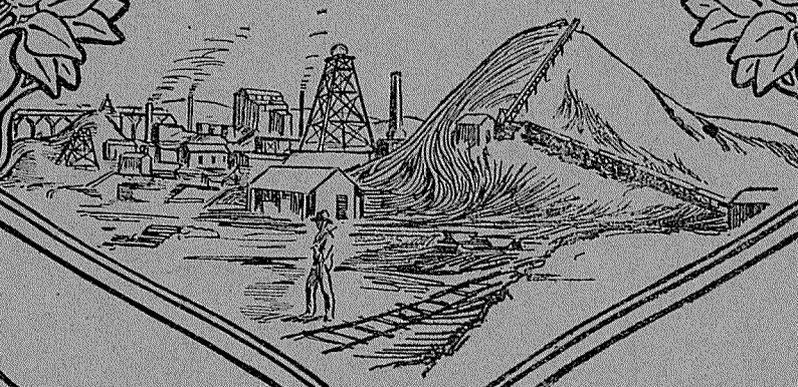




REPORT
OF THE
DEPARTMENT OF MINES
FOR THE YEAR
WESTERN · 1936 · AUSTRALIA



PRESENTED TO BOTH HOUSES OF PARLIAMENT

BY HIS EXCELLENCY'S COMMAND



1937.

WESTERN AUSTRALIA.

REPORT

of the

Department of Mines

FOR THE YEAR

1936.

PERTH:

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1937.

ANNUAL REPORT OF THE DEPARTMENT OF MINES, WESTERN AUSTRALIA, 1936.

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STATE OF WESTERN AUSTRALIA.

Report of the Department of Mines for the State of Western Australia for the Year 1936.

To the Hon. the Minister for Mines.

Sir,—

I have the honour to submit the Annual Report of the Department for the year 1936, together with reports from the officers controlling the sub-departments, and comparative tables furnishing statistics relative to the Mining Industry.

I have, etc.,

M. J. CALANCHINI,
Under Secretary for Mines.

Department of Mines,
Perth, 31st March, 1937.

DIVISION I.

The Hon. the Minister for Mines,—

I have the honour to submit, for your information, a report on the Mining Industry for the year 1936.

The estimated value of the mineral output of the State for the year was £4,039,605 (calculating gold at £4 4s. 11.45d. per ounce); an increase of £851,959. The estimated premium paid to gold-producers amounted to £3,779,079, raising the gross return from mineral production to £7,818,684, a total increase over 1935 of £1,685,873 in Australian currency.

There were increases in the quantity and value of asbestos, coal, felspar, gold, gypsum and tantalite, and in quantity of silver, and small consignments of copper and fire-clay were exported, and a quantity of lead ore raised. Decreases in the value and quantity of arsenic, glauconite and tin, and in the value of silver were recorded.

In previous reports the value of gold has been computed at the old price of £4 4s. 11.45d. per ounce when calculating percentage of total output, and failed to emphasise the importance of the industry. The actual value of the gold produced in 1936 was £A7,373,539 out of a total of £A7,818,684, or 94 per cent. (See footnote to Table 1, Part II.) Other minerals realised:—Coal, £331,565; arsenic, £62,460; silver, £11,773; felspar, £9,170; tantalite, £8,812; gypsum, £7,569; tin, £6,882; asbestos, £3,479; lead ore, £2,228, and glauconite, £1,095.

Dividends paid by mining companies amounted to £1,078,838, a reduction of £11,618, when compared with 1935. In addition, £23,129 were paid in redemption of profit sharing notes. (See Table 6.)

To the end of the year 1936 the total amount distributed by gold mining companies in dividends was £32,917,630. To the same date the value of the mineral production totalled £194,124,252, of which the gold production accounted for £179,274,999, based on normal values; but premiums from sales of gold during 1920-1924 and 1930-1936, and payments under "The Gold Bounty Act, 1930," increased by £17,198,732, the total values of mineral and gold productions respectively.

GOLD.

The reported yield of gold showed an increase of 206,272 fine ounces, the best since the year 1918.

The estimated average value per ton of ore treated in the State as a whole declined from 29.26 shillings per ton in 1935 to 28.85 shillings per ton in 1936, calculated at a rate of £4 4s. 11.45d. per fine ounce, but the average premium obtained for gold during the 12 months (105.13 per cent.) would more than double this estimate. In the East Coolgardie Goldfield (which produced approximately 46.75 per cent. of the State's reported yield) the estimated average value of ore treated rose from 28.95s. to 31.26s. per ton. The estimates for the East Murchison (Wiluna Gold Mine); Mt. Margaret (Sons of Gwalia and Lancefield Mines); and Murchison Goldfields (Triton and Mt. Magnet Mines) were 18.24s. (20.6s.); 31.36s. (31.15s.); 27.03s. (25.97s.) respectively; 1935 figures in parentheses.

The reported tonnage of ore treated in 1936, 2,492,034 tons, was an increase of 582,202 tons over the 1935 production. Increased tonnages were reported from the following Goldfields:—East Coolgardie (180,741), East Murchison (98,358), Mt. Mar-

garet (80,009), Yilgarn (69,547), Murchison (63,501), Dundas (47,683), North Coolgardie (33,450), Broad Arrow (9,523), Coolgardie (4,060), Pilbara (803), Phillips River (548), and North-East Coolgardie (377). The only two goldfields reporting decreased tonnages were Yalgoo (6,156) and Peak Hill (32).

The quantity of gold recorded as being received at the Perth branch of the Royal Mint and exported in bullion, concentrates, and other gold-bearing material exceeded that of 1935 by 197,159 fine ounces (*vide* Table 1). The reported yield, from the tonnage of ore treated, exceeded that of 1935 by 206,272 fine ounces (*vide* Table 3). The average tonnage of ore raised and the number of ounces of gold produced per man employed both showed substantial increases, when compared with figures for 1935, as shown in Table 4.

