22·43	50·00	7·69	...	59·07	965·49	3,173·44	1,242·41	...
Mainland	...	Voided leases	...	...	...	...	...	·41	3,296·77	7,565·62	25,026·07	...
		Sundry claims	...	20·61	...	...	...	16·57	767·19	1,337·95	701·31	...
Pinnacles ...	...	Voided leases	...	...	...	...	...	4·90	1,213·68	18,117·00	9,869·29	...
		Sundry claims	...	...	...	...	...	62·93	446·50	4,266·17	1,641·77	...
	From District generally :—											
	Sundry parcels treated at :											
	Various Works		...	...	...	...	...	...	16·61	962·75	1,985·65	...
	Reported by Banks and Gold Dealers		58·63	·69	...	...	...	2,029·47	34·66	...	12·57	...
	Totals		**58·63**	**43·73**	**1,913·00**	**5,117·99**	...	**3,049·53**	**11,256·91**	**2,018,140·78**	**1,344,313·35**	**169,210·44**

MOUNT MAGNET DISTRICT.

Jumbulyer ...	1401M	Gold Bug	...	...	63·50	15·19	...	...	...	131·25	134·98	...
	1406M	Granites	...	...	7·50	6·48	...	...	...	19·75	32·93	...
		Voided leases	...	...	...	...	...	...	13·37	660·35	328·81	...
		Sundry claims	1·87	...	76·00	30·26	...	20·32	116·27	1,119·45	797·63	...
Lennonville ...	1308M	Empress	...	...	30·00	8·63	...	...	...	435·00	125·24	...
	1379M	Galtee Moore	...	...	50·00	10·20	...	...	...	5,576·00	1,467·97	...
	1378M	Gambier Lass	...	...	...	...	...	...	5·85	419·00	101·26	...
	1430M	Souvenir	...	...	146·00	148·73	...	...	...	146·00	148·73	...
	1436M	Splendour Group	...	...	9·75	5·25	...	...	...	9·75	5·25	...
		Voided leases	...	...	...	...	...	...	3,221·06	144,095·30	126,061·37	458·82
		Sundry claims	4·16	...	186·75	59·80	...	23·30	108·82	13,809·52	5,230·89	...
Mt. Magnet ...	1432M	Chum	...	...	97·75	108·54	...	...	...	199·75	233·51	...
	1382M	Corona	...	...	...	1·03	...	...	...	3,472·65	2,723·12	...
	1255M, etc. ...	Edward Carson Leases	...	...	150·00	130·66	...	...	...	17,890·50	12,732·24	7·00
	1286M ...	Evening Star	...	...	300·00	28·41	...	...	36·37	3,082·32	1,209·10	...
	(1431M) ...	Good Hope	...	...	650·00	99·75	...	...	...	974·50	174·82	...
	1287M	Havelock	...	...	13·75	3·02	...	...	11·05	4,332·50	840·14	...
	1282M, etc. ...	Hill 50 Gold Mine, N.L.	...	...	44,842·00	12,819·38	216·48	...	...	317,893·90	94,337·65	690·60
	1361M	Jupiter	...	...	...	...	...	...	·83	307·00	102·98	...
	(1411M) ...	Leap Year	...	...	12·00	9·41	...	...	6·54	646·75	476·65	...
	1416M	Myra Lydia	...	...	...	...	...	...	...	45·25	2·83	...
	1246M	Neptune	...	...	...	8·94	·21	...	829·41	8,787·65	4,103·31	·21
	1281M, etc. ...	Saturn Leases	...	...	...	29·72	...	...	101·24	37,413·00	5,771·04	...
	1251M, etc. ...	Swan Bitter G.M. Co., N.L.	...	2·77	144·20	46·60	...	...	18·02	13,982·95	5,275·47	...
		Prior to transfers to present holders	...	...	...	...	...	...	320·21	6,081·25	3,180·61	...
	1322M	Three Boys	...	1·38	20·50	4·29	...	...	231·11	500·78	668·29	...
	1426M	Zenith	...	...	...	...	...	...	...	41·00	40·30	...
		Voided leases	...	...	...	...	...	29·26	9,098·14	766,505·26	292,600·38	851·37
		Sundry claims	·06	82·72	1,132·10	276·72	...	122·27	2,626·24	57,342·20	28,220·10	4·49
Mt. Magnet, East	... ...	Voided leases	...	...	...	...	...	63·29	764·53	5,522·28	2,811·75	...
		Sundry claims	...	...	...	...	...	...	37·22	418·25	428·29	...

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

MURCHISON GOLDFIELD—*continued.*

MOUNT MAGNET DISTRICT—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Moyagee	1355M	Moyagee	...	...	73·75	323·64	4·44	...	...	2,621·25	4,521·94	351·48
	1355M (1398M)	Moyagee Leases	...	...	...	...	...	...	...	4,641·00	5,489·13	382·52
		Voided leases	...	...	...	...	...	...	23·59	5,107·60	7,575·88	...
		Sundry claims	...	7·22	...	...	...	14·44	176·21	1,484·00	1,677·51	...
Paynesville ...	...	Voided leases	...	...	...	...	...	...	1,613·34	449·77	1,116·15	...
		Sundry claims	...	...	...	...	...	3·36	540·21	882·57	1,372·00	...
Winjangoo ...	...	Voided leases	...	...	...	...	...	·99	191·88	72·00	69·98	...
		Sundry claims	...	...	35·25	5·31	...	...	223·32	237·53	71·58	...
		From District generally :—										
		Sundry parcels treated at :										
		State Battery, Boogardie	...	...	...	...	...	...	...	125·26	*33,100·90	4·20
		Caritti's Cyanide Plant	...	...	3·00	*30·38	...	...	...	3·00	*30·38	...
		Empress Battery	...	...	...	...	...	...	...	...	*36·98	...
		Heines Tailings Treatment Plant	...	...	...	*48·68	5·26	...	...	...	*48·68	5·26
		Welcome Cyanide Plant	...	...	...	...	...	...	...	10·00	*941·39	...
		Various Works	...	...	...	...	...	...	...	43·06	*17,428·06	1·00
		Reported by Banks and Gold Dealers	25·90	6·88	...	...	·22	2,246·34	88·43	8·00	64·95	·22
		Totals	**31·99**	**100·97**	**48,043·80**	**14,259·02**	**226·61**	**2,523·57**	**20,403·17**	**1,427,546·15**	**663,913·15**	**2,757·17**
		Yalgoo Goldfield.										
Bilberatha ...	(1139)	Blaney's Gold Mine	...	...	63·00	16·78	...	1·27	90·94	2,121·50	1,353·21	...
		Voided leases	...	...	...	...	...	...	...	1,263·00	491·84	...
		Sundry claims	...	..	...	...	...	...	6·64	3,075·05	1,401·56	...
Carlaminda ...	...	Voided leases	...	...	...	...	...	1·28	3·39	2,056·57	862·42	3·30
		Sundry claims	...	...	...	...	...	...	...	1,368·50	600·68	...
Field's Find ...	907	Brown's Reward	...	...	...	...	...	...	...	300·00	75·91	...
	907, etc. ...	Brown's Reward Leases	...	...	...	...	...	...	...	4,450·55	3,800·16	...
	1119	Field's Find Central West ...	...	...	...	...	...	...	...	25·00	6·67	...
	1119 (1114) ...	Field's Find Central West Leases	...	...	...	...	...	...	...	4,625·00	1,074·53	56·69
	1027	Rose Marie	...	...	61·65	26·33	...	...	...	97·15	74·60	...
		Voided leases	...	...	...	...	...	...	226·72	40,635·41	28,671·03	...
		Sundry claims	...	...	...	...	...	5·77	179·54	5,415·25	1,759·04	...
Goodingnow ...	1063	Ark	...	...	119·00	30·64	...	...	1·23	960·50	410·21	...
	1102	Astor	...	...	...	...	...	...	...	5,442·75	2,925·64	...
	1198	Aster South	...	...	...	...	...	...	...	498·50	114·17	...

	1025	Carnation	...	...	115·00	61·00	...	...	...	16,261·55	11·826,96	...
	1206	Orchid	...	...	...	...	...	...	...	157·50	33·74	...
	1145	Oversight	...	...	178·00	124·41	...	...	...	1,838·85	645·58	...
	1208	Oversight, South	...	...	150·00	14·91	...	...	...	235·00	33·78	...
	1085	Sweet William	...	...	...	...	...	...	2·97	792·00	249·45	...
		Voided leases	...	...	...	...	...	146·70	277·66	49,369·06	46,525·98	...
		Sundry claims	...	...	193·50	27·84	...	152·96	169·70	10,056·75	5,076·14	...
Gullewa	1189	King Solomon's Mine	...	...	...	...	...	...	...	315·00	135·89	5·79
	1198, etc. ...	(King Solomon's Mines, Ltd.) ...	...	...	...	...	...	...	...	5,130·10	2,101·25	26·49
	1047	Mugga King	...	...	114·00	22·56	...	...	7·76	8,812·50	2,838·89	81·38
		Voided leases	...	...	...	...	...	...	11·29	25,536·00	15,882·93	·04
		Sundry claims	...	...	...	...	...	...	170·45	4,391·25	1,918·24	...
Kirkalucka ...	...	Voided leases	...	...	...	...	...	...	...	61·25	45·10	...
		Sundry cliams	...	...	...	...	...	...	17·79	257·30	126·29	...
Messengers' Patch	1197	Gnow's Nest	...	...	50·00	12·76	...	5·43	...	115·00	248·42	...
		Voided leases	...	...	...	...	...	...	349·71	39,721·51	28,314·92	1,083·01
		Sundry claims	...	...	...	...	...	463·12	338·98	1,585·35	583·39	...
Mt. Farmer ...	...	Voided leases	...	...	...	...	...	...	...	64·00	40·19	...
		Sundry claims	...	...	...	...	...	...	...	462·90	145·06	...
Mt. Gibson ...	...	Voided leases	...	...	...	...	...	...	6·44	526·50	888·70	...
		Sundry claims	...	...	35·75	12·72	...	1·03	44·72	1,022·85	430·20	1·00
Ninghan	...	Voided leases	...	...	...	...	...	...	...	10·00	1·41	...
		Sundry claims	...	...	...	...	...	...	...	324·75	123·28	...
Noongal	1137	City of Melbourne	...	...	...	...	...	...	...	2,046·50	860·05	...
	1201	Hard to Find	...	...	40·00	4·06	...	...	...	114·00	111·83	...
	1203	Revival	...	...	80·00	17·68	...	...	...	80·00	132·26	4·04
		Voided leases	...	...	...	...	...	7·88	31·96	9,023·25	4,666·85	...
		Sundry claims	...	...	...	...	...	36·16	310·31	8,497·30	3,556·78	...
												...
Nyounda	...	Voided Leases	...	...	...	...	...	...	217·63	416·00	183·91	...
		Sundry claims	...	...	8·00	1·47	...	...	30·88	722·00	180·83	...
Pinyalling ...	...	Voided leases	...	...	...	...	...	...	93·80	2,296·35	959·50	...
		Sundry claims	...	...	13·00	111·88	...	3·13	134·09	1,418·50	733·11	...
Retaliation ...	1,046	Alma May			217·50	67·61	...	...	...	1,841·25	752·33	...
		Voided leases	...	...	...	...	...	...	...	3,220·00	1,110·85	...
		Sundry Claims	...	...	...	...	...	...	...	778·25	304·71	...
Rothsay	1,204	Exchange	...	...	...	11·54	...	...	24·06	...	11·54	...
	(1,213) ...	Returned	...	...	64·00	12·18	...	...	...	54·00	12·18	...
		Voided leases	...	...	...	...	...	...	...	40,490·75	10,729·58	...
		Sundry claims	...	...	...	...	...	...	·73	6,469·50	2,562·03	...
Wadgingarra ...	...	Voided leases	...	...	...	...	...	...	...	691·11	650·63	...
		Sundry claims	...	...	...	...	...	...	...	2,131·30	559·83	...
Warda Warra ...	...	Voided leases	...	...	...	...	...	...	...	10,760·50	5,862·04	...
		Sundry claims	...	...	...	...	...	...	...	933·75	369·87	...
Warriedar ...	...	Voided leases	...	...	...	...	...	...	...	13,661·50	4,607·88	7·30
		Sundry claims	...	...	...	...	...	...	2·84	8,782·85	1,892·46	...

YALGOO GOLDFIELD—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1946. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lbs.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.	Total Production. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lbs.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.
Yalgoo	...	Voided leases	...	...	...	...	...	...	3·23	6,314·50	9,965·18	...
		Sundry claims	...	...	...	...	...	...	23·56	2,615·25	998·46	...
Yuin	...	Voided leases	...	...	...	...	...	...	127·12	68,139·50	27,908·57	130·13
		Sundry claims	...	...	...	...	...	...	4·70	335·50	67·53	...
		From Goldfield Generally :—										
		Sundry Parcels treated at :										
		State Battery Payne's Find	...	...	...	...	...	...	...	38·50	*4,529·92	...
		State Battery Warriedar	...	...	...	...	...	...	...	...	*6,503·21	...
		State Battery Yalgoo	...	...	...	...	...	...	...	...	*1,193·63	...
		P.W. Nevill's Rothsay Cyanide Plant ...	...	...	...	...	...	...	...	...	*144·59	72·23
		Yuin Cyanide Plant	...	...	...	*57·31	...	...	...	...	*57·31	...
		Various Works	...	...	...	...	...	9·42	...	664·00	*2,958·99	26·67
		Reported by Banks and Gold Dealers	10·67	8·46	...	...	·11	925·59	58·32	...	34·44	·11
		Totals	**10·67**	**8·46**	**1,502·40**	**633·68**	**·11**	**1,759·74**	**2,964·16**	**432,017·61**	**257,010·34**	**1,498·18**

Mt. Margaret Goldfield.

MOUNT MORGANS DISTRICT.

Australia United	...	Voided leases	...	...	...	...	...	...	1,911·63	15,913·69	23,305·76	1·76
		Sundry claims	...	...	...	...	...	...	580·98	1,307·50	2,227·65	...
Eucalyptus ...	...	Voided leases	...	...	...	...	...	...	2,878·56	1,603·85	3,251·01	...
		Sundry claims	...	...	35·00	22·04	...	...	588·28	2,029·30	1,947·42	...
Linden	522F	Ailsa	...	...	54·00	10·71	...	...	...	948·50	333·82	...
	539F	Democrat	...	...	806·50	1,068·73	...	...	...	2,269·00	3,532·01	...
	494F	Local Lady	...	...	575·00	815·41	...	...	1·65	2,161·50	2,331·21	...
	521F	North Democrat	...	...	157·00	198·68	...	...	...	2,339·75	4,815·53	...
	529F	Second Fortune	...	...	70·50	39·53	...	...	...	517·00	282·05	...
		Voided leases	...	...	...	...	...	7·53	564·13	57,934·81	45,719·89	·68
		Sundry claims	...	10·15	390·00	267·39	...	132·11	244·96	18,525·60	13,445·19	...
Mt. Margaret ...	MA 12F ...	Mt. Margaret Mission Station	...	...	...	...	...	113·08	18·87	403·00	133·14	·09
		Voided leases	...	...	...	...	...	12·13	1·89	8,900·39	5,291·51	12·55
		Sundry claims	...	...	...	...	...	25·22	102·12	1,701·35	652·62	...
Mt. Morgans ...	555F	Bernborough	...	...	115·50	63·56	...	...	...	115·50	63·56	...
	511F, etc. ...	Morgans Gold Mines Ltd.	...	...	...	...	...	...	...	4,466·80	13,776·04	...
		Prior to transfer to present holders	...	...	...	...	...	...	16·66	779,578·43	354,225·86	5,552·63
	547F	Vodice	...	...	110·25	20·99	...	...	...	543·50	115·94	...
		Voided leases	...	...	...	...	...	17·95	148·79	60,503·25	34,541·15	77·86
		Sundry claims	1·94	25·45	83·25	34·53	...	36·41	385·78	4,744·32	3,189·49	...

Murrin	395F	Arthur Rymer	...	...	...	...	...	...	...	8·42	3,848·25	744·25	...
	482F	Hill End	...	...	48·75	22·76	...	...	...	...	3,715·50	1,593·50	...
		Voided leases	...	...	...	...	...	10·43	222·93	129,376·47	101,692·22	29·60	
		Sundry claims	...	...	18·75	5·93	...	51·15	557·24	6,323·83	4,407·37	...	
Redcastle	... ...	Voided leases	...	...	...	...	...	4·49	436·54	4,107·20	4,043·41	...	
		Sundry claims	...	...	181·00	42·32	...	...	113·84	1,015·57	611·62	...	
Yundamindera ...	510F	Landed at Last	...	...	...	...	...	...	...	4,332·00	683·02	...	
	548F	Mulga Rose	...	...	60·00	15·13	...	...	...	290·00	203·79	...	
	540F	Vera	...	...	28·00	12·70	...	...	...	108·00	44·72	...	
		Voided leases	...	...	...	...	...	...	110·93	73,555·85	48,922·83	5·82	
		Sundry claims	...	...	...	...	...	3·01	271·93	6,409·35	4,694·45	...	
	From District Generally :—												
	Sundry Parcels treated at :												
	Crocker's Plant		...	...	...	...	...	...	...	10·00	16·40	...	
	Hill End Cyanide Plant		...	...	...	...	...	...	...	...	*556·95	...	
	State Battery Linden		...	...	10·00	*691·03	...	...	9·16	285·29	*12,663·07	...	
	Rymer's Cyanide Plant		...	...	...	2·32	...	...	...	...	*1,162·22	...	
	Turbett's Cyanide Plant		...	...	...	...	...	...	...	...	*1,232·20	...	
	Various Works		...	...	...	...	...	...	...	1,257·81	*5,587·24	99·97	
	Reported by Banks and Gold Dealers		15·73	...	...	...	...	2,917·50	141·84	10·30	95·75	·68	
	Totals		**17·67**	**35·60**	**2,743·50**	**3,333·76**	...	**3,331·01**	**9,317·13**	**1,201,152·46**	**702,135·86**	**5,781·64**	

MOUNT MALCOLM DISTRICT.

Cardinia	1,795c ...	Rangoon	...	...	...	10·50	...	...	...	250·00	117·14	...	
		Voided leases	...	...	...	...	...	13·87	1,591·66	4,600·24	3,979·15	...	
		Sundry claims	...	...	...	...	...	4·25	119·83	1,865·25	575·01	·66	
Diorite	1,786c ...	Puzzle	...	...	265·00	414·47	...	...	...	1,792·00	2,106·36	...	
		Voided leases	...	...	...	...	...	...	945·65	36,103·03	32,335·98	33·18	
		Sundry claims	...	...	...	...	...	11·21	329·32	4,597·30	4,405·51	...	
Dodgers Well ...	... ...	Voided leases	...	...	...	...	...	...	57·90	1,373·30	1,936·52	...	
		Sundry claims	...	...	...	...	...	·95	28·32	1,440·25	904·23	...	
Lake Darlot ...	1,818c ...	Ballangarry	...	...	8·00	2·00	·03	...	...	8·00	2·00	·03	
	1,784c ...	British King West	...	...	212·50	298·57	...	...	...	542·00	634·32	...	
	1,820c ...	The Dragon	...	...	33·00	36·17	...	...	...	33·00	36·17	...	
	1,816c ...	Zangbar	...	...	465·00	55·23	...	...	...	465·00	55·23	...	
		Voided leases	...	...	...	...	...	...	4,482·18	68,013·46	49,993·88	...	
		Sundry claims	...	...	200·00	163·29	...	67·68	557·70	7,428·34	4,977·52	2·60	
Leonora	1,754c ...	Gold Blocks	...	...	...	...	...	...	...	1,410·00	1,433·08	83·86	
	1,594c ...	Leonora Central G. M. Co., N.L. ...	...	...	...	...	...	...	...	8,621·00	853·23	...	
	1,788c ...	Little Gwalia	...	...	...	...	...	...	...	635·00	15·62	...	
	1,341c, etc. ...	Sons of Gwalia, Ltd.	...	...	87,683·00	27,055·56	2,372·46	...	...	5,172,527·53	2,124,399·96	149,156·08	
		Prior to transfer to present holders	...	...	...	...	...	...	...	109,081·00	55,989·21	8·66	
	1,557c ...	Tower Hill	...	...	...	4·50	...	...	·58	526·55	125·23	...	
		Voided leases	...	...	...	...	...	...	1,866·28	164,241·45	88,210·02	10·71	
		Sundry claims	7·42	17·50	23·70	15·77	...	37·73	351·39	17,663·25	11,408·82	...	
Malcolm	1,812c ...	North Star Extended	11·65	...	...	...	...	11·65	...	...	...	...	
		Voided leases	...	...	...	...	...	...	47·07	62,656·53	47,560·70	...	
		Sundry claims	...	...	...	...	...	5·75	33·39	4,280·97	2,633·51	...	