Only four goldfields failed to report yields of gold in excess of 1935 production, viz., Yalgoo, Kimberley, Phillips River, and North-East Coolgardie, which showed reductions of 886, 67, 3, and 2 ounces respectively. Increased outputs of gold were reported from East Coolgardie, 91,582 ounces; Mt. Margaret, 30,560 ounces; Murchison, 23,397 ounces; Yilgarn, 21,041 ounces; Dundas, 12,122 ounces; North Coolgardie, 11,389 ounces; East Murchison, 7,626 ounces; Broad Arrow, 5,945 ounces; Pilbara, 3,378 ounces; Peak Hill, 370 ounces, and Coolgardie, 58 ounces.

The acreage held under mining lease for all minerals is 72,705 acres, being a decrease of 9,804 acres when compared with 1935. The area held for gold mining is lesser by 5,782 acres and for other minerals lesser by 4,022 acres. The area held under prospecting areas is 46,452 acres, including 6,000 acres for coal. This is a decrease of 16,250 acres on the area held in 1935. In addition to the area held under

leases and prospecting areas there are large reservations created under Section 297 of the Mining Act which are being thoroughly prospected.

The averaged number of men engaged in mining operations was reported to be 16,652, an increase of 1,095 over the number recorded for 1935. The number engaged in the production of gold continues to show satisfactory progress, the number reported for 1936 being 15,696, an increase of 988. The increased number of men engaged in the production of minerals being 107. Increases in the coal mining industry of 79 men were reported, 25 men were employed in preliminary work on iron-ore deposits and the production of lead ore at Northampton for use in smelting operations at Wiluna accounted for 22 men. Five more men were engaged producing tantalite. The arsenic plant at Wiluna ceased operations in October, 1936, and the employees reduced in number and less men were employed in recovering asbestos, gypsum, and tin.

The estimated value of the average amount of gold produced per man engaged in the gold mining industry (calculated at normal value) was £230.69 in 1936, an increase over 1935 value of £38.35 per man. The estimated average tonnage of ore raised per man was 158.77 tons, in the previous year 133.37 tons, an increase of 25.4 tons per man. East Murchison, East Coolgardie, and Mt. Margaret Goldfields produced the highest tallies of ore per man with averages of 281.07, 266, and 191.76 tons respectively.

The periodical examination of mine workers under the provisions of the Mine Workers' Relief Act was completed on the 31st December, 1936, and the results of the examination, together with the results of the previous examinations, are shown in the following table:—

TABLE SHOWING RESULTS OF PERIODICAL EXAMINATION OF MINE WORKERS FROM INCEPTION OF EXAMINATIONS (1925) TO 31ST DECEMBER, 1936.

<i>First Examination (1925-26).</i>										per cent.		
Normals, 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
<i>Second Examination (1927).</i>										per cent.		
Normals, etc.—												
Previously reported as Normals, etc.	2,290		
New cases (<i>i.e.</i> , 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 Normals, 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

<i>Third Examination (1928).</i>										per cent.	
Normals, etc.—											
Previously reported as Normals, etc.	2,738	
New cases	239	
										2,977	= 85.5
Silicosis Early—											
Previously reported as Normals, etc.	47	
Previously reported as Silicosis Early	303	
New cases	12	
										362	= 10.4
Silicosis Advanced—											
Previously reported as Normals, 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 Normals, 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 Normals, etc.	3	
New case	1	
										4	= .1
Total number of men examined										3,483	= 100.0

<i>Fourth Examination (1929).</i>										per cent.	
Normals, etc.—											
Previously reported as Normals, etc.	2,099	
New cases	21	
										2,120	= 81.9
Silicosis Early—											
Previously reported as Normals, 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 Normals, etc.	8	
Previously reported as Silicosis Early	14	
Previously reported as Silicosis Advanced	19	
										41	= 1.6
Tuberculosis only—											
Previously reported as Normals, etc.	7	
										7	= .3
Total number of men examined										2,588	= 100.0

<i>Fifth Examination (1930).</i>										per cent.	
Normals, etc.—											
Previously reported as Normals, etc.	2,751	
New cases	34	
										2,785	= 81.9
Silicosis Early—											
Previously reported as Normals, 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 Normals, 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 Normals, etc.	47	
New cases	3	
										50	= 1.5
Total number of men examined										3,399	= 100.0

		<i>Sixth Examination (1931).</i>		per cent.
Normals, etc.—				
Previously reported as Normals, etc.	2,530			
	<hr/>	2,530	=	84.0
Silicosis Early—				
Previously reported as Normals, etc.	94			
Previously reported as Silicosis Early	252			
	<hr/>	346	=	11.5
Silicosis Advanced—				
Previously reported as Silicosis Early	18			
Previously reported as Silicosis Advanced	35			
	<hr/>	53	=	1.8
Silicosis plus Tuberculosis—				
Previously reported as Normals, etc.	4			
Previously reported as Silicosis Early	35			
Previously reported as Silicosis Advanced	19			
	<hr/>	58	=	1.9
Tuberculosis only—				
Previously reported as Normals, etc.	25			
	<hr/>	25	=	.8
Total number of men examined		3,012	=	100.0

		<i>Seventh Examination (1932).</i>		per cent.
Normals, etc.	3,835			
	<hr/>	3,835	=	89.5
Silicosis Early—				
Previously reported as Normals, etc.	35			
Previously reported as Silicosis Early	338			
	<hr/>	373	=	8.7
Silicosis Advanced—				
Previously reported as Silicosis Early	6			
Previously reported as Silicosis Advanced	47			
	<hr/>	53	=	1.2
Silicosis plus Tuberculosis—				
Previously reported as Normals, etc.	3			
Previously reported as Silicosis Early	9			
Previously reported as Silicosis Advanced	4			
	<hr/>	16	=	.4
Tuberculosis only—				
Previously reported as Normals, etc.	8			
	<hr/>	8	=	.2
Total number of men examined		4,285	=	100.0

		<i>Eighth Examination (1933).</i>		per cent.
Normals, etc.	2,920			
	<hr/>	2,920	=	86.5
Silicosis Early—				
Previously reported as Normals, etc.	57			
Previously reported as Silicosis Early	322			
	<hr/>	379	=	11.2
Silicosis Advanced—				
Previously reported as Normals, etc.	1			
Previously reported as Silicosis Early	15			
Previously reported as Silicosis Advanced	44			
	<hr/>	60	=	1.8
Silicosis plus Tuberculosis—				
Previously reported as Normals, etc.	2			
Previously reported as Silicosis Early	9			
Previously reported as Silicosis Advanced	4			
	<hr/>	15	=	.4
Tuberculosis only—				
Previously reported as Normals, etc.	3			
	<hr/>	3	=	.1
Total number of men examined		3,377	=	100.0