TABLE I.—*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 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Mertondale ...	...	Voided leases	...	...	...	...	...	...	...	89,024·75	60,935·32	1,497·58
		Sundry claims	...	...	32·75	13·25	...	1·82	85·74	3,144·91	2,262·64	...
Mt. Clifford ...	...	Voided leases	...	...	...	...	...	...	1,623·35	9,556·96	16,492·17	...
		Sundry claims	...	...	...	...	...	53·98	351·65	5,511·70	3,471·95	...
Pig Well	...	Voided leases	...	...	...	...	...	...	...	13,578·32	14,676·58	63·68
		Sundry claims	...	...	...	...	...	...	34·61	2,896·65	1,225·46	...
Randwick ...	1,794c ...	Mighty Splash	...	...	...	...	...	...	7·27	759·00	77·09	...
		Voided leases	...	...	...	...	...	...	239·49	10,141·65	9,653·78	...
		Sundry claims	...	...	16·00	4·22	...	66·57	164·02	2,480·64	1,303·36	...
Webster's Find ...	...	Voided leases	...	...	...	...	...	30·30	...	22,167·50	14,377·65	...
		Sundry claims	...	...	...	...	...	36·84	695·68	2,227·40	1,499·81	...
Wilson's Creek ...	...	Voided leases	...	...	...	...	...	...	...	333·50	168·27	...
		Sundry claims	...	...	...	...	...	·70	4·24	316·00	261·12	...
Wilson's Patch ...	...	Voided leases	...	...	...	...	...	...	99·38	28,863·35	13,050·19	1·05
		Sundry claims	...	...	16·00	7·15	...	4·68	50·57	1,514·16	1,371·66	...
	From Districts generally :—											
	Sundry parcels treated at :											
	State Battery Reserve Darlot		...	...	...	*60·77	...	...	...	10·00	*338·07	...
	H. J. Maund, LTT. 1012H.		...	...	...	*8·30	...	...	...	...	*90·67	...
	K. J. McPherson, LTT. 1044H		...	...	...	*89·29	12·82	...	...	...	*89·29	12·82
	Reefer Cyanide Plant		...	...	...	...	...	...	...	20·00	*2,744·15	22·38
	Various Works		...	...	...	...	...	...	...	789·50	*21,936·35	123·15
	Reported by Banks and Gold Dealers...		9·27	...	...	·73	...	3,414·74	249·87	21·50	45·90	...
	Totals		**28·34**	**17·50**	**88,954·95**	**28,239·77**	**2,385·31**	**3,762·72**	**14,017·14**	**5,863,520·94**	**2,600,759·88**	**151,016·44**

MOUNT MARGARET DISTRICT.

Burtville	2446T	Boomerang	...	...	79·00	574·60	...	...	...	502·00	3,935·92	21·54
	2476T	Happy Find	2·60	...	190·50	643·77	...	2·60	...	263·50	960·72	...
	2485T	Karridale	...	...	55·50	25·20	...	...	...	70·50	38·10	...
	2480T	Mocking Bird	...	...	34·15	41·04	...	...	...	79·15	134·66	...
	2138T	Nil Desperandum	...	...	25·75	28·87	...	...	5·30	1,427·87	3,125·23	...
	2412T	Sailor Prince	...	...	...	...	...	...	...	467·25	89·16	...
		Voided leases	...	...	...	...	...	2·29	413·80	68,523·68	104,615·47	275·27
		Sundry claims	...	...	27·75	5·75	...	2·65	208·27	7,193·66	5,338·60	...

Duketon	... ...	Voided leases	...	...	...	...	...	5·35	3,216·10	31,889·42	22,542·63	...
		Sundry claims	...	...	57·00	51·51	...	...	528·26	2,367·65	2,140·22	29·76
Eagle's Nest ...	... ...	Voided leases	...	...	...	...	...	...	145·34	534·50	1,238·22	...
		Sundry claims	·84	1·90	41·10	9·75	...	24·07	474·28	1,041·10	356·44	...
Erlistoun	2141T	King of Creation G. Ms., Ltd.	...	...	...	...	...	...	...	6,358·00	1,288·92	11·00
		Prior to transfer to present holders	...	...	...	...	...	...	...	13,723·00	3,199·66	...
	2458T	Westralia	...	...	...	...	...	...	...	192·00	171·69	...
	2345T, etc. ...	Western Mining Corporation, Ltd. ...	...	...	48·00	74·53	...	...	...	106,057·00	75,902·56	4,316·81
		Prior to transfer to present holders	...	...	...	...	...	...	...	119·25	140·97	...
		Voided leases	...	...	...	...	...	10·07	393·41	29,693·15	20,237·69	...
		Sundry claims	...	...	...	...	...	1,181·65	148·23	5,434·59	3,702·17	...
Euro	... ...	Voided leases	...	...	...	...	...	...	65·14	91,821·50	37,678·25	...
		Sundry claims	...	...	30·00	5·47	...	4·87	73·04	1,300·25	790·99	...
Laverton	2216T	Beria Main Lode	...	...	...	10·20	...	...	...	6,550·35	1,516·89	...
	2408T, etc. ...	Gladiator Gold Mines, Ltd.	...	...	...	...	...	...	...	103,538·00	25,965·35	...
	2229T	Ida H.	...	...	...	...	...	...	...	531·50	469·46	...
	2229T (2230T)	(Ida H. Leases	...	...	...	...	...	...	...	2,683·75	379·62	...
	2245T, etc. ...	Lancefield Leases	...	...	3,346·00	367·63	...	...	...	3,346·00	367·63	...
	2245T	Lancefield Extended West ...	...	...	...	...	...	...	....	881·25	846·79	...
	2478T	Lancefield North	...	...	132·00	27·68	...	...	...	149·25	116·64	...
	2489T	Wedge	...	...	222·00	21·19	...	...	...	222·00	21·19	...
		Voided leases	...	...	...	...	...	28·59	2,024·11	1,961,669·02	784,781·02	56,923·16
		Sundry claims	...	...	62·75	12·54	...	210·18	1,475·35	16,809·50	8,972·97	...
Mt. Barnicoat ...	(2254T) ...	Ulalla	...	...	19·75	3·27	...	...	...	412·25	95·71	...
		Voided leases	...	...	...	...	...	...	23·08	1,376·25	558·94	...
		Sundry claims	...	...	49·00	20·18	...	...	·68	1,126·00	844·47	...
Mt. Shenton ...	... ...	Voided leases	...	...	...	...	...	...	...	15·00	26·65	...
		Sundry claims	...	...	...	...	...	...	...	279·25	209·67	...
	From District generally :—											
	Sundry parcels treated at :											
	State Battery, Laverton		...	...	...	*812·42	...	...	...	97·50	*8,023·47	15·64
	D. Cables Cyanide Plant, LTT. 1037H		...	...	...	*38·19	...	...	...	...	*38·19	...
	D. Cables Cyanide Plant, LTT 976H, etc.		...	...	...	*136·68	...	...	...	...	*1,145·37	...
	G. E. Grey's Cyanide Plant, LTT. 996, etc. ...		...	...	...	*13·59	...	...	...	...	*5,550·06	...
	J. Shepherds' Cyanide Plant, MA. 23T... ...		...	...	...	*12·68	...	...	...	...	*74·32	...
	Various Works		...	...	...	...	...	...	...	159·50	*12,339·53	...
	Reported by Banks and Gold Dealers		18·49	1·09	...	...	...	2,498·75	106·99	...	26·76	...
	Totals		**21·93**	**2·99**	**4,420·25**	**2,936·74**	...	**3,971·07**	**9,301·38**	**2,468,905·39**	**1,139,798·95**	**61,593·18**

North Coolgardie Goldfield.

MENZIES DISTRICT.

Comet Vale ...	5719Z	Coonega	...	...	...	...	...	...	...	8·00	5·21	...
	ML. 23Z ...	King of the Hills	...	...	24·50	4·89	...	...	...	24·50	4·89	...
	5476Z	Sand Queen Gladsome Mines, N.L. ...	...	...	120·00	39·94	...	...	...	42,216·75	14,623·79	6·45
		Prior to transfer to present holders	...	...	...	...	...	...	...	75,754·50	59,007·25	...
		Voided leases	...	...	...	...	...	...	419·74	148,635·97	119,408·22	3,839·28
		Sundry claims	...	...	22·00	3·45	...	...	40·19	1,718·91	889·20	...

TABLE I.—*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 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Goongarrie ...	5726z	Pretty Easy	...	4·30	...	...	...	...	5·84	27·25	48·87	...
		Voided leases	...	...	...	...	...	·94	1,378·20	29,771·54	17,966·00	...
		Sundry claims	...	17·56	60·50	28·22	...	46·46	1,971·64	2,409·77	2,882·91	...
Menzies	5703z	Aspacia	...	5·01	40·00	24·24	...	...	23·47	1,020·50	911·93	5·24
	5543z	Black Swan	...	...	15·00	133·42	...	...	...	982·63	1,619·74	9·08
	5694z	Dark Horse	...	...	...	...	...	...	...	83·00	293·76	...
	5720z, etc. ...	First Hit G. Ms. (1934), N.L.	...	...	1,729·75	1,421·67	67·50	...	...	67,164·95	47,908·59	6,676·23
		Prior to transfer to present holders	...	...	...	...	...	...	...	1,672·75	4,687·69	...
	5542z	Good Block lease	...	...	17·00	42·27	...	...	7·32	1,472·00	2,277·89	...
	5549z	Lady Harriet	...	...	...	...	...	...	...	548·00	164·46	...
	5520z	Mignonette	...	...	263·00	115·48	...	...	...	431·50	324·95	...
	5697z	New-Florence	...	...	20·00	15·42	...	...	6·56	1,019·50	384·81	...
	5663z	Springfield	...	...	...	...	...	...	...	142·00	51·66	...
	5671z	Woolgar Gold Mines, Ltd.	...	...	...	...	...	...	...	42·00	8·75	...
		Voided leases	...	...	...	...	...	45·42	1,095·38	931,338·00	723,812·49	13,581·15
		Sundry claims	...	...	286·00	246·84	...	49·50	560·32	30,996·94	23,901·67	776·49
Mt. Ida	5668z	Federation	...	...	...	...	...	...	...	389·50	425·20	...
	5551z, etc. ...	Goldfields Australian Development Co, Ltd.	...	...	1,025·00	444·43	19·03	...	...	7,906·00	4,459·41	269·18
	5551z, etc. ...	(Mt. Ida Gold Mines, Ltd.)	...	...	...	...	...	...	...	17,638·50	8,075·96	558·74
		Prior to transfer to present holders	...	...	...	...	...	...	...	1,512·75	737·95	...
		Voided leases	...	...	...	...	...	...	92·21	68,341·67	72,253·94	106·63
		Sundry claims	...	...	10·50	44·13	...	48·14	321·01	15,575·91	7,963·96	·12
Twin Hills ...	5730z	Twin Hills, North	...	...	30·00	6·06	...	...	...	30·00	6·06	...
		Voided leases	...	...	...	...	...	...	...	552·30	568·87	...
		Sundry claims	...	...	...	...	...	...	...	97·80	86·69	...
	From District Generally :—											
	Sundry parcels treated at :											
	Gold Tailings, Ltd., Cyanide Plant		...	...	...	...	...	...	...	...	*365·87	5·84
	Lady Harriet Cyanide Plant		...	...	...	*612·42	...	...	...	279·50	*16,316·31	30·00
	State Battery, Mt. Ida		...	...	...	...	...	...	...	1,866·25	*6,829·04	...
	Yunndaga Sands Syndicate, LTT 1035H ...		...	...	...	*35·12	...	...	...	...	*35·12	...
	Various Works		...	...	...	...	...	...	...	2,512·30	*37,947·97	2,453·31
	Reported by Banks and Gold Dealers		6·21	...	...	...	...	1,432·56	382·80	35·00	7·72	...
	Totals		**6·21**	**26·87**	**3,663·25**	**3,218 00**	**86·53**	**1,623·02**	**6,334·68**	**1,454,218·44**	**1,177,244·90**	...

ULARRING DISTRICT.

Davyhurst ...	1137U ...	Frog	...	5·39	...	...	...	...	5·39	...	...	...
	1102U	Lights of Israel	...	...	...	...	...	...	...	1,075·00	176·42	...
	1016U	New Callion	...	...	...	...	...	...	...	5,293·30	2,002·37	119·67
	1136U	New Golden Pole	...	2·63	112·00	25·21	...	...	2·63	112·00	25·21	...
	1125U	Spitfire	...	...	188·00	29·58	...	...	...	188·00	29·58	...
		Voided leases	...	...	...	...	...	2·93	144·62	164,253·32	125,596·63	5,408·47
		Sundry claims	...	61·04	141·00	62·14	...	...	164·15	13,018·44	5,474·55	...
Morley's	1101U	Emerald	...	...	194·50	177·70	...	...	26·03	594·00	1,167·68	...
	1094U	First Hit	...	...	188·00	506·55	...	...	...	857·75	2,831·14	...
	1081U	Mabel Gertrude	...	...	106·00	161·58	...	...	...	454·00	588·13	...
	1089U	Paramount	...	...	285·00	146·79	...	...	...	975·50	1,129·18	...
	1078U	Rabbit	...	...	...	...	...	...	265·60	277·50	687·47	...
	1074U	Two Chinamen	...	...	...	...	...	...	3,411·83	794·50	2,884·37	...
		Voided leases	...	...	...	...	...	...	...	121·96	443·50	754·84
		Sundry claims	...	...	89·00	29·42	...	2·16	932·23	1,443·25	2,329·60	...
Mulline	1107U	Ajax West	...	...	56·00	214·98	...	...	1·37	394·25	817·47	...
	1069U, etc. ...	Riverina Gold Mines, Ltd.	...	...	...	...	...	...	...	32,058·00	11,662·42	...
		Voided leases	...	...	...	...	...	...	274·09	102,556·22	103,327·32	530·75
		Sundry claims	...	...	103·00	89·81	...	10·82	197·72	10,514·39	8,611·81	1·10
Mulwarrie ...	1113U. ...	Oakley	...	...	44·00	56·57	...	...	...	195·00	248·40	...
		Voided leases	...	...	...	...	...	...	165·29	19,480·68	26,369·21	38·47
		Sundry claims	...	...	63·00	10·94	...	·80	282·29	3,086·33	2,600·65	...
Ularring	... ...	Voided leases	...	...	...	...	...	...	563·34	9,771·60	13,907·76	...
		Sundry claims	...	...	...	...	...	...	...	671·50	309·48	...
	From District generally :—											
	Sundry parcels treated at :											
	State Battery, Mulline		...	...	...	...	...	...	...	639·99	*16,459·89	...
	State Battery, Mulwarrie		...	...	...	...	...	...	...	613·18	*6,564·16	...
	E. Rowe (M.A. 13U)		...	...	...	...	...	...	...	...	*21·65	...
	Waihi Cyanide Plant		...	...	...	*33·63	...	...	...	5·00	*526·59	...
	Waihi Golden Pole Cyanide Plant		...	...	...	...	...	...	...	...	*936·58	...
	Prior to Amalgamation		...	...	...	...	...	...	...	...	*5,032·24	...
	Various Works		...	...	...	...	...	...	15·82	233·15	*1,784·67	...
	Reported by Banks and Gold Dealers		·66	...	...	...	...	106·63	63·08	100·00	22·67	...
	Totals		**·66**	**69·06**	**1,569·50**	**1,544·90**	...	**123·34**	**6,637·50**	**370,099·35**	**344,880·14**	**6,098·4**

NIAGARA DISTRICT.

Desdemona ...	... ...	Voided leases	...	...	...	...	...	...	7·12	9,809·00	7,555·81	12·04
		Sundry claims	...	...	...	...	...	...	8·99	2,225·45	892·48	...
Kookynie	911G	Cosmopolitan, South	...	...	247·00	87·84	...	...	...	847·00	381·75	...
	916G	Ruby	...	...	116·00	97·83	...	...	...	186·00	126·69	...
	922G	Victory	...	...	8·00	1·79	...	...	...	8·00	1·79	...
		Voided leases	...	...	...	...	...	3·35	347·30	744,253·21	393,929·73	5,375·97
		Sundry claims	...	3·56	252·00	139·48	...	56·74	103·40	8,099·30	6,197·56	·18
Niagara	913G	New Gladstone	...	...	...	...	...	...	...	639·00	269·99	...
		Voided leases	...	...	...	...	...	...	104·54	85,237·50	52,095·06	...
		Sundry claims	...	...	...	...	...	28·10	97·22	14,205·66	8,019·92	...

TABLE 1.—*Production of Gold and Silver from all sources, etc.*—continued.

NORTH COOLGARDIE GOLDFIELD—*continued.*

NIAGARA DISTRICT—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Tampa	902G	Grafter	...	...	...	...	...	...	...	192·00	20·30	...
		Voided leases	...	...	...	...	...	...	41·58	50,285·57	23,267·41	174·24
		Sundry claims	...	...	...	...	...	32·60	283·40	8,016·33	4,100·19	...
	From District generally :—											
	Sundry parcels treated at :											
	Grafter Battery		...	...	...	...	...	...	...	...	*137·63	...
	Niagara State Battery		...	...	...	...	...	...	...	...	*10·08	...
	Various Works		...	...	...	...	...	...	...	1,220·50	*16,226·67	41·17
	Reported by Banks and Gold Dealers		3·63	...	...	...	...	1,587·49	823·66	...	63·53	...
		Totals	**3·63**	**3·56**	**623·00**	**326·94**	...	**1,708·28**	**1,817·21**	**925,224·52**	**513,296·59**	**5,603·60**
		YERILLA DISTRICT.										
Edjudina	1122R, etc. ...	Paget Gold Mines of Edjudina, Ltd. ...	...	...	...	...	...	...	...	841·50	187·51	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	738·75	559·80	...
		Voided leases	...	...	...	...	...	...	18·44	33,943·45	42,627·48	37·79
		Sundry claims	...	...	9·00	3·97	...	...	26·89	6,816·58	4,765·28	...
Patricia	... ...	Voided leases	...	...	...	...	...	...	...	4,158·50	5,396·40	25·40
		Sundry claims	...	...	...	...	...	...	...	35·00	17·76	...
Pinjin	... ...	Voided leases	...	...	...	...	...	...	48·34	17,463·30	10,742·77	...
		Sundry claims	...	...	...	...	...	...	154·86	5,623·59	3,466·70	...
Yarri	1211R. ...	Margaret	...	...	180·50	46·59	...	...	...	770·50	177·77	...
	1126R, etc. ...	Porphyry (1939), G. M., N.L. ...	...	...	...	...	...	...	...	66,648·00	9,855·05	261·86
	1126R	Edjudina Gold Mining Co., N.L. ...	...	...	...	...	...	...	...	30,220·00	5,409·93	507·51
		Prior to transfer to present holders	...	...	...	...	...	...	...	124·50	38·89	...
	1229R	Wallaby Central	...	...	302·00	36·60	...	...	...	302·00	36·60	...
		Voided leases	...	...	...	...	...	6·30	87·08	43,095·25	20,835·58	2·00
		Sundry claims	...	...	432·25	165·69	...	·87	5·93	14,147·05	5,395·36	...
Yerilla	... ...	Voided leases	...	...	...	...	...	...	3,107·25	16,161·93	12,733·54	13·93
		Sundry claims	...	20·63	33·00	20·58	...	19·30	54·93	2,728·58	1,559·52	...
Yilgangie	1221R	Golden Hill	...	...	591·00	216·08	...	...	...	958·00	462·65	...
	1318R	Rainbow	...	...	41·00	35·26	...	...	...	41·00	35·26	...
	1176R	Western Mining Corporation	...	...	...	...	...	...	...	646·75	446·89	...
		Prior to transfer to present holders	...	...	...	...	...	...	·85	1,244·75	1,830·28	...
		Voided leases	...	...	...	...	...	...	9·94	1,342·75	949·08	...
		Sundry Claims	...	...	107·50	160·59	...	121·67	98·20	2,982·80	1,854·77	...

From District Generally :—													
Sundry parcels treated at :													
State Battery, Yarri										271·50	*7,496·64	3·50
State Battery, Yerilla (N. C. Parry)										...	*43·52	...
Various Works								2·17	....	642·25	*6,049·24	...
Reported by Banks and Gold Dealers								1,161·08	160·08	...	4·11	...
Totals					**20·63**	**1,696·25**	**685·36**		**1,311·39**	**3,772·79**	**251,948·28**	**142,978·38**	**851·99**

Broad Arrow Goldfield.