		<i>Ninth Examination (1934).</i>		per cent.
Normals, etc.	5,140			
	<hr/>	5,140	=	92.4
Silicosis Early—				
Previously reported as Normals, etc.	54			
Previously reported as Silicosis Early	315			
	<hr/>	369	=	6.6
Silicosis Advanced—				
Previously reported as Normals, etc.	1			
Previously reported as Silicosis Early	24			
Previously reported as Silicosis Advanced	12			
	<hr/>	37	=	.7
Silicosis plus Tuberculosis—				
Previously reported as Normals, etc.	6			
Previously reported as Silicosis Advanced	6			
	<hr/>	12	=	.2
Tuberculosis only—				
Previously reported as Normals, etc.	5			
	<hr/>	5	=	.1
Total number of men examined		5,563	=	100.0

Tenth Examination (1935).

		per cent.
Normals, etc.	4,437	4,437 = 92.3
Silicosis Early—		
Previously reported as Normals, etc.	35	
Previously reported as Silicosis Early	303	
	338	338 = 7.0
Silicosis Advanced—		
Previously reported as Silicosis Early	24	
Previously reported as Silicosis Advanced	2	
	26	26 = .6
Silicosis plus Tuberculosis—		
Previously reported as Silicosis Early	5	5 = .1
Tuberculosis only—		
Previously reported as Normals, etc.	2	2 = .0
Total number of men examined	4,808	4,808 = 100.0

Eleventh Examination (1936).

		per cent.
Normals, etc.	6,972	6,972 = 94.7
Silicosis Early—		
Previously reported as Normals, etc.	29	
Previously reported as Silicosis Early	323	
	352	352 = 4.8
<i>(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.)</i>		
Silicosis Advanced—		
Previously reported as Normals, etc.	1	
Previously reported as Silicosis Early	15	
Previously reported as Silicosis Advanced	4	
	20	20 = .3
Silicosis plus Tuberculosis—		
Previously reported as Normals, etc.	3	
Previously reported as Silicosis Early	8	
	11	11 = .1
Tuberculosis only	8	8 = .1
Total number of men examined	7,363	7,363 = 100.0

Men employed in the outlying districts were not examined during 1929 or 1931, only those employed in Kalgoorlie and surrounding district 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.

In the East Murchison Field there was an increase of 7,626 fine ounces.

In the Black Range District there was a considerable improvement in output.

Returns were reported from Barrambie, Birri-grin, Curran's Find, Errolls, Hancocks, Jonesville, where the "Swan Bitter" and "North End" mines both had good outputs, Maninga Marley, Montagu, Nungarra, Sandstone, where large amounts of diamond drilling and development work were carried out by Atlas Gold Mines, Ltd., and Black Range Gold Mines, Ltd., on reservations held by them, and Youanmi, where the Youanmi Gold Mines, Ltd., commenced treatment in November and is continuing the erection of the second section of its plant. Although this mine was the only producer, a body of ore being opened up on a prospecting area about two (2) miles north of the township is stated to give promise of developing into a payable mine.

In the Lawlers District there was a decrease.

The most marked activity in this district was at Ogilvies, where the Emu Gold Mines, Ltd. has been carrying out an extensive developmental policy on the Waroonga group of leases and production should soon begin.

Crushings were reported from Kathleen Valley, Mount Sir Samuel and Lawlers, where a 5-head mill was erected and employed almost continuously during the latter months of the year.

In the Wiluna District there was an increase.

The Wiluna Gold Mines, Ltd. was actively developing and producing, also the Moonlight Wiluna Gold Mines, Ltd. On the Starlight Mine a considerable amount of diamond drilling and surface prospecting was carried out.

Returns were reported from the outside centres of Cole's Find, Corboy's Find, Diorite, Joyner's Find, Kingston, Mt. Keith, Mt. Eureka, Mt. Fisher, Moiler's Find, New England and Waldeck's Find. At most of these centres a good many prospectors were operating.

The Murchison Field had an increase of 23,397 fine ounces.

In the Meekatharra District there was a decrease attributable to lessened outputs from the mines in the Meekatharra centre, where, however, several properties were steadily working and the State Bat-

tery was running continuously. Outputs were reported from the outside centres of Abbots, where several prospectors were working, Bourke's Find, Burnakura, Chesterfield, Gabanintha, where there was a good deal of activity, Garden Gully, Gum Creek, Jilawarra, Munarra Gully, Mount Maitland, Nannine, where considerable development work was in progress and a good number of men employed, also some good returns were reported, Quinns, where there was much activity, Ruby Well, Wanganui, and Yaloginda, where a good many prospectors were engaged. No new finds of any note were reported.

In the Cue District there was an increase, attributable to the output by the Triton Gold Mines, N.L., at Reedy, which has become one of the leading producers of the State. In addition to the Cue centre, outputs were reported from the outside centres of Behring Pool, Cuddingwarra, Culleulli, Oliver's Patch, Reedy, Tuckabianna, Tuckanarra and Weld Range.

At Big Bell, the Big Bell Mines, Limited, a subsidiary of the Premier Gold Mining Company, has been actively developing and erecting plant, and it is anticipated that production on a large scale will eventuate soon. A railway line from Cue to the mine was completed by the Government in December.

In the Day Dawn District there was an increase.

Nothing has yet been announced as to the intentions of the Western Mining Corporation in regard to re-opening the old Great Fingal Mine and which it is understood would mean huge capital expenditure. In addition to the Day Dawn centre, productions were reported from Lake Austin, where operations were active, Mainland, which was very quiet, only one crushing being reported, Pinnacles and Webbs Patch, at each of which only a few prospectors were engaged.

In the Mount Magnet District there was an increase. This is attributable to increased outputs from mines in the vicinity of Mount Magnet and developments on some of them, together with projected increases in treatment plant capacity, justifying the conclusion that there will be a further increase. The Mount Magnet Gold Mines had a successful year and employed a large number of men.

The Hill 50 G.M. Co., N.L., commenced treatment in September, but the output has been retarded owing to difficulties with the power and treatment plants. Several other companies are also operating at Magnet and Boogardie, where mining is brisk. Crushings were reported from the outside centres of Lennonville, where matters were rather quiet, Moyagee, where only a few prospectors were working, and Paynesville, where also only a small amount of work was going on.

The Peak Hill Goldfield had an increase of 370 fine ounces.

In the immediate vicinity of Peak Hill there was a good deal of activity and the State Battery was fairly busy.

A company was engaged on the treatment of the old extensive sand dumps. Productions were reported from the outlying centres of Heines Find, where a battery had been erected, but developments were not encouraging, and this centre is now abandoned; Horseshoe, Mt. Egerton, where a small mill

has been erected and is operating, the owner apparently doing well, Mt. Padbury, Mt. Seabrook, Murphy's Well and Wilthorpe.

Nothing was reported from Jimble Bar, where only intermittent work was done, and this centre is apparently moribund.

The Yalgoo Field had a decrease of 886 fine ounces. In the immediate vicinity of Yalgoo only a few prospectors were operating and a very small output was recorded. Returns were reported from Bilberatha, Carlaminda, Field's Find, Goodingnow, where mining was active, Gullewa, where also there was considerable activity and the erection of a treatment plant by King Solomon's Mines was completed, and also on the Mugga King, Kirkalucka, Messenger's Patch, Noongal, Ninghan, Pinyalling, Retaliation, Rothsay, where the Rothsay Gold Mines, Ltd., temporarily suspended major operations and confined work to the treatment of tailings, but it is understood that the erection of a modern treatment plant will be commenced at an early date, Warda Warra, where the Western Queen Gold Mines began crushing in June, but shut down the mill in September, and it is understood that plant will be removed and the mine abandoned, Warriedar and Yuin.

No new discoveries were reported.

The Mount Margaret Field had an increase of 30,560 fine ounces.

In the Mount Margaret District the principal producer was the Lancefield Mine, which treated a large tonnage.

The Western Mining Corporation exercised its option over the main lease at Cox's Find, and forthwith erected plant and commenced production. The King of Creation Mine, now held by a strong company, had a small production, but alterations to the plant are being carried out and a large number of men is employed.

At Burtville there was a marked decrease in prospecting activities, and in the Mt. Ida locality matters were quiet. From Euro a small production was reported. Work is proceeding steadily in opening up the old Augusta Mine at Laverton, and it is expected that before long it will again enter the list of producers.

In the Mount Morgans District there was not much of note at Morgans, where the Westralia Renown Mines, which had taken over the old mine and also the Mt. Margaret Leases, were treating sands at the old mine and crushing the ore from the Mount Margaret Leases.

At Murrin Murrin the Mosstrooper Lease was working and producing and also crushing for prospectors. The Hill End Lease had a good output and the owners contemplate the erection of a small plant. Productions were also reported from Eucalyptus, Redcastle, Yundamindera and Linden, at each of which prospecting is very active.

In the Mount Malcolm District the principal producer was, as hitherto, the Sons of Gwalia Mine, which, excepting for one small stoppage, was working throughout the year.

In the early part of the year a good deal of interest centred in the old Tower Hill Leases, which were under option, but efforts to raise capital for

their development were not successful, and the leases were surrendered. On the old Harbour Lights Mine testing was carried out, but it is understood the results were not encouraging.

Returns were reported from the outlying centres Cardinia, Diorite King, Dodgers Well, Lake Darlot, Malcolm, Mertondale, Mount Clifford, Pig Well, Randwick, Webster's Find and Wilson's Patch. No development of note was reported.

The Coolgardie Field had an increase of 58 fine ounces.

At Coolgardie active development work was carried out by Phoenix Gold Mines, Limited, at Bayleys and by Consolidated Gold Mines of Coolgardie, Limited, at Tindals. It is hoped that both will soon enter the list of producers. Many prospectors were working at the centre and a large number of returns recorded. From Bonnievale a few crushings were reported, the largest being from tributaries on the Melva Maie Mine. From Burbanks several crushings were reported. Returns were also recorded from Bulla Bulling, Cave Rocks, Coondarrie, Emu Well, Eundynie, Gnarlbine, Grosmont, Gibraltar, Higginsville, which crushed the largest tonnage for all centres and where a 5-head mill was erected, on the Sons of Erin Mine, Hampton Plains, Kurrawang, Larkinville, Logans Londonderry, Love's Find, Nepean, Paris Group, Widgiemooltha, Red Hill, Ryan's Find, and Wannaway. At Sparrowville the property held by Spargo's Reward Gold Mines was under option to another company, but the option was not exercised.

At St. Ives there was only a small production and no developments of note.

In the Kunanalling District there was much activity and an improved output. Returns were recorded from Carbine, Chadwin, Dunnsville, Hawkin's Find, Jourdie Hills, Kintore, Kunanalling, London Group and Zuleika.

The Gold Fields Australian Development Co., Ltd., completed the purchase of Gorman's Find, near Kintore, after doing considerable development work. It is anticipated that the erection of plant will follow.

The North Coolgardie Field had an increase of 11,389 fine ounces.

In the Menzies District there was considerable prospecting activity and many payable outputs reported. The Lady Shenton commenced crushing and the Lady Harriet battery was doing public crushing throughout the year. At Yunndaga a considerable amount of prospecting was in evidence. At Comet Vale the Sand Queen-Gladsome, the principal mine, commenced production. At Mt. Ida there was a good deal of activity and many prospectors were in the locality. Some of the shows give much promise.

In the Ularring District the greater portion of the output was from the retreatment of sands. Plants for this purpose were in operation at Davyhurst, Mulwarrie, and Mulline. At the latter centre a number of prospectors operated with varying success. Nothing outstanding was reported.

At Riverina work was actively pursued on the property of the Riverina Gold Mines and production is expected to commence shortly.

In the Yerilla District the Paget Gold Mine at Edjudina continued development, and a large treatment plant was being erected.

At Porphyry the Edjudina G.M. Co. commenced crushing and produced a good deal of gold. Returns were also reported from Patricia, Pinjin, Yilgangi, where the Yilgangi Queen again recorded an excellent output, and Yarri.