Bardoc	2102w	Despatch			18·00	9·40				450·00	150·00	...
	2198w	Ellen Pearce			61·00	... 8·81				1,101·75	752·53	...
	2219w	Gippslander			...	...				26·00	26·76	...
		Voided leases			...	...			2,335·41	83,208·34	54,590·50	203·60
		Sundry claims			338·25	163·93		54·95	1,193·45	14,579·78	7,571·96	...
Black Flag ...	2229w	Bellevue		37·54	38·25	90·52			37·54	38·25	90·52	...
	(2190w) (2191w)	Bell Bird leases			16·00	2·67			1·55	165·25	46·67	...
		Voided leases			...	...		27·81	404·35	48,058·54	28,105·53	...
		Sundry claims		·83	196·25	50·24		712·92	251·59	7,401·96	4,563·55	...
Broad Arrow ...	2039w	Golden Arrow			571·00	82·55				4,594·50	705·51	...
	2239w ...	Good Luck		9·33	30·50	40·33			9·33	30·50	40·33	...
	1958w	Grace Darling			170·00	61·52			1·67	3,796·00	2,624·25	...
	2215w	Haglands Hill			9·50	29·42			10·11	9·50	29·42	...
	2216w	Kimra			33·50	13·12				1,008·75	1,271·05	...
	2148w	Lady Betty			...	...				390·80	79·43	...
	2223w	North Bulletin			66·50	15·74				569·25	436·60	...
	1771w	North Duke			4·00	1·69			1,670·51	196·80	630·11	...
	1933w	Oversight Tara United			...	...			1,147·01	837·29	909·72	...
	2221w	Undersight			33·25	3·18				128·25	19·00	...
		Voided leases			...	...		70·32	7,479·81	139,431·85	111,546·77	20·23
		Sundry claims		241·64	329·50	206·84		1,007·72	2,862·02	30,490·39	15,867·90	... ·11
Canegrass	... ...	Voided leases			...	...			27·77	669–82	460·72	...
		Sundry claims			...	...			227·55	717·45	505·06	...
Carnage	... ...	Voided leases			...	...		176·04	659·31	2,402·00	2,170·00	...
		Sundry claims			...	...			6·61	1,791·33	869·06	...
Cashmans ...	... ...	Voided leases			...	...		67·51	813·76	8,172·15	7,090·91	...
		Sundry claims			...	...			39·55	997·27	313·75	...
Christmas Reef ...	2175w	New Mexico			55·50	149·04				437·50	939·92	...
	2211w	New Year's Gift			...	...				11·25	9·03	...
		Voided leases			...	...			29·68	783·52	207·21	...
		Sundry claims			47·00	49·54			307·15	2,777·89	2,584·16	...
Fenbark	2188w ...	Golden Penny			116·00	31·55				2,337·50	396·95	...
	2228w	New Fenbark			36·00	3·26				111·75	26·42	...
		Voided leases			...	...			4·42	3,319·50	1,959·75	...
		Sundry claims			...	...			51·96	2,525·52	935·75	...
Grant's Patch ...	2242w	Lady Agnes		2·11	62·25	56·37			2·11	62·25	56·37	...
	2,227w ...	Magpie			66·25	76·01				206·50	315·82	...
	1,962w, etc. ...	Ora Banda Amalgamated Mines, N.L.			1,182·25	557·69				154,665·25	58,323·57	175·00
		Prior to transfer to present holders			...	...				12,424·50	9,540·07	...

TABLE I.—*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 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Grants Patch–*contd.*	2,208w ...	Wentworth	...	...	361·50	120·61	...	...	...	814·75	231·30	...
	2,224w ...	Whip Pole	...	...	21·75	8·98	...	...	...	21·75	8·98	...
		Voided leases	...	...	...	...	...	...	258·52	14,501·60	4,560·62	...
		Sundry claims	...	...	617·25	261·70	...	...	356·66	5,476·54	2,758·55	...
Ora Banda ...	1,336w ...	Associated Northern Ora Banda N.L.	...	...	...	...	...	...	...	2,727·50	406·53	4·87
		Prior to transfer to present holders	...	...	...	...	...	...	...	315,958·95	123,252·22	1,664·70
	2,232w ...	Cave Hill North	...	...	15·50	10·85	...	...	15·97	37·00	69·84	...
	1,943w ...	Ora Banda United Mines Limited ...	...	...	...	...	...	...	...	2,182·25	74·80	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	76,612·22	14,630·93	...
		Voided leases	...	...	...	...	...	...	829·75	24,532·10	12,526·19	...
		Sundry claims	...	12·63	249·75	82·06	...	...	336·76	12,231·00	4,150·70	...
Paddington ...	2,105w ...	Minnie Palmer	...	...	39·00	18·06	...	...	...	9,777·50	828·01	...
	2,122w ...	Pakeha	...	...	122·00	41·10	...	...	...	2,023·90	674·59	...
		Voided leases	...	...	...	...	...	5,566·30	463·31	179,865·91	83,685·57	18·96
		Sundry claims	...	10·69	128·50	45·05	...	1,714·16	291·43	15,540·48	8,921·32	...
Riche's Find ...	...	Voided leases	...	...	...	...	...	...	7·01	7,357·09	5,283·87	71·36
		Sundry claims	...	...	141·75	37·78	...	...	212·26	1,602·30	1,698·06	·13
Siberia	2,234w ...	Cat	...	...	8·75	66·49	...	...	67·97	8·75	66·49	...
		Voided leases	...	...	...	...	...	1·07	2,581·31	28,854·47	31,364·62	...
		Sundry claims	...	33·80	157·50	48·59	...	289·06	1,233·18	20,181·04	12,452·52	...
Smithfield ...	2,193w ...	King of Kings	...	...	465·00	51·57	...	...	...	2,608·75	584·35	...
		Voided leases	...	...	...	...	...	...	...	2,091·96	590·34	...
		Sundry claims	...	...	77·50	43·67	...	...	123·37	2,470·59	953·88	...
		From Goldfield Generally :—										
		Sundry Parcels treated at :										
		State Battery, Ora Banda	...	...	...	*907·49	...	...	...	128·05	*17,165·54	...
		Brearley's Cyanide Plant	...	...	...	...	...	...	...	...	*2,374·39	*1,227·68
		P. Doherty, L.T.T., 1,026H	...	...	...	...	...	...	...	71·00	2·79	...
		Golden Arrow Cyanide Plant	...	...	...	*81·38	...	...	...	26·00	*2,698·51	...
		T. J. Hennebury, L.T.T., 1,015H	...	...	...	...	...	...	...	...	·26	...
		Minnie Palmer Cyanide Plant	...	...	...	*192·66	...	...	...	...	*3,035·15	...
		R. G. Oliver, L.T.T.,(1,014H)	...	...	...	*3·75	...	...	...	...	*16·44	...
		Various works	...	...	...	...	...	2,275·66	1·24	16,896·02	*43,961·92	*1,875·77
		Reported by Banks and Gold Dealers	9·46	·43	...	...	...	9,927·05	131·39	61·68	90·35	...
		Totals	**9·46**	**349·00**	**5,886·50**	**3,725·21**	...	**218,90·57**	**26,484·35**	**1,275,587·85**	**695,882·93**	**5,262·41**

North-East Coolgardie Goldfield.

KANOWNA DISTRICT.

Gindalbie ...	1,561x ...	Kurrajong	...	...	16·25	5·55	...	...	...	16·25	5·55	...
	1,540x ...	Lady Betty	...	122·41	54·25	109·57	...	...	424·36	251·25	542·03	...
		Voided leases	...	...	...	...	...	...	19·94	44,077·78	39,512·90	38·31
		Sundry claims	...	2·60	30·25	21·18	...	...	716·52	4,841·02	2,762·26	...
Gordon	1,532x ...	Sirdar	...	2·39	273·50	107·31	...	...	92·66	4,725·85	3,301·07	517·61
		Voided leases	...	...	...	...	...	...	589·88	48,723·78	16,562·53	...
		Sundry claims	...	...	81·75	16·26	...	...	177·38	1,999·95	1,147·00	...
Kalpini	...	Voided claims	...	...	...	...	...	...	38·73	13,463·50	6,739·57	·07
		Sundry claims	...	16·89	30·50	12·59	...	24·70	269·72	1,467·50	1,023·01	...
Kanowna	1,562x ...	Ballarat	...	...	...	11·49	...	...	...	...	11·49	...
		Voided leases	...	...	...	...	...	24·94	4,511·34	684,992·35	380,148·04	2,482·24
		Sundry claims	...	8·11	409·00	109·04	...	118·94	2,154·37	24,258·02	11,197·38	1·50
Mulgarrie	...	Voided leases	...	...	...	...	...	...	1,216·63	6,902·26	4,197·98	...
		Sundry claims	...	...	...	...	...	...	16·78	1,261·75	631·40	...
Six Mile	...	Voided leases	...	...	...	...	...	...	1,603·72	559·00	767·72	...
		Sundry claims	...	...	...	...	...	...	54·14	739·25	225·56	...
	From District Generally :—											
	Sundry Parcels treated at Various works	...	...	...	...	...	330·42	867·52	158,935·05	153,205·89	...
	Reported by Banks and Gold Dealers	19·05	...	...	...	...	105,967·03	35·68	·50	101·55	...
	Totals	**19·05**	**152·40**	**895·50**	**392·99**	...	**106,466·03**	**12,789·37**	**997,215·06**	**622,082·93**	**3,039·73**

KURNALPI DISTRICT.

ubilee	...	Voided leases	...	...	...	...	...	...	145·13	2,122·50	1,465·16	...
		Sundry claims	...	...	...	...	...	25·27	13·52	1,219·25	511·63	...
Kurnalpi	...	Voided leases	...	...	...	...	...	371·18	3,166·80	4,052·51	3,957·71	6·27
		Sundry claims	...	...	...	...	...	371·61	727·39	4,255·36	2,063·34	...
Mulgabbie... ...	...	Voided leases	...	...	...	...	...	...	1,402·66	226·75	7,845·87	4·95
		Sundry claims	...	6·92	90·50	31·71	...	8·06	2,764·88	1,261·95	2,217·24	...
	From District Generally :—											
	Sundry Parcels treated at : Various works	...	...	...	...	...	...	...	101·50	388·63	...
	Reported by Banks and Gold Dealers	6·97	...	...	...	...	12,104·38	68·59	...	2·35	...
	Totals	**6·97**	**6·92**	**90·50**	**31·71**	...	**12,826·80**	**8,288·97**	**13,239·82**	**18,451·93**	**11·22**

East Coolgardie Goldfield.

EAST COOLGARDIE DISTRICT.

Binduli	6,025E ...	Red Star	...	...	111·00	2·523	...	...	...	400·25	55·60	...
		Voided leases	...	...	...	...	...	...	...	803·10	385·19	...
		Sundry claims	...	...	139·00	26·33	...	...	13·01	4,759·52	1,622·03	...

EAST COOLGARDIE GOLDFIELD—*continued.*

EAST COOLGARDIE DISTRICT—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Boorara	5,486E ...	Olympian	...	...	169·25	64·00	...	...	...	1,475·25	802·90	...
		Voided leases	...	...	...	...	...	...	459·07	306,930·82	171,842·83	408·36
		Sundry claims	...	...	...	...	...	·49	145·56	2,764·34	1,406·17	...
Boulder	5,465E ...	Birthday Gift	...	...	...	...	...	...	...	5,244·89	1,366·30	...
	5,690E ...	Boulder Perseverance Limited ...	...	...	101,144·49	29,105·57	12,027·81	...	...	1,924,643·41	809,968·53	242,742·38
		Prior to transfer to present holders	...	...	...	...	...	...	...	3,306,942·88	1,841,159·00	203,821·43
	6,077E ...	Brown Hill Consols	...	...	66·00	5·87	...	...	...	66·00	5·87	...
	5,472E ...	Golden Key	...	3·06	...	...	...	18·27	22·78	415·00	158·96	...
	5,692E, etc. ...	Gold Mines of Kalgoorlie, Ltd.. ...	...	...	151,871·00	36,758·31	6,880·84	...	...	1,148,670·86	330,358·28	104,514·68
	5,466E ...	(South Star)	...	...	...	...	...	...	233·46	4,237·43	1,494·78	...
	5,466E ...	Prior to transfer to present holders	...	...	...	...	...	...	5·22	1,835·75	748·78	...
	5,159E, etc. ...	(Lake View, South, (G.M.K. Ltd.)	...	...	...	...	...	...	...	62,278·38	21,536·66	...
	5,692E ...	Prior to transfer to present holders	...	...	...	...	...	...	545·23	527,790·53	568,643·05	4,844·50
	5,696E, etc. ...	Great Boulder Proprietary G.Ms. Ltd.	...	...	343,506·00	87,342·68	46,953·04	...	1·53	8,081,458·97	4,786,474·44	852,939·09
	5,845E ...	Happy Returns	...	...	259·50	67·04	...	...	...	446·00	112·82	...
	5345E, etc. ...	Kalgoorlie Enterprise Mines, Ltd. ...	...	...	51,111·57	16,530·26	1,325·70	...	...	489,696·49	152,186·05	14,898·21
	...	Prior to transfer to present holders	...	...	...	...	...	...	...	15,320·68	8,957·01	...
	5708E, etc. ...	Lake View and Star, Ltd.	...	...	453,317·00	132,203·66	15,460·66	...	...	7,232,714·30	2,442,442·54	182,614·59
		Prior to transfer to present holders	...	...	...	...	...	...	8·49	15,792,500·38	9,149,223·80	1,348,055·82
	5789E, etc. ...	North Kalgurli (1912), Ltd.	...	...	123,549·58	38,159·72	11,736·48	...	111·55	1,746,531·98	615,482·66	171,439·91
	5806E, etc. ...	North Kalgurli (1912), Ltd., Croesus										
	...	Pty. Group	...	...	...	...	...	...	51·20	90,159·00	19,261·22	...
	5891E	(New Croesus)	...	...	...	...	...	...	...	193·00	48·74	...
	5700E, etc. ...	Prior to transfer to present holders	...	...	...	...	...	43·99	...	4,018,436·01	2,815,911·21	97,625·03
	5429E, etc. ...	North Kalgurli United Mines, Ltd. ...	...	...	...	...	...	...	...	4,661·51	928·18	232·93
	...	Prior to transfer to present holders	...	...	...	...	...	...	...	131·74	76·74	...
	5853E, etc. ...	Paringa Junction Leases	...	...	236·50	16·58	...	...	5·12	1,182·50	465·30	...
	5853E	(Paringa Junction)	...	...	...	...	...	...	...	123·75	17·77	...
	5854E	(Paringa Junction North)... ...	...	...	...	...	...	...	...	60·50	10·64	...
	5855E	(Paringa Junction South) ...	...	...	...	...	...	...	...	1,473·25	228·42	...
	5456E, etc. ...	Paringa Mining and Exploration Co., Ltd.	...	...	99,568·00	22,529·34	1,645·61	...	...	732,813·06	180,028·46	12,343·52
	...	Prior to transfer to present holders	...	...	...	...	...	1·07	·79	57,618·03	24,452·83	...
	5808E, etc. ...	South Kalgurli Consolidated, Ltd. ...	...	...	75,914·77	18,570·50	2,264·54	...	...	2,484,103·67	980,799·05	25,333·98
	...	Prior to transfer to present holders	...	...	...	...	...	...	...	1,344,254·70	531,792·77	17,722·97
	...	Voided leases	...	...	...	...	...	109·90	11,998·25	621,233·84	472,550·60	6·83
	...	Sundry claims	...	...	69·50	8·25	...	24·58	201·30	11,472·49	4,237·88	...
Cutter's Luck ...	6056E	New Black Cat	...	97·00	19·00	39·24	...	...	100·06	31·00	203·31	...
	...	Voided leases	...	...	...	...	...	...	20·83	12·25	9·13	...
	...	Sundry claims	...	3·56	35·00	6·36	...	8·11	501·65	751·65	362·59	...
Feysville	...	Voided leases	...	...	...	...	...	...	110·93	561·30	394·24	...
	...	Sundry claims	...	...	...	...	...	...	199·00	1,096·35	618·03	...

Hampton Plains ...	P.P.L. 1 ...	Consolidated Gold Areas, N.L.	...	...	...	2·56	...	...	...	140,168·73	37,039·14	5,835·85
	P.P.L. 9 ...	Consolidated Gold Areas, N.L.	...	...	215·75	4·27	...	...	...	215·75	4·27	...
	P.P.L. 96 ...	Golden Hope, N.L.	...	...	...	...	...	...	...	5,964·00	2,006·14	...
	P.P.L. 192 ...	Good Hope North	...	...	...	...	...	...	...	353·00	201·02	...
	P.P.L. 12 ...	Junction Extended	...	...	510·75	72·71	...	...	...	2,807·00	431·38	...
	P.P.L. 227 ...	McGrath's Lease	...	...	...	...	...	...	...	215·75	47·87	...
	P.P.L. 252, 289	Mount Martin	...	...	...	...	...	...	...	14,953·75	5,731·52	...
	P.P.L. 279 ...	Mutooroo	...	...	...	...	...	...	...	6,151·88	1,087·26	...
	P.P.L. 277 ...	New Hope	...	...	991·50	154·67	...	...	17·23	54,985·05	10,281·76	...
	P.P.L. 371 ...	Victory	...	...	180·75	60·04	...	...	...	206·25	66·38	...
	P.P.L. 81 ...	Villers Brettaneaux...	...	...	...	...	...	...	...	3,562·02	1,435·55	...
		Voided leases	...	...	...	...	...	4,565·62	203·94	110,492·44	36,077·27	69·60
		Sundry claims	...	...	36·00	7·11	...	2·68	70·85	46,336·91	8,477·88	...
Kalgoorlie... ...	5927E	A.I.F.	...	...	13·00	5·90	...	...	...	13·00	5·90	...
	6048E	Auld Acquaintance...	...	...	...	...	...	...	...	7·50	2·36	...
	6078E	A.W.A. Extended	...	...	82·50	4·71	...	...	...	82·50	4·71	...
	5519E	Barbican Corporation, Ltd. (Hannon's Enterprise)	...	...	...	...	...	...	...	362·00	79·80	...
	5735E	Bonnie Lass	...	...	...	...	...	...	...	250·50	74·67	...
	5449E, etc. ...	Broken Hill Proprietary, Co., Ltd. ...	...	...	36,504·00	13,046·59	...	...	3·99	308,818·01	126,645·57	1,843·28
		Prior to transfer to present holders	...	...	...	...	...	...	...	1,558·49	316·58	...
	6046E	Colleen Bawn	...	...	136·25	21·95	...	...	...	278·50	60·25	...
	5867E	Concord	...	...	...	...	...	...	8·64	169·25	65·54	...
	5839E	Coronation	...	...	...	...	...	...	...	40·00	9·03	...
	5913E	Devon Consols	...	3·42	394·00	61·40	...	...	93·19	1,238·21	418·12	...
	5924E	Federal	...	...	...	...	...	...	...	36·25	4·51	...
	5737E	Golden Mile Channel	...	...	...	...	...	...	·97	2,534·50	199·41	...
	6020E	Golden Mile North	...	...	...	...	...	...	...	106·25	23·77	...
	6019E	Golden Seam	...	...	...	...	...	...	...	201·00	161·16	...
	5904E	Great Patience	...	...	14·75	3·00	...	...	1·07	219·50	65·02	...
	6044E	Kapai	...	...	51·00	4·55	...	...	...	51·00	4·55	...
	5878E	Lady May	...	...	330·00	48·10	...	...	62·05	2,369·00	601·75	...
	6091E	Lesanben	...	8·10	11·75	32·70	...	...	8·10	11·75	32·70	...
	6057E	Little Ray	...	...	18·50	3·03	...	...	...	71·00	13·24	...
	4547E, etc. ...	Mt. Charlotte (Kalgoorlie) G.M.'s, Ltd.	...	...	...	...	...	...	...	1,234·00	252·17	...
		Prior to transfer to present holders	...	...	...	...	...	...	5·72	48,292·60	13,930·79	...
	5437E	North End Extended	...	4·30	5·75	18·53	...	...	990·70	356·35	521·79	...
	5852E	Pedestal	...	...	...	...	...	...	...	1,608·75	444·93	...
	5468E	Phar Lap	...	...	8·75	1·86	...	...	...	474·00	349·08	...
	5415E, 5803E ...	Return Leases	...	...	28·25	6·02	...	...	5·64	3,698·75	644·44	...
	5934E, 5933E ...	Sceptre Leases	...	...	...	...	...	...	...	28·00	4·63	...
	6024E	Trident	...	...	...	...	...	...	...	58·75	36·67	...
		Voided leases	...	...	...	...	...	242·48	9,585·67	963·254,45	397,399·16	44,017·12
		Sundry claims	...	56·47	88·00	26·69	...	232·41	1,122·17	59,096·29	22,932·86	...
Wombola	6051E	Big Bull	...	...	7·50	3·84	...	...	...	47·50	28·88	...
	5688E	Caledonian	...	...	537·00	609·34	...	...	...	4,025·00	3,446·19	...
	5497E	Daisy...	...	...	1,047·50	755·33	...	...	...	5,653·25	4,730·98	...
	6032E	Dry Mount	...	...	46·50	58·41	...	...	...	116·50	212·74	...
	5872E	Everley	...	...	25·00	40·67	...	...	...	101·00	136·35	...
	5962E	G.D.N.	...	...	21·50	103·91	...	...	68·71	68·50	283·36	...
	5689E, 5525E ...	Haoma Leases	...	...	1,281·00	1,127·28	...	...	...	6,462·50	4,314·30	...
	5689E	(Haoma)	...	...	...	...	...	...	...	2,168·00	1,948·36	...
	5525E	(Xmas Flat)...	...	...	...	...	...	...	...	330·25	264·74	...
	5500E	Happy-Go-Lucky	...	...	...	...	...	...	...	2,075·25	1,675·85	...
	6043E	Launa Doone	...	...	43·00	27·58	...	...	...	105·50	62·09	...
	5961E	Loganberry	...	...	...	...	...	...	...	288·25	101·02	...
	5829E	Lurgan	...	...	...	...	...	...	·69	854·75	476·59	...