Yerilla continued to be very quiet, and nothing of note was reported.

In the Niagara District a good many prospectors were working in the Kookynie centre, where also the Western Mining Corporation continued operations and production.

Returns were also reported from Desdemona, Niagara and Tampa. At the latter centre a fair number of assisted prospectors are located and some excellent crushings were obtained from a lease called the Tranquil Toiler.

The North-East Coolgardie Goldfield had a decrease of two (2) fine ounces. The greater portion of the yield was the result of the treatment of sands. Most centres had nothing of note to report.

At Gindalbie and Binti Binti a few prospectors were operating and small outputs were reported.

In the Kurnalpi District matters remained very quiet and only a small production was reported.

The Broad Arrow Field had an increase of 5,945 fine ounces.

At Broad Arrow the Golden Arrow battery was continuously engaged in crushing for the public. The Broad Arrow Consols had a good output. From the Trump Lease a rich discovery was announced and the owners had an excellent crushing. Many prospectors were at work in this centre and mostly with payable results.

At Bardoc it is proposed to erect, with Government assistance, a plant on the Zoroastrian Mine from which a small output was reported. A good return was also got from Prospecting Area No. 2765 W. At Black Flag Parker's Battery crushed continuously for the public.

At Ora Banda a considerable number of men were employed. Many outputs were recorded and the State Battery was running continuously. The Ora Banda United Mines carried out a large developmental policy and report having a large tonnage developed. The Associated Northern Ora Banda, N.L., continued the treatment of tailings. At Grant's Patch the principal producer was Ora Banda Amalgamated Mines, N.L., which reported a large output. Returns were also recorded from Paddington, Riche's Find, Waverley and Carnage. Other centres did not report anything of note.

In the East Coolgardie Field the number of men engaged in mining was 4,066, and in 1935 3,565; an increase of 501. This goldfield gave employment to over 25 per cent. of the number of men engaged in gold mining and the reported production for the year was 398,531 fine ounces, over 46 per cent. of the total reported yield. The tonnage treated was 1,081,577 tons, being 180,741 tons greater than in 1935.

The average grade per ton of the ore treated rose from 28.95 shillings in 1935 to 31.26 shillings in

1936. The Lake View and Star, Limited, was again the chief producer. Considerable development work was carried on with very satisfactory results and this company employs an average of over 1,200 men. The Great Boulder showed an increased production and further extensions to its plant are in hand. Its future appears to be very bright. The Great Boulder Perseverance had an increased production, as also had the North Kalgurli. Operations on the South Kalgurli were maintained with satisfactory results and its output was in excess of the previous year. Retreatment of sands by the Golden Horseshoe (New), Limited, continued throughout the year. On the North Kalgurli United considerable development work was carried out but only a small output was reported. The Paringa Mine had an improved output and developments were satisfactory. The erection of a new treatment plant is in hand. The Australia East, Oroya, Blue Gap and Iron Duke Leases, controlled by the Gold Mines of Kalgoorlie, Ltd., were being actively developed and reported a good output. The Old Bank of England, worked by the North Boulder Gold Mines, N.L., had a new development and recorded some good returns.

The Enterprise and Paringa Extended were both working and producing. At the North End of the field boring operations were carried out on the Mt. Charlotte and Hannan's Reward Leases with, it is understood, satisfactory results. The Hannans North, owned by the Broken Hill Proprietary Co., Ltd., was actively working and had a good production. At Hampton Plains the Celebration Mine commenced producing and returns were also forthcoming from the New Hope. Quite a number of prospectors are at work in the locality.

At Golden Ridge and Binduli only a few men were at work.

At Mount Monger there was considerable activity and many rich crushings were reported. During the year a public crushing plant was erected with assistance from the Government, and is now operating. In the Bulong district there were several prospectors and many crushings were obtained. No outstanding discovery was reported.

The Kalgoorlie State Battery, to which a further five (5) head was added, making twenty (20) in all, was running continuously during the year.

The Yilgarn Field had an increase of 21,041 fine ounces.

In gold won and tonnage treated the figures for the year were the largest since 1919. At Bullfinch there was an increased production and mining was active. At Corinthia there was also an increase and a slight advance in the number of men employed.

At Eenuin there was little change. At Golden Valley there were several good crushings. Most of the mines at this centre are looking well and prospects are very bright. The leading producers were the "Radio" and "Radio Deeps."

At Greenmount the only production was from the "Transvaal North." On the old "Transvaal" Mine, now held by the Jupiter Gold Mines, Ltd., some plant was erected and it is stated a new lode was discovered. The future policy of the Company is now under consideration.

At Holleton the principal producer was the "Holleton." There was a decrease at this centre and the "North End" and "North End Extended" did no crushing, partly owing to the abnormally dry season which caused a severe water shortage. The number of men employed was slightly less than in the previous year. From Hope's Hill there were several crushings and an increased output. The principal producer was the "Pilot" Mine. From Kennyville there were also several crushings and the output was in excess of the previous year.

At Koolyanobbing there were a few crushings but decreases in both production and men employed.

At Marvel Loch there was a substantial increase in production and considerable activity was evident. The chief production was by the Marvel Loch Gold Development, No Liability. The Great Victoria United at Burbidge has merged with this company and its plant was removed to Marvel Loch. The "May Queen" also had a substantial output and is reported to be looking exceptionally well. The "Jacoletti" only treated a small tonnage and closed down. An effort is being made to sell the property. On the "Kurrajong" lease a 5-head mill was erected. At Edward's Find the returns continue to be satisfactory.

At Nevoria the leases formerly held by the B.A.N.Z. Mines, Ltd., were acquired by N.G.M., Ltd. This company has done a large amount of work and it is anticipated will erect a treatment plant to treat a large monthly tonnage.

The Yilgarn Gold Mine, N.L., had a small output and during the year reconstructed the new company being known as New Yilgarn Gold Mines, N.L. It is expected that there will now be steady production.

At Burbidge a group of leases were taken over by Prince George Gold Mines, Ltd., an English company with large capital. The property contains a large low-grade deposit and its future working will be watched with interest. At Mt. Jackson there were several crushings and increases in both production and men employed.