TABLE I.—*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 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Wombola—*contd.*	5798E	Maranoa	...	...	85·00	42·92	...	...	32·17	2,190·00	1,109·38	...
	6083E	Messina	...	...	17·50	24·94	...	...	...	17·50	24·94	...
	5493E	New Milano, No Liability	...	...	125·00	362·72	...	...	·25	17,155·75	10,911·69	479·00
	5493E	(Milano)	...	...	...	...	...	...	...	4,012·75	11,676·72	...
	5616E	(Leslie)	...	...	...	...	...	...	...	602·00	939·10	...
	5967E	North Caledonian	...	...	11·50	3·99	...	...	1·27	22·25	8·15	...
	5850E	Pauline	...	...	...	...	...	...	...	237·00	287·95	...
	4766E	Pericles Gold Mines, Ltd.	...	...	...	...	...	...	358·11	4,728·03	19,305·86	...
	6022E	Proprietary	...	...	...	...	...	...	...	357·25	388·02	...
	6018E	Reggio	...	...	27·00	11·23	...	...	·43	95·00	41·66	...
	5866E	Rosemary	...	...	...	...	...	...	...	32·50	67·19	...
	5925E	Tanguey	...	...	...	...	...	...	...	12·00	4·46	...
	5795E	Transvaal	...	...	...	...	...	...	...	504·75	102·14	...
	6052E	Vanenter	...	33·16	37·00	29·53	...	...	33·16	54·50	79·76	...
		Voided leases	...	...	...	...	...	...	2,003·68	19,037·31	18,386·22	...
		Sundry claims	...	3·38	226·25	51·10	...	...	701·43	20,615·93	12,944·81	...
		From District generally :—										
		Sundry claims	...	...	...	...	...	11,014·57	465·61	5,440·46	2,541·10	...
		Sundry Parcels treated at :	...	...				...	...	305·20	*20,628·71	...
		State Battery, Kalgoorlie	...	...	17·75	5·89	...	...	...	10·50	*31·43	...
		Cavalier Treatment Works	...	...	...	...	...	...	...	...	*1,538·16	*1,507·65
		Prior to transfer to present holders	...	...	...	...	...	...	...	...	*265,764·37	*242,140·57
		Golden Horseshoe (New), Ltd.	...	...	...	*8,809·88	*19,213·36	...	...	...	*2,574·64	...
		Pericles Cyanide Plant	...	...	...	*392·32	...	...	...	...	*149·38	...
		Polkinghorne's Cyanide Plant	...	...	...	...	...	...	...	9·50	6·06	...
		J. F. Poynton (M.A.I.)	...	...	...	...	...	384·36	64·70	41,115·02	*264,204·51	*12,606·81
		Various Works	...	...	...	...	...	16,638·12	9,955·84	355·63	3,152·22	...
		Reported by Banks and Gold Dealers	55·56	5·83	...	194·76	...					
		Totals	**55·56**	**218·28**	**1,444,264·41**	**407,700·97**	**117,508·04**	**33,286·65**	**40,574·01**	**51,950,436·57**	**27,261,574·04**	**3,588,044·11**

BULONG DISTRICT.

Balagundi		Voided leases	...	...	...	...	...	...	2,408·98	1,110·68	1,473·73	12·92
		Sundry claims	...	...	...	...	...	3·51	282·80	761·51	476·54	...
Bulong	1311Y	Blue Quartz	...	...	212·50	54·75	...	...	...	784·00	214·24	...
	1315Y	Lady Gwen	...	3·91	90·25	23·43	...	...	34·47	468·00	115·08	...
	1308Y	Southern Cross	...	...	298·50	50·92	...	...	1·30	1,443·25	212·32	...
		Voided leases	...	...	...	...	...	107·54	8,490·35	104,142·55	85,090·08	...
		Sundry claims	...	...	115·75	11·21	...	1,655·86	1,592·19	14,750·98	17,412·38	...

Majestic	...	Voided leases	...	...	...	...	...	19·45	63·19	1,317·94	647·62	...
		Sundry claims	...	3·91	...	...	...	42·88	154·58	1,899·05	940·62	...
Morelands... ...	...	Sundry claims	...	...	...	...	...	...	·13	183·00	58·51	...
Mt. Monger ...	...	Voided leases	...	...	...	...	...	...	2,771·39	1,437·85	1,256·10	...
		Sundry claims	...	...	...	...	...	215·60	...	379·05	308·48	...
Randalls	1316v	Flora Dora	...	...	80·50	11·16	...	...	...	80·50	11·16	...
		Voided leases	...	...	...	...	...	...	60·04	33,099·85	11,089·30	...
		Sundry claims	...	...	96·00	19·06	...	20·70	8·11	4,787·56	1,207·40	...
Taurus	...	Voided leases	...	...	...	...	...	2·06	3·70	1,765·10	909·84	...
		Sundry claims	...	...	11·00	1·55	...	112·69	51·88	2,608·35	1,037·88	...
Trans Find ...	P.P.L. 308A ...	Dawn of Hope	...	...	31·75	6·87	...	...	2·87	824·00	293·80	...
		Voided leases	...	...	...	...	...	...	...	983·92	865·71	...
		Sundry claims	...	...	27·00	7·23	...	...	5·93	726·25	319·31	...
	From District generally :—											
	Sundry Parcels treated at :											
	Various Works		...	...	...	...	...	...	...	6,102·15	6,675·38	...
	Reported by Banks and Gold Dealers		·97	...	...	...	...	25,196·22	70·15	·01	28·44	...
		Totals	**·97**	**7·82**	**963·25**	**186·18**	...	**27,376·51**	**16,002·78**	**179,655·55**	**130,643·92**	**12·92**

Coolgardie Goldfield.

COOLGARDIE DISTRICT.

Bonnievale ...	5596	Jenny Wren	...	9·06	172·75	267·67	...	...	150·23	747·75	940·72	4·17
	5622	Lucky Hit	...	...	...	...	...	...	...	703·25	297·46	...
	4600	Melva Maie	...	...	161·75	8·23	...	...	...	1,785·40	3,153·34	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	614·50	1,099·21	11·63
		Voided leases	...	...	...	...	...	...	30·03	352,675·34	188,804·77	...
		Sundry claims	...	...	92·50	30·82	...	...	158·69	6,055·43	4,534·85	...
Bulla Bulling ...	...	Voided leases	...	...	...	...	...	...	...	776·81	668·19	...
		Sundry claims	...	...	...	...	...	5·21	15·98	1,318·26	561·29	...
Burbanks	5605	Burbanks Deeps	...	...	...	...	...	...	...	103·00	53·46	...
	(5706)	Lord Bobs	...	...	80·00	14·42	...	...	...	171·50	45·95	...
	5443	New Gift	...	...	24·50	22·59	...	...	2·00	625·50	228·69	...
		Voided leases	...	...	...	...	...	14·90	372·17	415,584·71	304,569·63	521·06
		Sundry claims	...	10·73	126·25	46·12	...	55·05	477·11	14,220·85	8,502·69	...
Cave Rocks ...	5645	Goldcoin	...	...	100·25	24·87	...	...	...	343·00	64·17	...
	5665	Nornadeen	...	...	308·25	49·22	...	...	...	569·00	125·67	...
		Voided leases	...	...	...	...	...	...	...	2,302·05	588·18	...
		Sundry claims	...	...	...	...	...	...	50·00	3,415·65	785·28	...
Coolgardie ...	5679	Ada	...	...	330·00	26·78	...	...	...	1,130·25	107·11	...
	5637	Caledonia	...	...	681·75	145·73	...	...	7·30	2,334·00	381·77	...
	5297, etc. ...	Consolidated G.M's. of Coolgardie, Ltd.	...	...	...	...	...	...	...	282,560·70	50,610·27	4,812·12
		Prior to transfer to present holders	...	...	...	...	...	...	4·55	1,946·35	547·45	3·22
	5653	Gleesons	...	...	...	...	...	...	...	1,925·00	922·37	...
	5680	Greenhills	...	...	...	...	...	...	...	16·00	8·48	...
	5638	Grey's Hill	...	...	...	...	...	...	...	129·00	87·50	...

TABLE I.—*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 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Coolgardie—*contd.*	5686	Hillside	...	...	...	...	...	...	...	12·00	17·67	...
	5577	Iron Duke	...	...	...	...	...	...	...	826·00	589·23	...
	5598	King Solomon	...	...	49·50	9·13	...	2·69	...	664·50	101·79	...
	5713	Lady Grace	...	...	61·50	107·85	...	...	...	61·50	107·85	...
	5643	Lloyd George South	...	...	...	...	...	...	...	...	10·25	...
	5743	Moya Jan	...	...	138·75	71·31	...	...	...	138·75	71·31	...
	5239, etc.	Phoenix Gold Mines, Limited	...	...	29,520·00	7,585·93	...	...	...	199,435·00	55,709·84	2·54
		Prior to transfer to present holders	...	...	...	...	...	...	2·74	167·56	237·80	...
	5750	Sydenham	...	...	327·00	15·80	...	...	...	327·00	15·80	...
	5749	Sydenham	...	...	153·00	15·20	...	...	...	153·00	15·20	...
	5754	United	...	...	304·50	335·07	...	...	...	304·50	335·07	...
		Voided leases	...	...	...	...	...	1,299·02	4,660·89	570,843·43	326,325·19	...
		Sundry claims	...	·64	696·25	243·85	...	203·72	2,674·09	64,593·78	23,824·97	...
Eundynie	5634	Eundynie	...	...	...	...	...	...	...	54·00	71·56	...
		Voided leases	...	...	...	...	...	·92	16·09	31,697·20	16,423·28	1·75
		Sundry claims	...	...	...	...	...	...	10·18	630·19	311·52	...
Gibraltar	(5217)	Lloyd George	...	...	168·00	32·87	...	...	18·69	6,742·88	3,673·42	...
		Voided leases	...	...	...	...	...	...	15·28	31,849·75	16,424·07	...
		Sundry claims	...	...	...	...	...	1·39	50·76	2,891·70	1,273·56	...
Gnarlbine		Voided leases	...	...	...	...	...	...	13·95	2,731·75	1,341·60	...
		Sundry claims	...	...	...	...	...	...	4·90	1,186·10	504·18	...
Hampton Plains	P.P.L. 330	Barbara	...	...	186·00	204·32	...	...	...	2,157·75	1,655·63	...
	P.P.L. 361	Brown & Gordon's Lease	...	...	20·00	5·11	...	...	...	20·00	5·11	...
	P.P.L. 419	Chatanooka	...	...	196·25	44·75	...	...	...	196·25	44·75	...
	P.P.L. 338	Dry Hill	...	...	22·00	42·12	...	...	...	22·00	42·12	...
	P.P.L. 119	Golden Eagle	...	...	...	...	...	...	7·63	2807·59	2548·42	...
	P.P.L. 348	Hampton Gold Mining Areas, Ltd.	...	...	43·75	4·69	...	...	...	43·75	4·69	...
	P.P.L. 348	(Goldfields Australian Development Co., Ltd.)	...	...	...	...	...	...	...	78·00	12·89	...
	P.P.L. 334	Hampton Gold Mining Areas, Ltd.	...	...	130·50	48·70	...	...	...	130·50	48·70	...
	P.P.L. 454	Hampton Gold Mining Areas, Ltd.	...	...	37·75	3·71	...	...	...	37·75	3·71	...
	P.P.L. 435	Lady Jess	...	2·79	15·50	7·57	...	...	2·79	15·50	7·57	...
	P.P.L. 355	Lady Marie	...	...	...	...	...	...	...	65·50	25·13	...
	P.P.L. 319	Lady May	...	...	240·75	146·12	...	...	...	1,742·25	981·39	...
	P.P.L. 389	Lassie Come Home	...	...	30·00	6·54	...	...	...	30·00	6·54	...
	P.P.L. 315	Malvern Star	...	...	...	...	...	...	...	16·00	10·14	...
	P.P.L. 316	Surprise G.M.	...	...	1,104·50	440·57	...	...	...	7,189·00	3,425·59	...
		Voided leases	...	...	...	...	...	...	403·05	8,518·25	7,798·76	...
		Sundry claims	...	...	...	...	...	1·63	132·06	1,738·25	799·38	...

Higginsville ...	5647	Fair Play	...	...	1,300·00	198·29	...	...	...	8,339·00	1,645·89	...
	(5703)	Milesi Deeps	...	...	91·00	22·45	...	...	...	161·75	55·85	...
	(5662)	Sons of Erin	...	...	18·00	8·13	...	...	...	86·05	147·98	...
	5293	Two Boys	...	...	...	111·18	...	...	...	460·00	707·08	...
	5293 (5526) (5527)	(Two Boys)	...	...	...	...	...	...	...	6,888·00	3,193·95	...
	5666	War Time	...	...	24·00	13·46	·06	...	26·28	64·00	75·43	·06
		Voided leases	...	...	...	...	...	...	347·65	37,829·55	17,159·23	159·44
		Sundry claims	...	...	16·50	7·79	...	...	149·47	3,622·73	1,918·03	...
Larkinville ...	5667	Ground Lark	...	...	77·75	18·97	...	...	7·96	137·25	37·89	...
		Voided leases	...	...	...	...	...	22·77	46·48	2,098·91	3,198·09	...
		Sundry claims	...	...	...	...	...	...	147·20	448·53	1,029·03	...
Logan's	5324, etc. ...	Spargo's Reward G.M. (1935), N.L. ...	...	...	...	...	...	...	...	105,397·50	26,318·11	...
	5681	Twenty Grand	...	...	...	...	...	...	...	81·00	75·93	...
		Voided leases	...	...	...	...	...	...	...	1,182·31	531·33	...
		Sundry claims	...	...	42·25	17·28	...	...	128·95	1,581·35	860·72	...
Londonderry ...	5250	Vice Regal	...	...	90·50	59·67	...	...	1·91	4,056·50	1,309·88	...
		Voided leases	...	...	...	...	...	...	93·13	29,817·35	20,886·19	...
		Sundry claims	...	...	86·75	24·23	...	16·68	38·72	3,102·17	2,445·80	22·42
Mungari	...	Voided leases	...	...	...	...	...	...	17·71	735·00	331·78	...
		Sundry claims	...	...	279·00	66·51	...	1·77	151·34	1,383·44	500·25	...
Paris	5311, 5500 ...	Lister's Gold Mine	...	...	605·00	322·95	37·30	...	...	3,936·00	2,439·68	37·30
	5311, 5500 (5530)	(Lister's Gold Mine)	...	...	...	...	...	...	...	8,582·00	4,423·84	...
	5500	(Paris Central)	...	...	...	...	...	...	...	113·00	24·16	...
	5514	Paris	...	...	80·00	27·58	...	...	...	776·00	365·45	3·24
		Voided leases	...	...	...	...	...	...	4·30	463·00	209·47	...
		Sundry claims	...	...	...	...	...	...	...	2,037·25	501·81	...
Red Hill	...	Voided leases	...	...	...	...	...	14·87	1,551·81	40,797·40	31,070·65	...
		Sundry claims	...	·22	18·25	5·60	...	15·29	90·33	1,324·77	710·07	...
Ryan's Find ...	...	Voided leases	...	...	...	...	...	...	...	54·16	151·69	...
		Sundry claims	...	...	...	...	...	...	·44	101·69	228·66	...
St. Ives	5682	Alice May	...	...	11·00	14·50	...	...	...	71·00	144·97	...
	(5617) 5628, 5629	Ive's Reward Leases	...	...	...	...	...	...	...	1,617·00	450·47	...
		Voided leases	...	...	...	...	...	61·90	146·87	37,600·46	15,603·59	...
		Sundry claims	...	...	...	...	...	211·25	944·85	4,078·56	1,441·72	...
Wannaway ...	5725	Little Mary	...	7·95	18·60	417·81	...	...	7·95	18·60	417·81	...
		Voided leases	...	...	...	...	...	...	19·10	1,813·35	1,047·89	..
		Sundry claims	...	16·31	4·55	29·77	...	...	191·42	1,105·97	1,180·20	...
Widgiemooltha ...	5702	Cardiff Castle	...	...	590·00	146·92	...	...	...	590·00	146·92	...
	5451	Host Group	...	...	...	...	...	...	...	1,601·00	434·38	...
	5711	Imperial	...	...	65·00	5·03	...	...	...	65·00	5·03	...
	5658	Iron Knob	...	...	...	...	...	...	6·02	145·00	52·19	...
		Voided leases	...	...	...	...	...	9·42	1,108·92	20,362·70	11,292·64	·17
		Sundry claims	...	5·85	149·50	36·72	...	46·49	424·77	15,395·71	6,589·45	...
	From District generally :— Sundry Parcels treated at : State Battery, Coolgardie	...	...	...	*844·78	...	...	...	771·01	*32,378·31	*9·65

COOLGARDIE GOLDFIELD—*continued.*

COOLGARDIE DISTRICT—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Widgiemooltha —*Contd.*		Australian Machinery & Investment Company's Cyanide Plant	...	...	...	*110·64	...	...	...	...	*3,043·48	*86·31
		Frank's Cyanide Plant	...	...	...	...	...	...	...	...	*1,343·17	...
		Imperial Cyanide Plant	...	...	...	...	...	...	...	26·00	*340·76	...
		Lister's Cyanide Plant	...	...	...	...	...	...	...	...	*269·23	...
		Paris Central Cyanide Plant	...	...	...	...	...	...	...	...	*77·64	...
		Parry's Cyanide Plant	...	...	...	...	...	...	...	...	*23·77	...
		Widgiemooltha Cyanide Plant	...	...	...	...	...	...	...	...	*1,165·31	...
		Various Works	...	...	...	...	...	7·75	...	3,871·61	*26,465·97	*223·06
		Reported by Banks and Gold Dealers	38·29	...	...	1·79	...	14,713·39	715·18	48·25	66·70	...
		Totals	**38·29**	**53·55**	**39,191·15**	**12,519·71**	**37·36**	**16,706·11**	**15,649·92**	**2,387,011·11**	**1,259,029·70**	**5,899·10**

KUNANALLING DISTRICT.

Carbine	970s	Carbine	...	...	...	...	...	...	...	13,820·00	7,047·96	...
	970s, etc. ...	Carbine leases	...	...	...	...	...	...	687·98	51,991·86	39,862·25	...
		Voided leases	...	...	...	...	...	...	...	20,116·00	5,470·81	...
		Sundry claims	...	...	72·25	64·61	...	136·08	93·96	5,923·78	2,010·68	...
Chadwin	1014s	Magdala	...	...	169·50	403·16	...	...	...	455·00	524·94	...
	(1020s) ...	Question Mark	...	...	153·00	296·11	...	...	...	700·00	996·74	...
		Voided leases	...	...	...	...	...	...	...	3,578·55	3,691·68	2·50
		Sundry claims	...	...	302·50	126·78	...	14·28	78·02	4,811·05	2,656·88	...
Dunnsville ...	...	Voided leases	...	...	...	...	...	...	828·58	17,489·60	8,642·30	...
		Sundry claims	...	...	72·00	20·14	...	3·35	1,020·90	2,533·56	1,798·37	...
Jourdie Hills ...	...	Voided leases	...	...	...	...	...	...	18·00	28,009·74	19,401·09	28·45
		Sundry claims	...	...	...	...	...	1·86	49·81	1,648·75	811·80	1·05
Kintore	1026s	Makale	...	...	68·25	40·98	...	...	...	68·25	40·98	...
		Voided leases	...	...	...	...	...	18·70	169·33	54,044·64	39,197·31	677·88
		Sundry claims	...	...	44·25	9·67	...	111·91	102·70	2,920·38	2,063·55	...
Kunanalling ...	1024s	Kioro...	...	...	269·70	154·71	...	...	...	269·70	154·71	...
	987s	Premier	...	...	25·00	140·48	...	·23	...	4,096·00	2,424·84	...
	987s etc. ...	(Kunanalling Gold, N.L.)	...	...	...	...	...	...	...	6,482·50	5,440·77	...
		Prior to transfer to present holders	...	...	...	...	...	...	..	690·00	847·30	12·78
	988s	Premier North	...	...	...	...	...	...	...	410·00	288·08	...
		Voided leases	...	...	...	...	...	85·90	1,734·92	117,678·66	91,323·50	27·99
		Sundry claims	...	...	296·25	108·08	...	216·53	808·12	13,155·57	9,024·40	...

Kundana	...	Voided leases	...	...	...	...	...	...	...	...	465·00	68·12	...
		Sundry claims	...	...	105·00	9·85	...	...	...	410·25	44·48	...
		From District generally :—											
		Sundry Parcels treated at :											
		Goldfields Australian Development Treatment Works	...	...	...	...	...	...	...	...	*548·07	...
		Various Works	...	...	...	...	...	42·23	...	1,782·26	*5,061·33	...
		Reported by Banks and Gold Dealers...	...	...	...	...	...	857·98	17·93	...	5·85	·49
		Totals	...	...	**1,577·70**	**1,374·57**	...	**1,489·05**	**5,610·25**	**353,551·10**	**249,448·79**	**751·14**

Yilgarn Goldfield.

Blackborne's ...	...	Voided leases	...	...	...	...	...	...	...	1,282·50	341·37	...
		Sundry claims	...	...	...	...	...	...	...	340·50	74·59	...
Bullfinch	3345	Copperhead	...	...	...	...	...	...	...	7,427·32	2,076·32	...
	3378	Copperhead Deeps	...	...	...	...	...	...	...	13,554·65	4,102·83	...
	3347, 3458 ...	Easter Gift Leases	...	...	...	...	...	...	...	1,697·00	472·43	...
		Prior to transfer to present holders	...	...	...	...	...	...	48·03	3,594·26	1,169·82	...
	3400	Frances May	...	...	...	...	...	...	7·74	8,683·55	3,341·69	...
	3397	Goldfinch	...	...	...	...	...	...	6·73	6,456·03	2,634·10	...
	4009	Reynold's Find	...	...	...	...	...	...	...	241·00	114·95	...
	3350	Rising Sun	...	...	...	...	...	...	2·30	37,059·53	10,837·80	...
		Voided leases	...	...	...	...	...	...	10·14	490,120·07	185,374·08	27,958·41
		Sundry claims	...	...	38·00	12·13	...	8·47	37·04	7,322·75	3,961·29	...
Corinthian ...	45P.P.	Babylonia	...	...	72·00	54·78	...	...	...	72·00	54·78	...
	3398, 3425 ...	Corinthian Leases	...	...	...	...	...	...	...	3,081·83	1,770·09	...
	3398	(Corinthian)	...	...	...	...	...	...	...	7,383·75	2,543·16	...
	3425	(Corinthian North)	...	...	...	...	...	...	...	3,951·00	1,934·78	...
	3415	Deliverance	...	...	...	...	...	...	...	3,019·40	3,173·07	...
		Voided leases	...	...	...	...	...	...	...	135,095·00	30,011·76	...
		Sundry claims	...	...	...	...	...	...	·68	1,088·35	640·61	...
Eenuin	4020	Birthday	...	...	24·00	73·87	...	...	·95	32·00	133·92	...
	4042	Birthday South	...	...	...	...	...	...	1·03	15·00	50·50	...
	4067	Lone Pine	...	...	...	...	...	...	...	106·75	29·41	...
	3936	Newfield Central	...	...	...	...	...	...	...	281·00	418·04	...
	3936	(Yellowdine Gold Areas, N.L.) ...	...	...	...	...	...	...	...	7,341·50	7,605·06	...
		Voided leases	...	...	...	...	...	...	178·46	1,749·81	1,841·75	...
		Sundry claims	1·90	...	20·00	7·46	...	2·50	73·97	2,311·60	1,609·92	...
Evanston	3895	Blue Peter	...	...	...	...	...	...	...	1,288·00	285·84	...
	3868, etc. ...	Evanston Gold, N.L.	...	...	748·20	245·00	...	...	...	748·20	245·00	...
	3868	(Evanston)	...	...	...	...	...	...	...	48,125·30	25,848·30	10·14
	3870	(Evanston East)	...	...	...	...	...	...	...	34·00	13·59	...
	3888	(Goldies)	...	...	...	...	...	...	...	200·00	43·15	...
	3869	Evanston North	...	...	...	...	...	...	...	1,598·76	1,079·93	...
	3997	Gravel Pit	...	...	...	...	...	...	79·27	238·80	160·25	...
		Voided leases	...	...	...	...	...	...	...	649·00	230·70	...
		Sundry claims	...	...	...	...	...	4·98	...	503·35	133·66	...
Forrestonia ...	...	Voided leases	...	...	...	...	...	...	...	1,185·00	298·15	...
		Sundry claims	...	...	...	...	...	...	...	372·00	141·78	...

TABLE I.—*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 1946.					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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Golden Valley ...	3575, etc. ...	Great Bingin Leases	...	...	...	...	...	...	...	16,771·00	10,248·61	...
	3573	(Marie's Find)	...	...	...	...	...	...	...	742·00	353·15	...
	3822	(Queen Marie)	...	...	...	...	...	...	...	180·50	164·83	...
	3248	Radio Deeps...	...	...	10·00	5·86	...	...	...	5,720·58	6,297·01	...
	2994, etc. ...	Radio Leases	...	...	901·00	1,057·27	70·67	...	2·70	18,398·80	39,651·24	78·10
	3993	Stumpy Doodle	...	...	...	...	...	...	·58	2,280·00	824·22	8·99
		Voided leases	...	...	...	...	...	...	35·76	10,802·84	10,584·40	2·00
		Sundry claims	...	3·46	192·00	95·48	...	4·58	61·29	6,347·77	4,623·26	1·02
Greenmount ...	...	Voided leases	...	...	...	...	...	45·99	21·62	125,022·64	31,575·09	944·50
		Sundry claims	...	...	...	...	...	·46	4·27	2,856·58	779·67	...
Holleton	37P.P.	Brittania	...	...	45·00	63·86	...	...	...	323·00	487·77	...
		Voided leases	...	...	...	...	...	...	9·33	44,700·25	13,037·52	34·53
		Sundry claims	...	...	...	...	...	...	3·75	3,464·05	923·78	·20
Hopes Hill ...	3414	Pilot	...	...	...	...	...	...	...	19,446·12	2,948·68	...
	4033	Queen Elizabeth	...	...	...	...	...	...	...	113·00	46·22	...
		Voided leases	...	...	...	...	...	...	74·78	132,361·55	36,369·69	1·00
		Sundry claims	...	...	18·00	1·13	...	18·67	33·36	4,169·02	1,302·90	...
Kennyville ...	4136	Leviathan	...	...	25·00	15·54	...	...	...	25·00	15·54	...
	3875	Victoria	...	...	450·00	43·85	...	...	...	4,042·00	885·40	·63
		Voided leases	...	...	...	...	...	...	18·76	55,581·63	21,520·61	·59
		Sundry claims	...	...	190·00	81·22	...	...	5·06	8,427·50	2,218·76	...
Koolyanobbing ...	...	Voided leases	...	...	...	...	...	...	...	1,707·05	884·28	...
		Sundry claims	...	...	5·00	5·64	...	·26	...	585·00	231·10	...
Marvel Loch ...	4046	Banker	...	...	25·00	7·38	...	...	...	75·00	27·05	...
	3987, etc. ...	Burbidge Gold Mines, N.L.	...	...	3,850·00	148·72	...	...	...	76,635·00	7,552·87	...
	3987	(Grand National)	...	...	...	...	...	...	...	19,739·00	2,647·30	...
	4003	Christmas Gift	...	1,025·04	...	...	...	...	1,026·44	90·00	46·58	...
	3957	Comet	...	...	...	...	...	...	...	1,067·00	639·66	6·85
	13P.P.	Cricket	...	...	...	...	...	...	...	1,616·00	921·75	...
	3966	Donovan's Find	...	...	...	...	...	...	...	200·05	56·02	...
	3942, etc. ...	Edward's Reward Leases	...	...	2,805·00	1,014·99	...	...	...	21,812·50	10,678·58	...
	3942	(Edward's Reward)...	...	...	...	...	...	...	...	2,080·00	2,016·32	...
	3943	(Sunshine)	...	...	...	...	...	...	...	3,866·00	2,384·79	...
	4034	Firelight	...	...	194·00	36·33	...	...	...	839·00	153·87	...
	3724	Frances Firness	...	...	...	...	...	...	...	8,012·00	3,731·76	...
	3941	Geelong	...	...	...	...	...	...	1·95	413·50	73·37	...
	4069	Gentle Annie	...	...	20·00	16·74	...	...	...	20·00	16·74	...
	3683	Golden Cube	...	...	20·00	7·44	...	...	20·27	1,330·00	660·98	...
	4074	Greenbird	...	60·51	30·00	9·18	...	...	60·51	80·00	107·80	...
	3718	Kurrajong	...	...	...	...	...	...	...	9,106·00	3,231·11	...

	4047	Lennenberg's Reward	...	...	...	...	...	...	...	341·00	32·40	...
	3431, etc. ...	Lenodo Leases	...	...	...	...	...	...	...	5,006·00	1,032·14	·36
		Prior to transfer to present holders	...	...	...	...	...	...	...	1,056·00	177·67	...
	3914	May	...	...	...	...	...	...	...	145·00	45·86	...
	3459	May Queen	...	...	25·00	12·64	...	...	...	3,763·00	6,934·87	...
	4073	Mountain King	...	...	62·00	24·49	...	...	...	79·00	33·24	...
	3970	Mountain Queen	...	...	...	...	...	...	...	661·00	382·37	...
	3390, etc. ...	N.G.M., Ltd.	...	...	...	...	...	...	...	4,067·50	351·36	·50
		Prior to transfer to present holders	...	...	...	...	...	...	...	2,675·00	459·60	...
	4068	Try Again	...	...	685·00	182·91	...	...	...	1,445·00	464·87	...
	4035	Undaunted	...	...	...	...	...	...	...	742·00	92·19	...
	(4006)	Union Jack	...	...	45·00	3·01	...	...	...	952·00	180·75	1·04
		Voided leases	...	...	...	...	...	...	385·60	626,945·16	176,930·88	2,464·70
		Sundry claims	...	14·57	700·00	131·43	·02	11·35	230·20	33,982·84	12,978·63	·02
Mt. Jackson ...	3449	Die Hardy	...	...	67·00	90·27	...	...	...	432·50	434·13	...
	3859	Great Unknown	...	...	26·00	23·91	...	...	14·71	734·50	674·88	...
	3418	Clamps Central	...	...	...	1·96	...	...	...	1,232·50	667·31	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	7,224·00	6,457·63	6·34
		Voided leases	...	...	...	...	...	...	164·60	44,202·28	30,726·43	2,307·43
		Sundry claims	...	...	303·05	80·99	...	6·44	52·87	10,144·90	4,544·44	70·74
Mt. Palmer ...	3544, etc. ...	Yellowdine Gold Development, Ltd. ...	...	...	...	188·17	...	...	...	304·234·50	155,580·79	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	1,564·65	2,540·71	...
		Voided leases	...	...	...	...	...	...	...	67·25	22·90	...
		Sundry claims	...	...	10·00	11·83	...	1,643·48	18·19	395·25	367·90	...
Mt. Rankin ...	3,555	No Trumps	...	...	...	...	...	...	...	5,205·37	819·29	...
		Voided leases	...	...	...	...	...	3·84	5·20	496·00	122·17	...
		Sundry claims	...	...	...	...	...	...	...	491·00	117·59	...
Parker's Range ...	3,520	Centenary	...	...	...	...	...	...	...	1,671·00	440·00	...
	4,052	McIntosh	...	...	22·00	24·68	...	...	...	354·00	258·71	...
	4,000	Olga	...	...	10·00	10·76	...	...	...	106·00	124·90	...
	4,062	Victory	...	...	256·00	67·96	...	...	...	975·00	586·45	...
	3,969	White Horseshoe	...	...	500·00	285·59	...	...	...	2,854·60	1,705·68	25·95
		Voided leases	...	...	...	...	...	·42	149·33	53,226·75	26,122·23	·45
		Sundry claims	...	...	294·00	132·44	...	6·59	51·73	10,299·75	4,514·27	·08
Southern Cross ...	4,082	Day Dawn	...	...	50·00	4·50	...	...	...	50·00	4·50	...
	4,004	Excelsior	...	...	47·00	7·00	...	...	...	913·00	268·16	...
	4,018	Fraser's	...	...	...	...	...	...	...	1,211·50	152·41	...
	3,944	Nil Desperandum	...	...	136·00	21·20	...	...	...	1,433·00	211·03	...
	3,444	Three Boys' Gold Mines, Limited ...	...	...	...	...	...	...	...	9,947·00	1,376·56	1·26
	3,444	(Three Boys)	...	...	...	...	...	...	...	4,180·00	727·75	...
	3,934	(Three Boys North)	...	...	...	...	...	...	...	106·00	14·66	...
	3,981	(Three Kings)	...	...	...	...	...	...	...	104·00	10·01	...
	3,444, etc. ...	(Yellowdine Options, N.L.)	...	...	...	...	...	...	...	8,074·25	2,000·29	...
		Voided leases	...	...	...	...	...	4·89	261·35	453,476·68	215,028·52	364·41
		Sundry claims	...	...	50·00	11·38	...	95·90	642·09	8,149·66	2,620·77	...
Westonia	3,308, etc. ...	Edna May (W.A.) Amalgamated G.M's., N.L.	...	...	11,464·00	4,612·85	327·95	...	...	124,654·00	53,386·70	4,562·01
		Prior to transfer to present holders	...	...	...	...	...	...	...	4,092·00	2,867·26	...
	4,023	Greenfinch	...	...	...	...	...	...	...	479·65	432·13	...
		Voided leases	...	...	...	...	...	...	4·06	445,495·49	314,459·63	21·78
		Sundry claims	...	...	8·00	1·53	...	9·51	64·96	3,861·41	2,488·87	...

TABLE I.—*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 1946. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lbs.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.	Total Production. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lbs.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.
		From Goldfield Generally :—										
		Sundry Parcels treated at :										
		Butcher Bird Cyanide Plant	...	...	...	*17·85	...	...	...	...	*17·85	...
		Centenary Cyanide Plant	...	...	...	...	...	...	...	...	*455·52	...
		Copperhead Cyanide Plant	...	...	...	*212·42	...	...	...	...	*16,377·50	...
		Holleton Cyanide Plant	...	...	...	...	...	...	...	...	*691·34	*47·50
		Howlett's Cyanide Plant	...	...	...	*12·36	...	...	...	110·00	*13,405·34	...
		Howlett's Banker Treatment Plant	...	...	...	*340·72	*16·75	...	...	...	*397·64	*16·75
		Invermay Cyanide Plant	...	...	...	...	...	...	...	...	*609·49	*3·57
		Kurrajong Cyanide Plant	...	...	...	...	...	...	...	...	*409·57	...
		A. Maifri, L.T.T, 1,045H	...	...	20·00	4·34	...	...	...	20·00	4·34	...
		Pilot Cyanide Plant	...	...	8·00	2·41	...	...	...	8·00	*3,748·36	...
		Pringle's Cyanide Plant	...	...	...	*26·43	...	...	...	...	*26·43	...
		Queen Ann Treatment Works	...	...	...	...	...	...	...	...	*169·05	...
		Radio Deeps Cyanide Plant	...	...	...	*51·51	...	...	...	...	*1,540·40	...
		Three Boys' Cyanide Plant	...	...	...	...	...	...	...	7·00	*2,249·37	...
		E. C. & L. C. Wesley's Cyanide Plant ...	...	...	...	...	...	...	...	...	*1,220·67	...
		Various works	...	...	...	...	...	...	...	161·28	*61,553·57	36·54
		Reported by Banks and Gold Dealers	...	...	...	...	...	313·91	67·10	...	9·54	...
		Totals	**1·90**	**1,103·58**	**24,470·25**	**9,603·41**	**415·39**	**2,182·24**	**3,938·76**	**3,603,505·71**	**1,651,578·22**	**38,978·39**

Dundas Goldfield.

Buldania	...	Voided leases	...	...	...	...	...	...	3·02	846·05	708·99	...
		Sundry claims	...	2·72	33·00	22·38	·60	...	39·25	1,314·02	859·58	·72
Dundas	...	Voided leases	...	...	...	...	...	1·88	28·02	6,103·48	2,545·38	155·02
		Sundry claims	...	...	245·50	70·36	·51	·76	413·85	2,007·25	1,089·55	18·32
Norseman ...	1,596	Abbotshall	...	...	38·25	28·08	2·04	...	...	2,511·45	1,096·71	754·37
	1,468	Bronzewing	...	...	687·00	513·66	55·86	...	33·89	2,395·50	1,869·91	142·36
	1,617	Caesar	...	...	...	...	...	...	...	54·00	42·72	...
	1,319, etc ...	Central Norseman Gold Corporation, N.L.	...	...	105,640·00	35,958·64	23,086·45	...	...	865,239·20	317,495·95	290,031·06
		Prior to transfer to present holders.			...	...	...	...	1,663·32	69,819·83	47,892·08	16,508·85
	1,421	Dundas Gold Mines, N.L.	...	...	477·75	235·25	20·37	...	...	477·75	235·25	20·37
	1,421	(Empress Gold Mines, N.L.)	...	...	...	...	...	...	...	567·50	516·08	54·61
	1,619	Dunkerque	...	...	...	...	...	...	...	246·75	240·07	4·86
	(1,637) ...	Ellen Terry	...	...	87·50	109·87	9·41	...	...	592·75	880·21	83·15
	1,674	Golden 'Ole	...	...	153·50	124·39	9·60	...	...	153·50	124·39	9·60
	1,665	Lady Eunice	...	...	25·00	18·46	2·08	...	...	72·75	64·83	6·12
	1,364	Lady Mary	...	...	...	...	...	...	...	99·00	15·45	...
	1,315, etc. ...	Norseman Gold Mines, N.L.	...	...	42,099·00	5,601·00	9,775·00	...	...	958,241·00	240,055·95	352,122·54
		Prior to transfer to present holders.	...	...	...	...	...	...	...	20,657·00	3,099·60	4,981·00
	1,588	O.K.	...	...	...	...	...	...	...	288·00	133·72	2·37

	1,664	O.K., East	...	...	15·00	1·93	·03	...	...	15·00	1·93	·03
	1,661	O.K., South	...	...	...	...	...	...	...	64·00	58·13	5·65
	1,422	Onkaparinga	...	...	33·00	46·50	4·76	...	...	624·75	1,178·29	110·42
	1,468, 1,422 ...	Bronzewing and Onkaparinga (Prior to cancellation of amalgamation) ...	...	...	...	...	...	...	...	843·00	1,396·98	3·62
	1,530	Second Try	...	...	505·00	374·88	38·86	...	4·37	2,041·75	1,218·81	140·16
	1,667, etc. ...	Sun Leases	...	...	555·00	404·25	34·20	...	...	577·00	433·63	37·85
	1,671	Surprise	...	...	55·25	17·87	1·06	...	...	55·25	17·87	1·06
	(1657)	Trump	...	...	129·25	24·60	2·01	...	...	386·50	135·97	13·40
	1624	Valhalla	...	...	66·25	70·20	2·73	...	...	400·25	321·82	15·47
		Voided leases	...	...	...	...	...	9·31	10,562·89	891,560·97	586·163,23	36,653·24
		Sundry claims	...	...	507·50	246·69	18·17	1,041·31	3,377·55	44,534·41	21,491·05	179·65
Peninsula	1616	Day Dawn	...	...	144·50	64·86	·10	...	...	509·25	479·07	3·07
	1597	Peninsula North	...	...	26·25	12·61	·75	...	...	218·00	243·68	8·29
		Voided leases	...	...	...	...	...	...	24·29	8,817·14	5,373·87	...
		Sundry claims	...	...	14·25	11·14	...	...	...	217·25	119·32	·97
	From Goldfield-generally :—											
	Sundry parcels treated at :											
	State Battery. Norseman		...	...	...	*360·52	*26·68	...	...	405·39	*24,454·58	*1,050·33
	Princess Royal Cyanide Plant		...	...	...	...	...	...	...	...	*1,949·04	*1,571·78
	Various Works		...	...	...	...	...	...	54·52	483·14	*12,857·24	*844·36
	Reported by Banks and Gold Dealers...		...	5·77	...	...	·27	1,181·77	48·76	47·50	18·62	·70
	Totals		...	**8·49**	**151,537·75**	**44,318·14**	**33,091·54**	**2,235·03**	**16,253·73**	**2,883,487·33**	**1,277,689·55**	**705,536·00**

Phillips River Goldfield.