The main output was by Mt. Jackson Gold Mines, N.L., the returns from which are very rich. The ample crushing facilities at this centre have attracted many prospectors.

At Mt. Palmer the Yellowdine Gold Development, Ltd., completed the erection of crushing plant and commenced treatment in May, the output to the end of the year being approximately 13,000 ounces. Apart from this, there was only a small production from sundry claims.

From Mt. Rankin there was only a small output from one lease.

At Parker's Range there were a good many crushings and increases in production and men employed. Several additions to existing treatment plants were also made.

At Southern Cross there were increases in the output and the number of men employed. The Southern Cross United Mines continued active operations, and it is understood important developments took place. The erection of a 20-head battery is now proceeding, and should be in operation about the middle of the year. Yellowdine Gold Options, No Liability, com-

menced crushing in July and did some for the public. The 5-head mill on the Queen Ann Lease was in operation throughout the year.

In the Westonia District there was a decrease in output, but slight increase in the number of men employed. The Edna May (W.A.) Amalgamated Gold Mines, No Liability, continued unwatering and development work, but no announcement has been made as to when crushing will commence. There were outputs from sundry leases, prospecting areas and claims.

From Yellowdine only one crushing was reported, and there is no activity at this centre.

The Dundas field had an increase of 12,122 fine ounces. This is attributable to increased production by Norseman Gold Mines, No Liability, and the Central Norseman Gold Corporation, No Liability, having reached the production stage. Both these companies carried out extensive development programmes, and each employed a large number of men. The extension of the Goldfields Water Supply Scheme, which is approaching completion, to this field will be of great assistance to the industry. Returns were recorded from Buldania, Cumberland, Dundas, Lake Kirk, Norseman, Peninsular, Princess Royal, Red White and Blue, and Scotia. Throughout this field there was much activity, and a large number of assisted prospectors was operating.

The Phillips River field had a decrease of 3 fine ounces.

At Kundip work on the Beryl Mine was suspended, and operations concentrated on sinking a main shaft on the Gem Lease. No development of note was recorded. In the vicinity of Ravensthorpe a few leases reported crushings, and the treatment of some old accumulations of sands was being undertaken. At Hatter's Hill centre there was a marked falling off, but a crushing subsidy on all ore yielding less than 12 dwts. having been granted an improvement is anticipated, as several low grade shows can now be profitably worked.

Shortage of water, consequent on a greatly reduced rainfall, considerably hampered developments in this field.

The Pilbara Field had an increase of 3,378 fine ounces. This is the largest production for many years, and present indications are that it will be exceeded in the next year. In the Marble Bar District returns were reported from Bamboo Creek, Marble Bar, North Shaw, Shark's Gully, Talga, Tambourah, Twenty Ounce Gully, Western Shaw, Yandicoogina, and a promising find about twenty-five (25) miles south of Marble Bar. At Marble Bar there was noticeable activity, and early in the year a prospector located a deposit in virgin country about five (5) miles south of Marble Bar. It proved to be exceptionally rich, and the prospector and his mates within a few months broke over four hundred (400) tons of ore averaging over eight (8) ounces per ton. It is known as the "Halley's Comet" Mine, and has been acquired by Comet Gold Mines, Ltd., a strong English company, and is being equipped and developed. Developments so far indicate that the original optimistic opinions regarding the property will be justified. Naturally there is considerable prospecting activity in the locality, and satisfactory developments have been reported from other holdings.

At Bamboo Creek production was retarded owing to shortage of water, but several properties were actively working and producing. At Lalla Rookh, although there was not any production, the re-opening of the old "Lalla Rookh" Mine by Lalla Rookh Gold Mines, Ltd., an English company, gives promise of a great improvement shortly. Plant is being erected, and many men are employed.

At Yandicoogina the crushing plant erected on the "Uncle Tom" treated several parcels.

At Tambourah a Huntington mill was erected, and there was a small production, but operations were retarded through shortage of water.

In the Nullagine District returns were reported from Eastern Creek, Middle Creek, Mosquito Creek, Nullagine, Elsie and McPhee's Creek. At Mosquito Creek the treatment plant which was erected with financial assistance from the Government has been of great help to local prospectors.

The abnormally dry weather throughout the year has been a great handicap to this field.

The Ashburton Goldfield recorded an output of 309 fine ounces, being an increase of 177 fine ounces. Only a small amount of prospecting is being done on this field. Not any production was reported from the Gascoyne Goldfield. The Kimberley Goldfield had an output of 323 fine ounces, a decrease of 67 fine ounces. The investigations into the possibilities of some of the old mines on this field, on behalf of English investors, did not result in anything tangible. The erection of a crushing plant, with Government assistance, is now proceeding, and it is hoped will help the prospectors considerably and advance the industry in this remote part of the State. From districts outside the proclaimed goldfields, productions were reported from West Pilbara, Burracoppin, Little Wongan and Toodyay.

TIN.

The quantity of tin reported was 50 tons, valued at £6,882—a decrease in tonnage of 10 tons and in value of £1,947. The production reported was 5 tons, valued at £677, from the Pilbara Goldfield, and 22 tons, valued at £2,784, from the Greenbushes Mineral Field. The average number of men employed in the Greenbushes Field was 40, being 10 less than in the previous year.

During the year the Government carried out a programme of boring in the hope of locating payable deep alluvial, but the results were discouraging. Details are given in the report of the Government Geologist. Towards the close of the year there was noticeable increased activity in the field, and if the price of tin remains satisfactory, the outlook is promising.

TANTALITE.

Fourteen (14) tons valued at £8,812, were exported, an increase in tonnage of six (6) tons and in value of £4,032.

The reported production was fourteen (14) tons from the Pilbara Field.

COPPER.

Two (2) tons, valued at £97, were exported, but not any production was reported.

LEAD.

No lead was exported, but the production of 1,535 tons, valued at £2,228, was reported from the Northampton Field. In this field there was a pronounced revival. Several leases and prospecting areas were taken up and a treatment plant erected. A large number of men is employed and the prospects are brighter than for many years.

COAL.

The output of coal was 565,075 tons, being 27,887 tons more than in 1935. The whole production was from the Collie field, where five (5) mines were operating. The number of men employed, 768, was 79 more than in the preceding year, and the output per man was in 1935, 780 tons, and in 1936, 736 tons.