Hatter's Hill ...	...	Voided leases	...	...	...	...	...	...	4·38	1,499·55	1,182·75	...
		Sundry claims	...	...	...	...	...	74·91	21·69	5,225·60	2,720·90	26·09
Kundip	249, etc. ...	Beryl Gold Mines, Limited	...	...	72·00	9·49	...	...	...	2,437·00	2,340·01	197·78
	261	Gem Restored	...		...	...	...	...	...	68·00	10·29	...
		Voided leases	...	...	...	...	...	113·28	556·17	82,109·58	58,196·98	3,811·03
		Sundry claims	...	...	30·50	12·62	...	90·27	73·02	6,434·68	1,951·87	54·65
Mt. Desmond ...	...	Voided leases	...	...	...	...	...	...	1·40	9·00	3,905·46	6,891·59
		Sundry claims	...	...	...	...	...	...	...	...	32·81	51·01
Ravenshtorpe ...	...	Voided leases	...	...	...	...	...	...	141·80	24,723·55	26,070·94	4,384·07
		Sundry claims	...	...	10·00	1·26	...	163·96	7·68	7,261·57	3,195·67	41·12
West River ...	...	Voided leases	...	...	...	...	...	...	...	...	10·34	31·06
		Sundry claims	...	...	...	...	...	...	...	...	6·60	3·44
	From Goldfield generally :—											
	Sundry Parcels treated at :											
	Cordingup Copper Smelter...		...	...	...	10·18	4·27	...	...	...	10·18	4·27
	Cordingup Cyanide Plant		...	...	...	...	...	...	...	...	*909·37	*4·36
	Floater Cyanided Plant		...	...	...	...	...	...	...	12·00	*245·95	...
	Daw and Toleman's Cyanide Plant		...	...	...	...	...	...	...	...	*342·19	...
	Kundip Cyanide Plant		...	...	...	...	...	...	...	15·00	15·25	...
	Various Works		...	...	...	...	...	...	...	...	*1,932·66	*496·46
	Reported by Banks and Gold Dealers...		...	...	...	...	...	164·69	12·14	...	...	...
	Totals		...	...	**112·50**	**33·55**	**4·27**	**607·11**	**818·28**	**129,795·53**	**103,080·22**	**15,996·93**

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

OUTSIDE PROCLAIMED GOLDFIELD.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1946.					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. (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons. (2,240 lbs.).	Fine ozs.	Fine ozs.
Burracoppin ...	...	Voided leases	...	...	...	...	...	...	...	710·85	706·38	...
		Sundry claims	...	...	...	...	...	...	...	372·75	213·97	...
Donnybrook ...	...	Voided leases	...	...	...	...	...	23·24	...	1,613·30	816·23	...
		Sundry claims	...	...	...	...	...	44·01	42·29	119·50	15·71	15·18
Jimperding ...	1P.P., Avon ...	Hillside	...	...	...	...	...	...	...	1,261·75	298·05	...
Roebourne ...	68H, etc. ...	Corderoy Mines, Limited	...	...	...	...	...	...	...	1,954·50	451·44	10·79
		Voided leases	...	...	...	...	...	177·74	93·21	19,975·11	22·105,90	1,258·16
		Sundry claims	...	3·29	...	...	...	46·39	92·26	1,074·35	845·13	99·11
		Reported by Banks and Gold Dealers...	3·77	...	...	...	...	6,067·52	170·45	103·50	228·32	...
		From State generally :—										
		Sundry parcels treated at :										
		Fremantle Smelter, Limited	...	...	...	...	...	...	...	...	*1,879·08	*1,109·06
		Various Works	...	...	...	...	...	...	...	27·00	*7,233·06	30,417·57
		Sundry Specimens	...	...	...	...	...	4·24	56·85	...	...	...
		Voided leases and sundry claims...	...	...	...	...	...	245·45	14·13	201·60	43·58	...
		Reported by Banks and Gold Dealers...	19·77	22·63	...	39·71	...	1,039·10	868·43	...	279·85	59·99
		Totals	**23·54**	**25·92**	...	**39·71**	...	**7,647·69**	**1,337·62**	**27,414·21**	**35,116·70**	**32,969·86**

TABLE II

PRODUCTION OF GOLD AND SILVER FROM ALL SOURCES, SHOWING IN FINE OUNCES THE OUTPUT, AS REPORTED TO THE MINES DEPARTMENT DURING THE YEAR 1946.

Goldfield.	District.	District.						Goldfield.					
		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 (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.
Kimberley	... ...	...	...	...	...	...	...	167·92	65·55	...	...	233·47	...
Pilbara	Marble Bar ...	42·58	...	14,443·45	9,580·63	9,623·21	...						
	Nullagine ...	32·73	140·34	10,006·00	2,695·10	2,868·17	...	75·31	140·34	24,449·45	12,275·73	12,491·38	...
Ashburton	... ...	...	...	...	...	...	...	2·42	50·80	...	...	53·22	...
Gascoyne	... ...	...	...	...	...	...	...	15·92	...	...	...	15·92	...
Peak Hill	... ...	...	...	...	...	...	...	...	...	2,628·50	1,160·49	1,160·49	...
East Murchison ...	Lawlers ...	·63	1·79	29,460·75	7,384·05	7,386·47	...						
	Wiluna ...	...	·86	152,559·00	28,730·53	28,731·39	885·42	15·93	4·40	183,005·25	37,128·29	37,148·26	885·42
	Black Range ...	15·30	1·39	985·50	1,013·71	1,030·40	...						
Murchison	Cue	21·79	164·71	155,507·00	20,659·62	20,846·12	7,298·28						
	Meekatharra ...	14·07	36·21	4,767·75	3,795·06	3,845·34	...						
	Day Dawn ...	58·63	43·73	1,913·00	5,117·99	5,220·35	...	126·48	345·62	210,231·55	43,831·69	44,303·79	7,524·89
	Mt. Magnet ...	31·99	100·97	48,043·80	14,259·02	14,391·98	226·61						
Yalgoo	... ...	...	...	...	...	...	...	10·67	8·46	1,502·40	633·68	652·81	·11
Mt. Margaret ...	Mt. Morgans ...	17·67	35·60	2,743·50	3,333·76	3,387·03	...						
	Mt. Malcolm ...	28·34	17·50	88,954·95	28,239·77	28,285·61	2,385·31	67·94	56·09	96,118·70	34,510·27	34,634·30	2,385·31
	Mt. Margaret...	21·93	2·99	4,420·25	2,936·74	2,961·66	...						
North Coolgardie ...	Menzies ...	6·21	26·87	3,663·25	3,218·00	3,251·08	86·53						
	Ularring ...	·66	69·06	1,569·50	1,544·90	1,614·62	...						
	Niagara ...	3·63	3·56	623·00	326·94	334·13	...	10·50	120·12	7,552·00	5,775·20	5,905·82	86·53
	Yerilla ...	...	20·63	1,696·25	685·36	705·99	...						
Broad Arrow ...	... ...	...	...	...	...	...	...	9·46	349·00	5,886·50	3,725·21	4,083·67	...
N.E. Coolgardie ...	Kanowna ...	19·05	152·40	895·50	392·99	564·44	...						
	Kurnalpi ...	6·97	6·92	90·50	31·71	45·60	...	26·02	159·32	986·00	424·70	610·04	...
East Coolgardie ...	East Coolgardie	55·56	218·28	1,444,264·41	407,700·97	407,974·81	117,508·04						
	Bulong ...	·97	7·82	963·25	186·18	194·97	...	56·53	226·10	1,445,227·66	407,887·15	408,169·78	117,508·04
Coolgardie	Coolgardie ...	38·29	53·55	39,191·15	12,519·71	12,611·55	37·36						
	Kunanalling ...	...	...	1,577·70	1,374·57	1,374·57	...	38·29	53·55	40,768·85	13,894·28	13,986·12	37·36
Yilgarn	... ...	...	...	...	...	...	...	1·90	1,103·58	24,470·25	9,603·41	10,708·89	415·39
Dundas	... ...	...	...	...	...	...	...	...	8·49	151,537·75	44,318·14	44,326·63	33,091·54
Phillips River ...	... ...	...	...	...	...	...	...	...	...	112·50	33·55	33·55	4·27
Outside Proclaimed Goldfields ...		...	...	...	...	...	...	23·54	25·92	...	39·71	89·17	...
		...	...	...	...	...	...	**648·83**	**2,716·98**	**2,194,477·36**	**615,241·50**	**618,607·31**	**161,938·86**

TABLE III.

RETURN SHOWING TOTAL PRODUCTION REPORTED TO THE MINES DEPARTMENT, AND RESPECTIVE DISTRICTS AND GOLDFIELDS FROM WHENCE DERIVED, TO 31ST DECEMBER, 1946.

Goldfield.	District.	DISTRICT.						GOLDFIELD.					
		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	... ...	...	...	...	...	...	...	8,100·50	207·98	22,453·15	17,036·31	25,344·79	93·00
Pilbara	Marble Bar ...	14,788·33	4,410·08	288,157·82	291,992·77	311,191·18	755·05	24,477·10	5,343·31	375,907·01	386,127·94	415,948·35	783·72
	Nullagine ...	9,688·77	933·23	87,749·19	94,135·17	104,757·17	28·67						
Ashburton	... ...	...	...	...	...	...	...	9,257·56	479·40	5,684·25	2,398·70	12,135·66	8,183·68
Gascoyne	... ...	...	...	...	...	...	...	693·44	41·57	387·00	517·29	1,252·30	...
Peak Hill	... ...	...	...	...	...	...	...	3,374·41	5,160·38	612,388·18	292,884·04	301,418·83	2,311·33
East Murchison ...	Lawlers ...	6,859·49	2,279·27	1,977,382·51	813,311·44	822,450·20	26,279·64	8,714·52	21,662·07	12,554,028·07	3,595,445·48	3,625,822·07	52,548·48
	Wiluna ...	222·36	1,247·37	8,856,078·09	1,836,620·36	1,838,090·09	3,774·84						
	Black Range ...	1,632·67	18,135·43	1,720,567·47	945,513·68	965,281·78	22,494·00						
Murchison	Cue	4,982·63	8,218·89	3,528,231·29	934,533·54	947,735·06	125,887·33	24,805·32	57,351·68	9,204,933·46	4,214,574·31	4,296,731·31	302,897·21
	Meekatharra ...	14,249·59	17,472·71	2,231,015·24	1,271,814·27	1,303,536·57	5,042·27						
	Day Dawn ...	3,049·53	11,256·91	2,018,140·78	1,344,313·35	1,358,619·79	169,210·44						
	Mt. Magnet ...	2,523·57	20,403·17	1,427,546·15	663,913·15	686,839·89	2,757·17						
Yalgoo	... ...	...	...	...	...	...	...	1,759·74	2,964·16	432,017·61	257,010·34	261,734·24	1,498·18
Mt. Margaret ...	Mt. Morgans ...	3,331·01	9,317·13	1,201,152·46	702,135·86	714,784·00	5,781·64	11,064·80	32,635·65	9,533,578·79	4,442,894·69	4,486,595·14	218,391·26
	Mt. Malcolm ...	3,762·72	14,017·14	5,863,520·94	2,600,759·88	2,618,539·74	151,016·44						
	Mt. Margaret...	3,971·07	9,301·38	2,468,905·39	1,139,998·95	1,153,271·40	61,593·18						
North Coolgardie ...	Menzies ...	1,623·02	6,334·68	1,454,218·44	1,177,244·90	1,185,202·60	29,823·39	4,766·03	18,562·18	3,001,490·59	2,178,400·01	2,201,728·22	42,377·44
	Ularring ...	123·34	6,637·50	370,099·35	344,880·14	351,640·98	6,098·46						
	Niagara ...	1,708·28	1,817·21	925,224·52	513,296·59	516,822·08	5,603·60						
	Yerilla ...	1,311·39	3,772·79	251,948·28	142,978·38	148,062·56	851·99						
Broad Arrow ...	... ...	...	...	...	...	...	...	21,890·57	26,484·35	1,275,587·85	695,882·93	744,257·85	5,262·41
N.E. Coolgardie ...	Kanowna ...	106,466·03	12,789·37	997,215·06	622,082·93	741,338·33	3,039·73	119,292·83	21,078·34	1,010,454·88	640,534·86	780,906·03	3,050·95
	Kurnalpi ...	12,826·80	8,288·97	13,239·82	18,451·93	39,567·70	11·22						
East Coolgardie ...	East Coolgardie	33,286·65	40,574·01	51,950,436·57	27,261,574·04	27,335,434·70	3,588,044·11	60,663·16	56,576·79	52,130,092·12	27,392,217·96	27,509,457·91	3,588,057·03
	Bulong ...	27,376·51	16,002·78	179,655·55	130,643·92	174,023·21	12·92						
Coolgardie	Coolgardie ...	16,706·11	15,649·92	2,387,011·11	1,259,029·70	1,291,385·73	5,899·10	18,195·16	21,260·17	2,740,562·21	1,508,478·49	1,547,933·82	6,650·24
	Kunanalling ...	1,489·05	5,610·25	353,551·10	249,448·79	256,548·09	751·14						
Yilgarn	... ...	...	...	...	...	...	...	2,182·24	3,938·76	3,603,505·71	1,651,578·22	1,657,699·22	38,978·39
Dundas	... ...	...	...	...	...	...	...	2,235·03	16,253·73	2,883,487·33	1,277,689·55	1,296,178·31	705,536·00
Phillips River ...	... ...	...	...	...	...	...	...	607·11	818·28	129,795·53	103,080·22	104,505·61	15,996·93
Outside Proclaimed Goldfields ...		...	...	...	...	...	...	7,647·69	1,337·62	27,414·21	35,116·70	44,102·01	32,969·86
		...	...	...	...	...	...	**329,727·21**	**292,156·42**	**99,543,767·95**	**48,691,868·04**	**49,313,751·67**	**5,025,586·11**

TABLE IV.

TOTAL OUTPUT OF GOLD (BULLION AND CONCENTRATES ENTERED FOR EXPORT AND GOLD RECEIVED AT THE ROYAL MINT, PERTH), FROM 1ST JANUARY, 1886 TO 31st DECEMBER, 1946; SHOWING IN FINE OUNCES THE QUANTITY CREDITED TO THE RESPECTIVE GOLDFIELDS.

Year.	Export.	Mint.	Total.	Export.	Mint.	Total.
		KIMBERLEY			PILBARA	
	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.
Prior to 1943	22,422·06	13,102·03	35,524·09	147,612·59	296,054·84	443,667·43
1943	....	249·60	249·60	....	16,222·38	16,222·38
1944	....	154·00	154·00	234·60	12,871·67	13,106·27
1945	....	113·81	113·81	....	8,203·99	8,203·99
1946	....	168·08	168·08	2,671·75	10,536·27	13,208·02
Total	22,422·06	13,787·52	36,209·58	150,518·94	343,889·15	494,408·09
		(*a*) WEST PILBARA			ASHBURTON	
Prior to 1943	4,351·11	26,760·61	31,111·72	4,104·96	5,578·95	9,863·91
1943	....	....	....	....	33·57	33·57
1944	....	....	....	....	69·21	69·21
1945	....	....	....	....	53·36	53·36
1946	....	....	....	....	54·21	54·21
Total	4,351·11	26,760·61	31,111·72	4,104·96	5,969·30	10,074·26
		(*b*) GASCOYNE			(*c*) PEAK HILL	
Prior to 1943	304·55	1,063·89	1,368·44	41,102·76	202,213·16	243,315·92
1943	....	....	....	....	388·52	388·52
1944	....	....	....	....	446·42	446·42
1945	....	....	....	....	389·95	389·95
1946	....	4·28	4·28	....	949·93	949·93
Total	304·55	1,068·17	1,372·72	41,102·76	204,387·98	245,490·74
		EAST MURCHISON			MURCHISON	
Prior to 1943	252,092·49	2,790,867·33	3,042,959·82	1,573,146·04	2,890,748·67	4,463,894·71
1943	3,025·25	63,725·90	66,751·15	568·11	25,431·99	26,000·10
1944	23·76	44,926·42	44,950·18	1·18	16,304·32	16,305·50
1945	3,723·82	43,178·04	46,901·86	....	18,498·50	18,498·50
1946	97·59	29,563·16	29,660·75	248·07	39,065·42	39,313·49
Total	258,962·91	2,972,260·85	3,231,223·76	1,573,963·40	2,990,048·90	4,564,012·30
		(*d*) YALGOO			(*e*) MT. MARGARET	
Prior to 1943	13,550·73	187,875·87	201,426·60	691,445·07	3,561,335·85	4,252,800·92
1943	22·42	1,272·93	1,295·35	411·87	24,666·82	25,078·69
1944	....	1,042·47	1,042·47	297·57	23,414·33	23,711·90
1945	....	788·86	788·86	413·27	20,755·71	21,168·98
1946	20·97	608·95	629·92	569·82	28,775·41	29,345·23
Total	13,594·12	191,589·08	205,183·20	693,137·60	3,658,968·12	4,352,105·72
		(*f*) NORTH COOLGARDIE			(*g*) BROAD ARROW	
Prior to 1943	263,074·43	1,965,565·84	2,228,640·27	122,393·37	400,204·64	522,598·01
1943	97·63	8,220·58	8,318·21	46·24	7,318·34	7,364·58
1944	3·08	5,937·46	5,940·54	8·56	2,398·22	2,406·78
1945	48·62	4,792·75	4,841·37	1·33	976·11	977·44
1946	57·05	5,869·50	5,926·55	17·67	3,751·69	3,769·36
Total	263,280·81	1,990,386·13	2,253,666·94	122,467·17	414,649·00	537,116·17
		(*f*) NORTH-EAST COOLGARDIE			(*f*) EAST COOLGARDIE	
Prior to 1943	235,831·42	455,660·02	691,491·44	7,020,312·10	20,674,828·57	27,695,140·67
1943	6·03	395·36	401·39	828·72	316,369·51	317,198·23
1944	38·71	492·21	530·92	488·24	293,919·88	294,408·12
1945	....	235·28	235·28	513·14	319,060·21	319,573·35
1946	11·85	500·01	511·86	1,334·89	425,167·70	426,502·59
Total	235,888·01	457,282·88	693,170·89	7,023,447·09	22,029,345·87	29,052,822·96
		(*h*) COOLGARDIE			YILGARN	
Prior to 1943	662,631·60	1,128,078·61	1,790,710·21	218,354·79	1,458,463·07	1,676,817·86
1943	172·36	16,897·52	17,069·88	600·83	14,505·05	15,105·88
1944	48·59	14,022·60	14,071·19	87·90	9,287·35	9,375·25
1945	55·55	11,590·78	11,646·33	12·47	5,160·98	5,173·45
1946	48·49	13,817·57	13,866·06	322·25	9,525·64	9,847·89
Total	662,596·59	1,184,407·08	1,847,363·67	219,378·24	1,496,942·09	1,716,320·33
		(*i*) DUNDAS			(*j*) PHILLIPS RIVER.	
Prior to 1943	168,888·66	1,076,682·58	1,245,571·24	40,594·66	62,329·13	102,923·79
1943	40·35	44.115·34	44,155·69	1·88	80·80	82·68
1944	376·43	38,559·52	38,935·95	5·85	106·99	112·84
1945	55·81	29,157·22	29,213·03	....	109·98	109·98
1946	424·24	41,801·85	42,226·09	4·52	22·13	26·65
Total	169,785·49	1,230,316·51	1,400,102·00	40,606·91	62,649·03	103,255·94
		¶ DONNYBROOK.			OUTSIDE PROCLAIMED GOLDFIELDS.	
Prior to 1943	282·21	557·53	839·74	20,614·32	35,275·45	55,889·77
1943	....	....	....	586·65	172·87	759·52
1944	....	....	....	210·52	486·69	697·21
1945	....	....	....	205·37	455·81	661·18
1946	....	....	....	260·98	691·72	952·70
Total	282·21	557·53	839·74	21,877·84	37,082·53	58,960·38

(*a*) Prior to 1st May, 1898, included with Pilbara, and abolished 12th July, 1929. (*b*) Prior to March, 1899, included with Ashburton. (*c*) From 1st August, 1897. (*d*) Prior to 1st April, 1897, included with Murchison. (*e*) From 1st August, 1897. (*f*) Prior to 1st May, 1896, included with Coolgardie. (*g*) From 1st September, 1897. (*h*) Declared 5th April, 1894, to which date included with Yilgarn. (*i*) Prior to 1893, included with Yilgarn. (*j*) Prior to 1902, included in Outside Proclaimed Goldfields. ¶ Abolished 4th March, 1908.

TABLE V.

TOTAL OUTPUT OF GOLD BULLION, CONCENTRATES, ETC., ENTERED FOR EXPORT AND RECEIVED AT THE PERTH BRANCH OF THE ROYAL MINT.

FROM 1st JANUARY, 1886.

Year.	Export.	Mint.	Total.	Estimated Value.
	fine ozs.	fine ozs.	fine ozs.	£A.
1886	270·17	...	270·17	1,147
1887	4,359·37	...	4,359·37	18,518
1888	3,124·82	...	3,124·82	13,273
1889	13,859·52	...	13,859·52	58,871
1890	20,402·42	...	20,402·42	86,664
1891	27,116·14	...	27,116·14	115,182
1892	53,271·65	...	53,271·65	226,284
1893	99,202·50	...	99,202·50	421,385
1894	185,298·73	...	185,298·73	787,099
1895	207,110·20	...	207,110·20	879,749
1896	251,618·69	...	251,618·69	1,068,808
1897	603,846·44	...	603,846·44	2,564,977
1898	939,489·49	...	939,489·49	3,990,697
1899	1,283,360·25	187,244·41	1,470,604·66	6,246,732
1900	894,387·27	519,923·59	1,414,310·86	6,007,610
1901	923,686·96	779,729·56	1,703,416·52	7,235,654
1902	707,039·75	1,163,997·60	1,871,037·35	7,947,661
1903	833,685·78	1,231,115·62	2,064,801·40	8,770,719
1904	810,616·04	1,172,614·03	1,983,230·07	8,424,226
1905	655,089·88	1,300,226·00	1,955,315·88	8,305,654
1906	562,250·59	1,232,296·01	1,794,546·60	7,622,749
1907	431,803·14	1,265,750·45	1,697,553·59	7,210,750
1908	356,353·96	1,291,557·17	1,647,911·13	6,999,881
1909	386,370·58	1,208,898·83	1,595,269·41	6,776,274
1910	233,970·34	1,236,661·68	1,470,632·02	6,246,848
1911	160,422·28	1,210,445·24	1,370,867·52	5,823,075
1912	83,577·12	1,199,080·87	1,282,657·99	5,448,385
1913	86,255·13	1,227,788·15	1,314,043·28	5,581,701
1914	51,454·65	1,181,522·17	1,232,976·82	5,237,352
1915	17,340·47	1,192,771·23	1,210,111·70	5,140,228
1916	26,742·17	1,034,655·87	1,061,398·04	4,508,532
1917	9,022·49	961,294·67	970,317·16	4,121,646
1918	15,644·12	860,867·03	876,511·15	3,723,183
1919	6,445·89	727,619·90	734,065·79	3,618,509
1920	5,261·13	612,581·00	617,842·13	3,598,931
1921	7,170·74	546,559·92	553,730·66	2,942,526
1922	5,320·16	532,926·12	538,246·28	2,525,812
1923	5,933·82	498,577·59	504,511·41	2,232,186
1924	2,585·20	482,449·78	485,034·98	2,255,927
1925	3,910·59	437,341·56	441,252·15	1,874,320
1926	3,188·22	434,154·98	437,343·20	1,857,715
1927	3,359·10	404,993·41	408,352·51	1,734,572
1928	3,339·30	390,069·19	393,408·49	1,671,093
1929	3,037·12	374,138·96	377,176·08	1,602,142
1930	1,753·09	415,765·00	417,518·09	1,864,442
1931	1,726·66	508,845·36	510,572·02	2,998,137
1932	3,887·07	601,674·33	605,561·40	4,403,642
1933	2,446·97	634,760·40	637,207·37	4,886,254
1934	3,520·40	647,817·95	651,338·35	5,558,873
1935	9,868·71	639,180·38	649,049·09	5,702,149
1936	55,024·58	791,183·21	846,207·79	7,373,539
1937	71,646·91	928,999·84	1,000,646·75	8,743,755
1938	113,620·06	1,054,171·13	1,167,791·19	10,363,023
1939	98,739·88	1,115,497·76	1,214,237·64	11,842,964
1940	71,680·47	1,119,801·08	1,191,481·55	12,696,503
1941	65,925·94	1,043,391·96	1,109,317·90	11,851,445
1942	15,676·48	832,503·97	848,180·45	8,865,495
1943	6,408·34	540,067·08	546,475·42	5,710,669
1944	1,824·99	464,439·76	466,264·75	4 899 997
1945	5,029·38	463,521·34	468,550·72	5,010,541
1946	6,090·14	610,873·52	616,963·66	6,640,069
Total	11,522,464·45	39,312,346·66	50,834,811·11	282,936,744

	1945. £A	1946. £A
Estimated total par value of above production	213,311,810	215,932,503
Premiums received on sales of gold during 1920–1924 and 1930–1946 (approximate)	62,984,865	67,004,241
Estimated Total	£A276,296,675	£A282,936,744
Gross estimated value of gold won (including £161,448, bonus paid under the Commonwealth Bounty Act, 1930)	£A276,458,123	£A283,098,192

TABLE VI.—MINERALS OTHER THAN GOLD.

GENERAL RETURN OF ORE AND MINERALS, OTHER THAN GOLD, SHOWING THE QUANTITY PRODUCED AND THE VALUE THEREOF AS REPORTED TO THE MINES DEPARTMENT FROM THE RESPECTIVE GOLDFIELDS AND MINERAL FIELDS, DURING 1946, AND PREVIOUS YEARS.

Period.	ALUNITE (POTASH).				ARSENIC.†	
	Yilgarn Goldfield.		Total.		East Murchison Goldfield (Wiluna District).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£
Prior to 1943	....	....	....	....	29,035·70	540,958
1943	....	....	....	....	2,283·00	47,943
1944	943·20	14,229	943·20	14,229	2,304·00	48,384
1945	1,358·80	23,902	1,358·80	23,902	1,989·00	41,771
1946	1,735·80	41,658	1,735·80	41,658	1,624·50	33,935
Total	**4,037·80**	**79,789**	**4,037·80**	***79,984**	**37,236·20**	**712,991**

* Includes Alunite valued at £195 from State generally. † By-product from Wiluna Goldfields, Ltd.

Period.	ANTIMONY.*								
	East Murchison Goldfield.			Pilbara Goldfield.			Total.		
	Conc.	Metal.	Value.	Conc.	Metal.	Value.	Conc.	Metal.	Value.
	tons.	tons.	£	tons.	tons.	£	tons.	tons.	£
Prior to 1943	5,539·83	2,716·63	80,022	39·94	15·71	459	†5,600·55	2,743·90	80,972
1943	1,742·43	848·23	63,295	24·83	11·65	647	1,767·26	859·88	63,942
1944	....	....	....	5·92	3·60	252	5·92	3·60	252
1945	....	....	....	....	....	....	....	....	....
1946	601·40	306·07	13,981	388·53	155·94	9,477	989·93	462·01	23,458
Total	**7,883·66**	**3,870·93**	**157,298**	**459·22**	**186·90**	**10,835**	**8,363·66**	**4,069·39**	**168,624**

* By product of Gold Mining. † Includes 20·78 tons Conc. containing 11·56 tons Metal valued at £491 from State generally.

Period.	ASBESTOS.							
	Ashburton Goldfield.		Pilbara Goldfield.		State Generally.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1943	10·00	959	1,650·00	73,279	*1,421·01	38,205	*3,081·01	112,443
1943	....	....	12·25	456	230·83	12,519	243·08	12,975
1944	....	....	2·00	200	306·53	10,656	308·53	10,856
1945	....	....	....	....	1,091·94	44,662	1,091·94	44,662
1946	....	....	....	....	†374·06	13,525	†374·06	13,525
Total	**10·00**	**959**	**1,664·25**	**73,935**	**3,424·37**	**119,567**	**5,098·62**	**194,461**

* Includes 5 tons valued at £20 from East Coolgardie Goldfield.
†Includes 3·5 tons valued at £21 from East Coolgardie Goldfield.

Period.	BERYL ORE.										BARYTES.	
	Pilbara Goldfield.		Murchison Goldfield.		Coolgardie Goldfield.		State Generally.		Total.		North East Coolgardie Goldfield	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1943	....	....	....	....	....	....	9·55	83	9·55	83	....	....
1943	476·75	13,560	....	....	....	....	38·74	1,004	515·49	14,564	....	....
1944	298·89	9,380	21·53	824	28·71	946	37·83	1,452	386·96	12,602	....	....
1945	11·13	324	3·00	104	19·23	519	·25	5	33·61	*952	....	....
1946	15·49	581	....	....	....	....	....	....	15·49	581	10·00	50
Total	**802·26**	**23,845**	**24·53**	**928**	**47·94**	**1,465**	**86·37**	**2,544**	**961·10**	**28,782**	**10·00**	**50**

* Incomplete.

TABLE VI.—*Minerals other than Gold*—continued.

Period.	KAOLIN.		BENTONITE.		BISMUTH		CLAYS.					
	State Generally.		State Generally.		State Generally.		Collie Mineral Field.		State Generally.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity	Value.	Quantity.	Value.
	tons.	£	tons.	£	lbs.	£	tons.	£	tons.	£	tons.	£
Prior to 1943	70·00	100	15·70	33	3,398·40	1,029	1,051·00	738	*6,027·05	*3,755	7,078·05	4,493
1943	67·00	335	159·03	337	560·00	137	....	....	2,044·75	1,052	2,044·75	1,052
1944	124·00	620	290·90	660	1,042·00	482	....	....	1,491·50	1,106	1,491·50	1,106
1945	54·00	270	50·00	120	506·00	152	....	....	2,309·00	1,154	2,309·00	1,154
1946	....	....	62·00	186	....	....	....	....	2,682·00	1,341	2,682·00	1,341
Total	**315·00**	**1,325**	**577·63**	**1,336**	**5,506·40**	**1,800**	**1,051·00**	**738**	**14,554·30**	**8,408**	**15·605,30**	**9,146**

* Amended.

Period.	COAL.		COPPER ORE.									
	Collie Coalfield.		West Kimberley Goldfield.		Pilbara Goldfield.				West Pilbara Goldfield.		Ashburton Goldfield.	
					Marble Bar District.		Nullagine District.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1943	16,112,003·83	10,720,819	109·52	1,709	32·87	386	14·00	480	82,745·45	748,482	353·07	6,431
1943	531,546·38	489,721	....	....	....	....	....	....	....	....	....	....
1944	558,322·11	583,076	....	....	....	....	....	....	....	....	....	....
1945	543,362·55	572,895	....	....	....	....	....	....	....	....	....	....
1946	642,286·70	730,104	....	....	....	....	....	....	....	....	....	....
Total	**18,387,521·57**	**13,096,615**	**109·52**	**1,709**	**32·87**	**386**	**14·00**	**480**	**82,745·45**	**748,482**	**353·07**	**6,431**

Period.	COPPER ORE—*continued.*											
	Peak Hill Goldfield.		East Murchison Goldfield. (Lawlers District).		Murchison Goldfield.		Yalgoo Goldfield.		Northampton Mineral Field.		Yandanooka Mineral Field.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1943	1,043·35	32,632	247·99	4,677	1,024·02	11,236	51·90	606	24,026·25	119,497	171·55	1,889
1943	....	....	·40	33	....	....	....	....	....	....	....	....
1944	....	....	26·80	183	18·00	54	....	....	....	....	....	....
1945	....	....	9·12	159	....	....	30·45	205	....	....	....	....
1946	....	....	....	....	....	....	....	....	....	....	....	....
Total	**1,043·35**	**32,632**	**284·31**	**5,052**	**1,042·02**	**11,290**	**82·35**	**811**	**24,026·25**	**119,497**	**171·55**	**1,889**

Period.	COPPER ORE—*continued.*											
	Mt. Margaret Goldfield.		North Coolgardie Goldfield. (Menzies District).		East Coolgardie Goldfield (East Coolgardie District).		Phillips River Goldfield.		Yilgarn Goldfield.			
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.		
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£		
Prior to 1943	47,860·52	230,846	6·12	51	50·67	379	95,756·43	588,705	16·00	77		
1943	....	....	....	....	....	....	....	....	....	....		
1944	....	....	....	....	....	....	†1·21	*130	....	....		
1945	....	....	....	....	....	....	....	....	....	....		
1946	....	....	....	....	....	....	74·00	105	....	....		
Total	**47,860·52**	**230,846**	**6·12**	**51**	**†50·67**	**379**	**95,831·64**	**588,940**	**16·00**	**77**		

* Metallic value. † Incomplete.

Period.	COPPER ORE—*continued.*				DIATOMACEOUS EARTH.		DOLOMITE.		DIAMONDS.		EMERALDS.	
	State Generally.		Total.		State Generally.		Murchison Goldfield. (Mt. Magnet District).		Pilbara Goldfield. (Nullagine District).		Murchison Goldfield. (Cue District).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	carats.	£	carats (cut and rough).	£
Prior to 1943	5·11	56	253,514·82	1,748,130	....	....	....	....	....	24	18,373·00	1,609
1943	....	....	·40	33	40·00	640	....	....	....	....	....	....
1944	....	....	46·01	367	....	....	158·51	795	....	....	....	....
1945	....	....	39·57	364	*30·00	480	105·35	502	....	....	....	....
1946	....	....	74·00	105	....	....	98·09	490	....	....	....	....
Total	**5·11**	**56**	**253,674·80**	**1,749,008**	**70·00**	**1,120**	**361·95**	**1,787**	**....**	**24**	**18,373·00**	**1,609**

* Late report for 1942.

TABLE VI.—*Minerals other than Gold*—continued.

Period.	EMERY.		FELSPAR.						GLASS SAND.	
	State Generally.		Coolgardie Goldfield.		State Generally.		Total.		State Generally.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1943	13·00	130	28,099·75	63,318	426·00	838	28,525·75	64,156	162·75	199
1943	....	....	2,289·00	6,867	24·50	57	2,313·50	6,924	340·30	304
1944	....	....	1,881·00	10,376	77·50	155	1,958·50	10,531	157·50	204
1945	....	....	1,234·50	4,321	....	....	1,234·50	4,321	175·00	227
1946	....	....	1,793·00	6,282	....	....	1,793·00	6,282	180·50	227
Total	**13·00**	**130**	**35,297·25**	**91,164**	**528·00**	**1,050**	**35,825·25**	**92,214**	**1,016·05**	**1,161**

Period.	GADOLINITE.		GLAUCONITE.		GRAPHITE.		LEAD ORE.			
	Pilbara Goldfield. (Marble Bar District).		State Generally.		State Generally.		Northampton Mineral Field.		State Generally.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1943	1·00	112	2,407·50	24,171	7·10	42	416,703·32	1,280,194	127·85	1,651
1943	....	....	98·00	2,450	11·00	55	1,250·00	1,100	....	....
1944	....	....	144·00	3,600	....	....	....	....	....	....
1945	....	....	180·00	4,500	....	....	....	....	....	....
1946	....	....	366·50	9,162	....	....	36·21	1,068	....	....
Total	**1·00**	**112**	**3,196·00**	**43,883**	**18·10**	**97**	**417,989·53**	**1,282,362**	**127·85**	**1,651**

Period.	LEAD ORE—*continued.*		*LIMESTONE.							
	Total.		Murchison Goldfield (Cue District.).		Yilgarn Goldfield.		State Generally.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons	£	tons.	£	tons.	£
Prior to 1943	416,831·17	1,281,845	298·00	772	2,548·00	1,607	90,859·00	15,911	93,705·00	18,290
1943	1,250·00	1,100	....	....	....	....	....	....	....	....
1944	....	....	....	....	....	....	....	....	....	....
1945	....	....	....	....	....	....	....	....	....	....
1946	36·21	1.068	....	....	....	....	....	....	....	....
Total	**418,117·38**	**1,284,013**	**298·00**	**772**	**2,548·00**	**1,607**	**90,859·00**	**15,911**	**93,705·00**	**18,290**

* Only reported to year 1907.

Period.	GYPSUM.								IRON ORE.	
	Dundas Goldfield.		Yilgarn Goldfield.		State Generally.		Total.		State Generally.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1943	1,401·00	351	11,374·00	10,892	103,093·24	123,588	115,868·24	134,831	*57,980·00	36,920
1943	....	....	....	....	935·30	880	935·30	880	84·35	128
1944	....	....	....	....	3,604·45	3,722	3,604·45	3,722	....	....
1945	....	....	....	....	7,232·50	9,136	7,232·50	9,136	....	....
1946	212·00	317	4,012·00	6,018	11,126·16	14,819	15,350·16	21,154	....	....
Total	**1,613·00**	**668**	**15,386·00**	**16,910**	**125,991·65**	**152,145**	**142,990·65**	**169,723**	**58,064·35**	**37,048**

* Includes 450 tons from East Coolgardie Goldfield.

Period.	MAGNESITE.						MANGANESE.		PHOSPHATIC GUANO.	
	East Coolgardie Goldfield (Bulong District).		Coolgardie Goldfield.		Total.		Peak Hill Goldfield.		State Generally.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1943	924·75	1,141	291·65	342	1,216·40	1,483	77·00	436	59·73	314
1943	....	....	....	....	....	....	....	....	42·00	21
1944	....	....	....	....	....	....	....	....	2,215·00	12,183
1945	....	....	....	....	....	....	....	....	8,483·00	46,656
1946	10·50	26	....	....	10·50	26	....	....	....	....
Total	**935·25**	**1,167**	**291·65**	**342**	**1,226·90**	**1,509**	**77·00**	**436**	**10,799·73**	**59,174**

TABLE VI.—*Minerals other than Gold*—continued.

Period.	MICA.		PYRITES.		RED OXIDE.							
	State Generally.		Dundas Goldfield.		East Coolgardie Goldfield.		Murchison Goldfield (Cue District).		State Generally.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	lbs.	£	tons	£	tons	£	tons	£	§tons	§£	tons	£
Prior to 1943	*9,401·00	647	†74,415·56	46,103	....	....	....	....	1,044·40	10,494	1,044·40	10,494
1943	13,907·75	715	13,942·00	19,078	15·35	46	....	....	486·00	5,606	501·35	5,652
1944	8,367·50	1,279	43,648·00	68,340	20·00	80	74·00	563	903·00	11,446	997·00	12,089
1945	....	....	66,504·00	102,053	....	....	50·00	320	600·00	8,677	650·00	8,997
1946	....	....	77,784·00	107,250	....	....	505·85	4,398	354·05	5,133	859·90	9,531
Total	**31,676·25**	**2,641**	**276,293·56**	**342,824**	**35·35**	**126**	**629·85**	**5,281**	**3,387·45**	**41,356**	**4,052·65**	**46,763**

*Includes 7,868 lbs. Crude Mica. †Includes 74,047·56 tons, value £45,496, from Mt. Margaret Goldfield. §Amended.

Period.	SILVER LEAD ORE.						SOAPSTONE.					
	Pilbara Goldfield (Marble Bar District).		Ashburton Goldfield.		Total.		Greenbushes Mineral Field.		State Generally.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1943	195·00	3,658	2,974·00	35,796	3,169·00	39,454	255·00	950	10·00	25	265·00	975
1943	....	....	....	....	....	....	....	....	....	....	....	....
1944	....	....	....	....	....	....	262·00	828	....	....	262·00	828
1945	....	....	....	....	....	....	....	....	....	....	....	....
1946	....	....	....	....	....	....	....	....	....	....	....	....
Total	**195·00**	**3,658**	**2,974·00**	**35,796**	**3,169·00**	**39,454**	**517·00**	**1,778**	**10·00**	**25**	**527·00**	**1,803**

Period.	KYANITE		TALC		VERMICULITE							
	State Generally		East Coolgardie Goldfield		East Coolgardie Goldfield (Bulong District)		Yilgarn Goldfield		State Generally		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	tons	£	tons	£	tons	£	tons	£	tons	£	tons	£
Prior to 1943	....	....	38·00	57	95·40	677	....	....	382·75	2,363	478·15	3,040
1943	....	....	72·55	170	....	....	20·00	60	342·80	2,057	362·80	2,117
1944	....	....	....	....	....	....	....	....	123·00	738	123·00	738
1945	*19·95	100	....	....	....	....	....	....	59·00	354	59·00	354
1946	139·74	568	389·41	1,499	2·50	12	....	....	201·00	1,206	203·50	1,218
Total	**159,69**	**668**	**499·96**	**1,726**	**97·90**	**689**	**20·00**	**60**	**1,108·55**	**6,718**	**1,226·45**	**7,467**

*Late report for 1938.

Period.	TIN.											
	Kimberley Goldfield.				Pilbara Goldfield (Marble Bar District).				East Murchison Goldfield.			
	Quantity.			Value.	Quantity.			Value.	Quantity.			Value.
	Lode.	Stream.	Total.		Lode.	Stream.	Total.		Lode.	Stream.	Total.	
	tons.	tons.	tons.	£	tons.	tons.	tons.	£	tons.	tons.	tons.	£
Prior to 1943	....	....	....	....	372·62	5,540·38	5,913·00	549,093	....	....	....	....
1943	....	·60	·60	143	....	4·60	4·60	1,022	·14	....	·14	53
1944	....	....	....	....	9·87	....	9·87	2,175	....	....	....	....
1945	....	....	....	....	....	10·81	10·81	2,250	·25	....	·25	50
1946	....	....	....	....	....	13·99	13·99	2,750	....	....	....	....
Total	....	**·60**	**·60**	**143**	**382·49**	**5,569·78**	**5,952·27**	**557,290**	**·39**	....	**·39**	**103**

TABLE VI.—*Minerals other than Gold*—continued.