OIL.

The following companies had experts in the field on various oil areas during the year:—

Wooramel Oil Co. (1936), N.L.
 Freney Kimberley Oil Co. (1932), N.L.
 Oil Search, Ltd.

The reports furnished all recommended additional work and expenditure. During the year a Petroleum Act was passed, comprising modern legislation governing petroleum prospecting. It will come into operation on a date which will shortly be proclaimed.

ASBESTOS.

The reported production was 159 tons, valued at £3,479—an increase in tonnage of 18 tons, and decrease in value of £590, all from the West Pilbara District.

OTHER MINERALS.

The quantity of silver obtained as a by-product and exported was 105,219 ounces, valued at £11,773—an increase of 25,340 ounces, but decrease in value of £914. Felspar, 3,048 tons, valued at £9,170 (reported production 2,840 tons, valued at £5,680) and 4 tons of fireclay, valued at £15.

The production of 3,470 tons of arsenic, valued at £62,460, 219 tons of glauconite, valued at £1,095, and 6,661 tons of gypsum, valued at £7,569, was also reported.

It is expected that soon there will be a large output of iron ore, an English company being now vigorously developing the deposits at Yampi Sound.

MINING GENERALLY.

The West Australian gold production was 49.146 per cent. of the total for Australasia and Mandated Territory of New Guinea, and in the preceding year 47.115 per cent. The only base metals produced were lead, tin and tantalite.

In gold mining marked activity was maintained and as anticipated the production showed a substantial increase on the previous year, the output for which, however, was affected by a labour dispute which caused the closing down of some large producers for a few weeks. The production was the highest since 1918 and reflects the increased outputs from several of the larger mines and the

results of the coming into operation of many new mills. As several large companies have not yet reached the producing stage, and others are increasing their mill capacity, it seems safe to assume that next year will again record a substantial increase. The Government is alive to the great value of the industry and all possible assistance and encouragement are extended. The State scheme for assisting prospectors was continued and the total number of men helped since inception to the end of 1936 was 2,850. At the end of the year 160 men were in receipt of full assistance, including ration orders, while 194 men held prospecting tools only, on loan.

At that date the cost to the Department since inception totalled £89,942, while refunds from successful prospectors amounted to £15,395. The year's refunds were £3,169. Reported production by prospectors whilst on the scheme was 9,684 fine ounces and after going off the scheme, 5,051 fine ounces. Operations under the Commonwealth Metalliferous Fund were continued very satisfactorily and the expenditure totalled £56,453 17s. 9d. This was divided under four headings:—

	£	s.	d.
1. Staff	1,211	1	2
2. Prospecting	27,478	18	3
3. Batteries, etc.	26,581	17	11
4. Education of Miners	1,182	0	5

Under (1) the services of two geologists have been continued and much valuable work accomplished.

(2) To the end of the year 2,262 prospectors had received full assistance by way of rations and loan of tools and 65 had been granted the loan of tools only, and 18 rail fares only. At the close of the year 424 were in receipt of full assistance. Reported production was 4,908 fine ounces and refunds totalled £6,747 16s. 9d.

(3) This item was mainly assistance to provide treatment facilities in various parts of the State.

(4) This item was utilised in the extension of facilities at the Government Chemical Laboratory and the Schools of Mines at Kalgoorlie and Wiluna.

The area held under prospecting areas for gold and minerals, apart from coal, was 40,452 acres, and in the previous year 59,702 acres.

AERIAL, GEOLOGICAL, AND GEOPHYSICAL SURVEY OF NORTHERN AUSTRALIA.

The work of the survey in Western Australia has directed attention to the possibilities of exploitation of parts of the Pilbara Goldfield. During 1936 the Lalla Rookh Mine started operations as a result of the report of the survey for 1935; this mine is now employing 40 men.

In addition, special attention has been drawn to the possibilities of other localities such as Halley's Comet area, which Comet Gold Mines, Limited, is now working successfully.

The survey suggests as a result of its work during 1936 that other centres in the Pilbara Goldfield suitable for exploitation by prospectors and small working parties are Station Peak, Yandicoogina, Tambourah, North Shaw, Sharks, Apex-Salgash, Eastern Creek, Middle Creek, Twenty Mile Creek, Mosquito Creek, and Blue Spec-Billjim.

A reconnaissance of the Kimberley (Hall's Creek District) suggests that the portion of the goldfield embracing Ruby Creek, Mount Bradley, and Brockman areas, could be brought into production. Further work will be done in these centres early in 1937.

The proposed work of the survey during 1937 includes aerial photography in the following districts:—In the West Pilbarra District near Onslow, in the Pilbara District between Shark's and North Shaw, in the West Kimberley District in the vicinity of Mt. Broome and Yampi Sound, and in the Kimberley District in the vicinity of Mt. Dockerell.

Geological work will be carried out in the following localities:—

Kimberley District—Hall's Creek, Ruby Creek, Brockman's, Grant's Creek (The Panton), and Mt. Dockerell.

West Kimberley District—Mt. Broome, Richenda River.

Jimble Bar District—Coobina, Jimble Bar.

Pilbara District—Halley's Comet, Shark's-North Shaw, Braeside, Weerianna, Nichol Bay, Toweranna,

Pilbara, Hong Kong, Croydon, Wodgina, Mallina, Egina, and Whim Creek.

Ashburton-Gascoyne District—Top Camp, Soldier's Secret, Mt. Mortimer, Dead Finish, Bangemall, Uaroo, Weston's.

Geophysical investigations will be carried out in the following localities:—

Pilbara District—Bamboo Creek, Barton-Hopetoun line, and Braeside.

Jimble Bar District—Jimble Bar.

Ashburton-Gascoyne District—Uaroo.

It is also proposed to carry out some geophysical work in the central goldfields, probably at the Big Bell Mine, Cue; Wiluna Gold Mines, Wiluna; Lancefield Gold Mine, Beria; and the Cosmopolitan Gold Mine at Kookynie.

The expenditure incurred in rendering assistance to mine owners and the industry generally under the provisions of the Mining Development Act totalled £13,956 11s. 3d., and in the preceding year £44,791 6s. 5d.

PART II.—MINERALS.