Period.	TIN—*continued.*								TANTALITE.			
	Greenbushes Mineral Field.				Total.				Pilbara Goldfield (Marble Bar District).			
	Quantity.			Value.	Quantity.			Value	Quantity.			Value.
	Lode.	Stream.	Total.		Lode.	Stream.	Total.		Lode.	Stream.	Total.	
	tons.	tons.	tons.	£	tons.	tons.	tons.	£	tons.	tons.	tons.	£
Prior to 1943	357·28	10,961·59	11,318·87	994,740	†730·50	*16,506·84	17,237·34	1,544,254	52·53	201·45	253·98	116,760
1943	....	5·87	5·87	1,097	·14	11·07	11·21	2,315	·87	....	·87	780
1944	....	·90	·90	176	9·87	·90	10·77	2,351	9·86	....	9·86	12,851
1945	....	10·70	10·70	2,069	·25	21·51	21·76	4,369	....	....	....	....
1946	....	14·53	14·53	3,088	....	28·52	28·52	5,838	....	·36	·36	281
Total	**357·28**	**10,993·59**	**11,350·87**	**1,001,170**	**740·76**	**16,568·84**	**17,309·60**	**1,559,127**	**63·26**	**201·81**	**265·07**	**130,672**

* Includes 4·72 tons valued at £360 and ·15 tons valued at £15 ; the product of Cue and Coolgardie Goldfields respectively.
† Includes ·60 tons valued at £46 from Yilgarn Goldfield.

Period.	TANTALITE—*continued.*								TIN-TANTALUM.	
	Greenbushes Mineral Field.				Total.				Greenbushes Mineral Field.	
	Quantity.			Value.	Quantity.			Value.	Quantity.	Value. (Tin content only
	Lode.	Stream.	Total.		Lode.	Stream.	Total.			
	tons.	tons.	tons.	£	tons.	tons.	tons.	£	tons.	£
Prior to 1943	....	4·12	4·12	2,127	*55·03	205·57	260·60	121,227	....	....
1943	....	7·39	7·39	6,952	·87	7·39	8·26	7,732	....	....
1944	....	....	....	....	†10·17	....	10·17	13,020	20·16	2,045
1945	....	....	....	....	....	....	....	....	6·17	915
1946	....	....	....	....	....	·36	·36	281	....	....
Total	....	**11·51**	**11·51**	**9,079**	**66·07**	**213·32**	**279·39**	**142,260**	**26·33**	**2,960**

* Includes 2·50 tons valued at £2,340 from Coolgardie Goldfield. † Includes ·31 tons valued at £169 from Coolgardie Goldfield.

Period.	WOLFRAM.								SCHEELITE.			
	Broad Arrow Goldfield.		Yalgoo Goldfield.		State Generally.		Total.		Murchison Goldfield.		Yalgoo Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	units.	£	units.	£	units.	£	units.	£	units.	£	units.	£
Prior to 1943	16	88	1	8	601	1,506	618	1,602	....	....	....	....
1943	....	....	14	80	....	....	14	80	....	....	194	1,050
1944	....	....	....	....	....	....	....	....	11	59	....	....
1945	....	....	....	....	....	....	....	....	....	....	....	....
1946	....	....	....	....	....	....	....	....	....	....	....	....
Total	**16**	**88**	**15**	**88**	**601**	**1,506**	**632**	**1,682**	**11**	**59**	**194**	**1,050**

Period.	SCHEELITE—*continued.*											
	Broad Arrow Goldfield.		Coolgardie Goldfield (Coolgardie District).		North Coolgardie Goldfield (Menzies District).		Yilgarn Goldfield.		Dundas Goldfield.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	units.	£	units.	£	units.	£	units.	£	units.	£	units.	£
Prior to 1943	70	175	781	2,537	398	1,006	....	....	4	10	1,253	3,728
1943	....	....	281	1,540	7	24	8	41	2	9	492	2,664
1944	....	....	16	90	....	....	3,873	21,271	....	....	3,900	21,420
1945	....	....	....	....	....	....	1,638	8,946	....	....	1,638	8,946
1946	....	....	27	150	....	....	258	1,402	....	....	285	1,552
Total	**70**	**175**	**1,105**	**4,317**	**405**	**1,030**	**5,777**	**31,660**	**6**	**19**	**7,568**	**38,310**

TABLE VII.

Quantity and Value of Minerals, other than Gold and Silver, reported during year, 1946.

Number of Lease, Claim or Area	Goldfield or Mineral Field	Registered Name of Company or Lease	Quantity		Value
		ALUNITE	tons	Crude Potash tons	£A
M.L.'s 43, etc.	Yilgarn ...	State (W.A.) Alunite Industries ...	35,136·00	1,735·80	41,658·40
		ANTIMONY	Concentrates	Antimony tons	
G.M.L. 10J	East Murchison	Moonlight Wiluna G.M.'s, Ltd. ...	509·82	258·02	11,474·00
G.M.L. 667J	East Murchison	Wiluna G.M.'s, Ltd.	91·58	48·05	2,507·00
G.M.L. 231L	Pilbara ...	Blue Spec. G.M.'s, N.L.	388·53	155·94	9,477·00
			989·93	462·01	23,458·00
		ARSENIC			
G.M.L. 667J	East Murchison	Wiluna G.M.'s, Ltd.	1,624·50	...	33,934·50
		ASBESTOS—(Anthophyllite)			
Private Property (Bindi-Bindi)	State generally	Midland Mining and Development Synd.	5·00	...	100·00
P.A. 1268Y (Bulong) ...	East Coolgardie	Fletcher, C. H.	3·50	...	21·00
		ASBESTOS—(Crocidolite)			
M.C.'s 269H, etc. (Wittenoom Gorge)	State generally	Australian Blue Asbestos, Ltd.... ...	247·99	...	8,431·76
M.C.'s 221H, etc. (Wittenoom & Yampire Gorges)	State generally	W.A. Blue Asbestos Fibres Co., Ltd. ...	117·57	...	4,972·24
			374·06	...	13,525·00
		BARYTES			
M.C. 1K (Kurnalpi) ...	N-E Coolgardie	Jones, R. L. C.	10·00	...	50·00
		BENTONITE			
M.C.'s 282H, etc. (Marchagee)	State generally	Fennell & Bryant	62·00	...	186·00
		BERYL ORE		BeO Long Ton units	
Crown Lands	Pilbara ...	Lamont, G.	15·49	197·29	580·60
		CLAYS			
M.C'.s 150H, etc. (Clackline)	State generally	Clackline Firebrick Co.	1,792·00	...	896·00
M.C. 357H (Mt. Helena) ...	State generally	Swan Portland Cement, Ltd.	890·00	...	445·00
			2,682·00	...	1,341·00
		COAL	tons		£A
M.L.'s 314, etc.	Collie ...	Griffin Coal Mining Co., Ltd.	81,288·50	...	81,893·80
		Wyvern Colliery	20,152·30	...	20,770·00
M.L.'s 85, etc.	Collie ...	Amalgamated Collieries of W.A.—			
		Cardiff Mine	69,738·57	...	79,174·28
		Co-operative Mine	87,651·01	...	102,698·08
		Proprietary Mine	128,962·97	...	148,665·32
		Stockton Mine	100,101·33	...	117,101·47
		Stockton Open Cut	122,959·57	...	142,476·50
		Wallsend Open Cut	31,432·45	...	37,325·02
			642,286·70	...	730,104·47

TABLE VII—*continued.*

Quantity and Value of Minerals, other than Gold and Silver, reported during year 1946.

Number of Lease, Claim or Area	Goldfield or Mineral Field	Registered Name of Company or Lease	Quantity		Value
		COPPER ORE	tons	Copper, tons	£A
L.T.T. 1007H (Ravensthorpe)	Phillips River	Wehr Bros.	74·00	1·10	104·99
		DOLOMITE			
M.L.'s 10M, 11M (Mt. Magnet)	Murchison ...	Atkinson & Giles...	98·09	...	490·50
		FELSPAR			
M.L.'s 80, etc. (Londonderry)	Coolgardie ...	Australian Glass Manufacturers Co., Pty., Ltd.	1,793·00	...	6,281·50
		GLASS SAND			
M.C. 365H (East Wanneroo)	State generally	Leach, R. J.	16·50	...	21·00
M.C.'s 161H, etc. (Lake Gnangarra)	State generally	Leach, W. M.	164·00	...	206·00
			180·50	...	227·00
		GLAUCONITE	Greensand tons	Glauconite tons	
Private Property (Gin Gin)	State generally	Brook, G. E.	1,832·50	366·50	9,162·50
		GYPSUM			
M.C.'s 33H, etc. (Woolundra)	State generally	Ajax Plaster Co., Ltd.	2,602·16	...	3,572·77
M.C. 293H (Woolundra)	State generally	Ripper, P....	1,374·00	...	1,532·85
M.C. 280H (Lake Brown)	State generally	Saunders, G. R., (Junr.)...	2,650·00	...	3,900·50
M.C. 31H, etc. (Baandee)	State generally	Millar's Timber and Trading Co. ...	754·00	...	1,130·50
M.C.'s 126H, 127H(Baandee)	State generally	Perth Modelling Works, Ltd.	3,746·00	...	4,682·50
M.C.'s 9, 10 (Yellowdine)	Yilgarn ...	Perth Modelling Works, Ltd.	4,012·00	...	6,017·60
M.C.'s 8, etc. (Norseman)	Dundas ...	Perth Modelling Works, Ltd.	212·00	...	317·00
			15,350·16	...	21,153·72
		KYANITE	tons		£A
M.C. 287H (Yanmah) ...	State generally	Smith, J. H.	139·74	...	568·00
		LEAD ORE			
M.L.'s 205, 209	Northampton	Galena Lead Mines	16·21	...	468·00
Private Property (Loc. 119)	Northampton	Heinsen Bros.	20·00	...	600·00
			36·21	...	1,068·00
		MAGNESITE			
M.C. 3Y (Bulong)... ...	East Coolgardie	Jones, R. L. C.	10·50	...	26·25
		PYRITES	Pyritic Ore tons	Sulphur tons	
G.M.L.'s 1460, etc. ...	Dundas ...	Norseman G.M.'s, N.L.	77,784·00	14,852·54	107,250·00
		RED OCHRE			
M.L. 270H (Opthalmia Range)	State generally	Smith, R. J.	354·05	...	5,132·50
M.C. 26 (Cue)	Murchison ...	Cassidy & Zadow	505·85	...	4,398·25
			859·90	...	9,530·75

TABLE VII.—*continued.*

Quantity and Value of Minerals, other than Gold and Silver, reported during year 1946.

Number of Lease, Claim or Area	Goldfield or Mineral Field	Registered Name of Company or Lease	Quantity		Value
		TALC	tons		£A
G.M.L. 5961E (Mt. Monger)	East Coolgardie	Collett, J. H.	389·41	...	1,498·90
		TANTALITE			
M.C.'s 107, etc. (Wodgina)	Pilbara ...	Tantalite, Ltd.	·36	...	281·00
		TIN			
M.C.'s 4, etc.	Greenbushes...	Freeman, F. E. D.	14·10	...	3,012·00
M.C. 45	Greenbushes...	Patterson, H.	·43	...	76·00
D.C. 16 (Moolyella) ...	Pilbara ...	Brompton-Burns, R.	2·55	...	560·00
Sundry claims	Pilbara ...	Sundry claims	11·44	...	2,190·00
			28·52	...	5,838·00
		TUNGSTEN ORES—SCHEELITE			
			Concentrates lbs.	W.O.3 lbs.	
T.L. 132, G.M.L. 3447 ...	Yilgarn ...	Edna May (W.A.) Amalgamated G.M.'s, N.L.	9,558·00	5,785·46	1,402·20
G.M.L. 5671	Coolgardie ...	Kent, W. A.	910·00	609·70	150·00
			10,468·00	6,395·16	1,552·20
		VERMICULITE			
			tons		
M.C.'s 187H, etc (Young River)	State generally	Perth Modelling Works, Ltd.	201·00	...	1,206·00
M.C. 3Y (Bulong)... ...	East Coolgardie	Jones, R. L.	2·50	...	12·50
			203·50	...	1,218·50

By Authority: William H. Wyatt, Government Printer, Perth.

TABLE SHOWING AVERAGE NUMBER OF MEN EMPLOYED ABOVE AND UNDER GROUND IN THE LARGER GOLD-MINING COMPANIES OPERATING IN WESTERN AUSTRALIA DURING THE YEARS FROM 1937 TO 1946 INCLUSIVE.

Compiled from Quarterly Figures furnished by Companies concerned to the Mines Department up to 1942 *and Monthly Figures thereafter.*

COMPANY.	1937.			1938.			1939.			1940.			1941.			1942.			1943.			1944.			1945.			1946.		
	Above	Under	Total.	Above	Under	Total.	Above	Under	Total.	Above	Under	Total.	Above	Under	Total.	Above	Under	Total.	Above	Under	Total.	Above	Under	Total.	Above	Under	Total.	Above	Under	Total.
Boulder Perseverence, Ltd.	202	163	365	180	159	339	141	147	288	160	149	309	158	157	315	144	102	246	117	96	213	116	101	217	127	115	242	178	148	326
Broken Hill Pty. Co., Ltd.	34	45	79	70	66	136	38	92	130	47	95	142	48	93	141	32	54	86	5	....	5	4	....	4	11	2	13	33	82	115
Consolidated Gold Area, N.L.	....	....	....	....	....	....	11	21	32	22	51	73	24	38	62	27	33	60	13	16	29	1	....	1	1	....	1	2	....	2
Golden Horseshoe (New), Ltd.	54	....	54	46	....	46	52	....	52	50	....	50	50	....	50	41	....	41	39	....	39	38	....	38	39	....	39	45	....	45
Gold Mines of Kalgoorlie, Ltd.	82	149	231	73	161	234	92	156	248	96	174	270	105	167	272	91	108	199	95	96	191	90	98	188	103	114	217	144	171	315
Great Boulder Pty., Ltd.	326	477	803	411	564	975	382	591	973	340	620	960	350	608	958	281	408	689	249	329	578	226	305	531	237	344	581	310	469	779
Kalgoorlie Enterprise, Ltd.	....	47	47	....	92	92	....	77	77	....	87	87	....	103	103	....	74	74	....	55	55	....	53	53	....	74	74	....	99	99
Lake View and Star, Ltd.	377	894	1,271	397	876	1,273	422	861	1,283	426	812	1,238	410	792	1,202	256	323	579	218	186	404	225	214	439	246	242	488	337	422	759
North Kalgurli (1912), Ltd.	50	191	241	47	196	243	66	195	261	91	220	311	82	286	368	48	154	202	37	91	128	42	107	149	52	131	183	62	173	235
Paringa Mining and Exploration Co., Ltd.	40	45	85	58	86	144	60	123	183	66	152	218	72	149	221	59	115	174	59	88	147	78	82	160	69	103	172	76	113	189
South Kalgurli Consolidated, Ltd.	155	114	269	146	125	271	159	150	309	158	153	311	151	143	294	131	98	229	67	77	144	43	74	117	51	80	131	80	91	171
Kalgurli Ore Treatment Co., Ltd.	....	....	....	82	....	82	76	....	76	76	....	76	80	....	80	67	....	67	65	....	65	67	....	67	68	....	68	73	....	73
New Milano, N.L.	....	....	....	....	....	....	....	....	....	15	13	28	29	17	46	20	15	35	6	8	14	1	....	1	2	....	2	2	1	3
Comet Gold Mines, Ltd.	24	22	46	41	14	55	55	44	99	43	28	71	44	36	80	59	31	90	54	28	82	47	30	77	42	33	75	43	32	75
Blue Spec Gold Mines, N.L.	1	2	3	5	2	7	2	2	4	10	11	21	9	4	13	6	4	10	5	4	9	28	7	35	32	12	44	38	17	55
Wiluna Gold Mines, Ltd.	397	631	1,028	394	534	928	326	485	811	267	361	628	255	342	597	247	292	539	255	282	537	237	244	481	214	196	410	168	96	264
Moonlight Wiluna Gold Mines, Ltd.	48	99	147	48	122	170	42	109	151	37	113	150	38	105	143	29	81	110	18	61	79	16	44	60	4	5	9	....	....	....
Emu Gold Mines, Ltd.	48	63	111	47	65	112	38	85	123	47	87	134	48	21	69	33	43	76	33	32	65	29	28	57	34	38	72	38	40	78
Youanmi Gold Mines, Ltd.	74	143	217	83	179	262	76	161	237	68	164	232	56	140	196	10	12	22	....	....	....	....	....	....	....	....	....	....	....	....
Big Bell Mines, Ltd.	233	97	330	142	144	286	164	193	357	185	259	444	180	237	417	165	162	327	29	11	40	14	1	15	29	16	45	171	143	314
Triton Gold Mines, N.L.	72	157	229	76	194	270	83	223	306	83	239	322	82	223	305	36	74	110	4	10	14	8	15	23	11	23	34	41	66	107
Hill 50 Gold Mine, N.L.	23	32	55	28	30	58	25	45	70	31	40	71	33	41	74	28	42	70	32	42	74	32	41	73	41	45	86	55	48	103
Mt. Magnet Gold Mines, Ltd.	48	53	101	42	49	91	42	64	106	38	42	80	9	4	13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Sons of Gwalia, Ltd.	123	237	360	127	237	364	136	242	378	132	253	385	124	241	365	97	163	260	101	125	226	101	115	216	104	106	210	122	160	282
First Hit Gold Mine, N.L.	24	27	51	22	25	47	20	18	38	22	17	39	20	14	34	18	12	30	17	15	32	21	14	35	20	15	35	7	7	14
Gold Fields Australian Development Co., Ltd.	....	....	....	....	....	....	....	....	....	9	11	20	13	15	28	12	15	27	10	10	20	4	2	6	2	....	2	13	11	24
Ora Banda Amalgamated, Ltd.	35	50	85	35	50	85	35	50	85	30	45	75	30	45	75	26	38	64	22	26	48	7	5	12	4	....	4	11	20	31
Consolidated Gold Mines of Coolgardie, Ltd.	31	63	94	23	23	46	47	63	110	64	107	171	67	86	153	45	53	98	37	44	81	20	23	43	8	1	9	2	....	2
Phoenix Gold Mines, Ltd.	25	37	62	22	33	55	40	45	85	44	79	123	54	65	119	43	40	83	35	36	71	40	38	78	48	33	81	50	30	80
Burbidge Gold Mines, N.L.	....	....	....	....	....	....	....	....	....	....	....	....	38	....	38	25	2	27	3	....	3	....	....	....	....	....	....	18	....	18
Yellowdine Gold Development, Ltd.	59	75	134	63	83	146	67	81	148	60	84	144	57	74	131	41	47	88	30	28	58	13	9	22	2	....	2	4	....	4
Edna May Amalgamated, N.L.	13	13	26	34	47	81	40	61	101	40	61	101	39	62	101	29	35	64	30	35	65	35	36	71	33	34	67	29	42	71
Evanston Gold, N.L.	....	....	....	....	....	....	17	18	35	21	21	42	31	32	63	19	21	40	5	7	12	....	....	....	....	....	....	28	32	60
Central Norseman Gold Corporation, N.L.	75	175	250	62	189	251	75	252	327	107	333	440	112	223	335	91	148	239	82	117	199	72	115	187	77	135	212	103	201	304
*Norseman Gold Mines, N.L.	104	169	273	138	169	307	152	217	369	161	233	394	148	195	343	110	151	261	101	104	205	87	72	159	98	56	154	105	79	184
Sunshine Reward Amalgamated Leases	....	....	....	3	4	7	6	5	11	6	6	12	6	6	12	4	5	9	5	6	11	5	5	10	4	3	7	5	7	12
All Other Operators	4,821	4,306	9,127	4,243	3,668	7,911	3,878	3,475	7,353	3,367	3,054	6,421	2,819	2,471	5,290	1,474	1,324	2,798	604	499	1,103	512	437	949	606	389	995	1,019	692	1,711
State Average (incl. Diggers)	7,598	8,576	16,174	7,188	8,186	15,374	6,865	8,351	15,216	6,419	8,174	14,593	5,871	7,235	13,106	3,844	4,279	8,123	2,488	2,591	5,079	2,266	2,348	4,614	2,424	2,394	4,818	3,416	3,545	6,961
*Also additional men engaged exclusively on Pyrites Production	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	27	33	7	33	40	5	49	54	4	53	57