TABLE 1.

Quantity and Value of Minerals produced and/or exported during Years 1935 and 1936.

Description of Minerals.	1935.		1936.		Increase or Decrease for Year compared with 1935.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
1. Arsenic (reported), statute tons	3,728	£ 67,108	3,470	£ 62,460	— 258	— 4,648
2. Asbestos (reported), statute tons	141	2,889	159	3,479	+ 18	+ 590
3. Copper (exported), statute tons ... ..	...	...	2	97	+ 2	+ 97
4. Coal (raised), statute tons	537,188	318,013	565,075	331,565	+ 27,887	+ 13,552
5. Felspar (exported), statute tons	2,660	7,928	3,048	9,170	+ 388	+ 1,242
6. Fireclay (exported), statute tons ... ..	...	...	4	15	+ 4	+ 15
7. Glauconite (reported), statute tons	308	1,540	219	1,095	— 89	— 445
8. Gold (exported and minted), fine ozs.	649,049	*2,756,984	846,208	*3,594,460	+197,159	+837,476
9. Gypsum (reported), statute tons	5,461	6,888	6,661	7,569	+ 1,200	+ 681
10. Lead Ore (raised), statute tons ... ..	...	...	1,535	2,228	+ 1,535	+ 2,228
11. Silver (exported), fine ozs.	79,879	12,687	105,219	11,773	+ 25,340	— 914
12. Tantalite (exported), statute tons	8	4,780	14	8,812	+ 6	+ 4,032
13. Tin (exported), statute tons	60	8,829	50	6,882	— 10	— 1,947
...	...	3,187,646	...	4,039,605	...	+851,959

* The value of fine gold is computed at £4 4s. 11.45d. per ounce; in addition the estimated premiums received by producers amounted to £A3,779,079 for 1936, as compared with £A2,945,165 for 1935.

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	19,219,146	6,793,831	35·35
Total since 1902 ...	433,315,841	166,984,743	38·54

Exclusive of Arsenic prior to 1935.

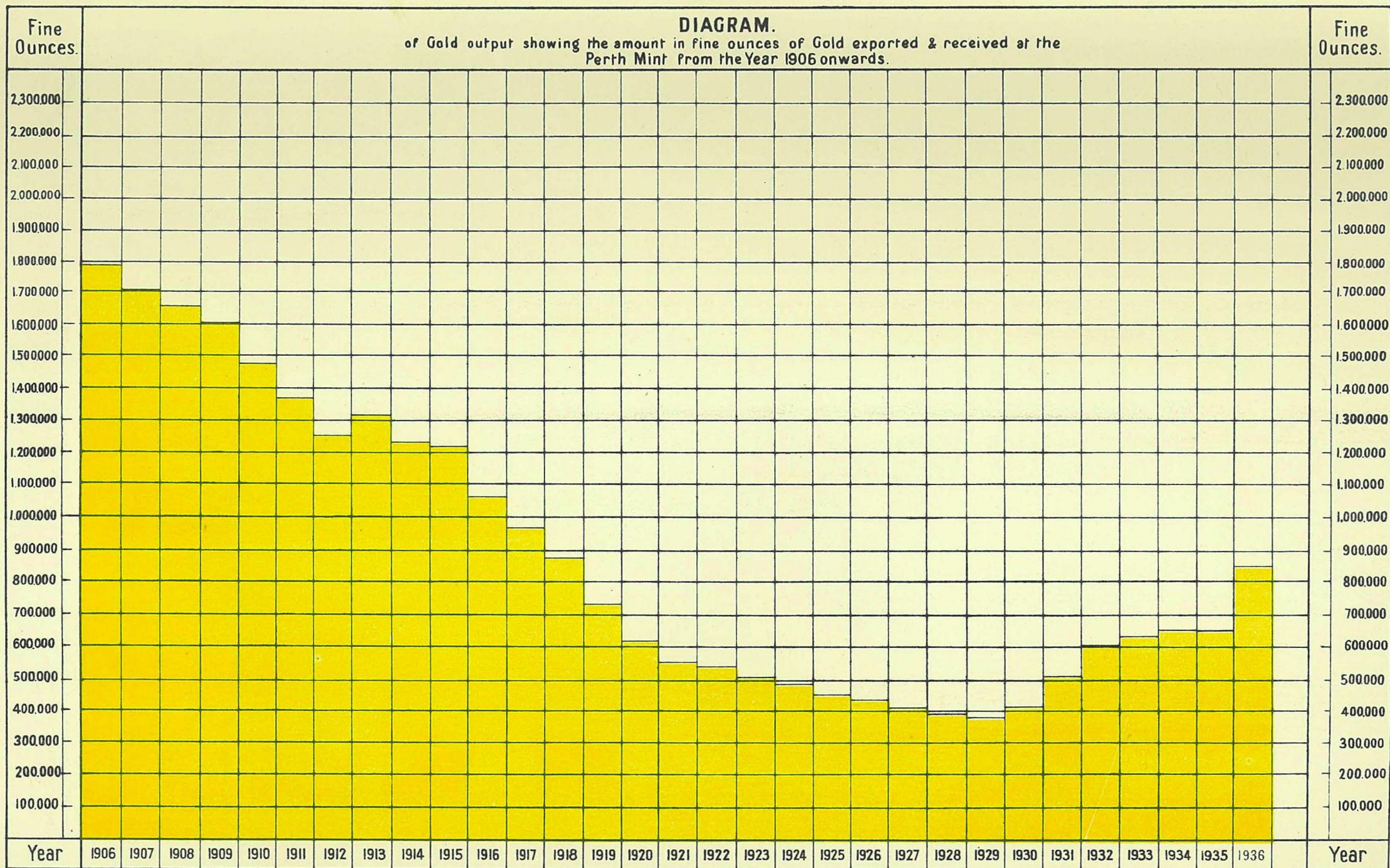
TABLE 3.

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

Goldfield.	Reported Yield.		Percentage for each Goldfield. °		Average Value per ton of Ore Treated. (Gold at £4 4s. 11·45d. per fine oz.).	
	1935.	1936.	1935.	1936.	1935.	1936.
	fine ozs.	fine ozs.			shillings.	shillings.
1. Kimberley	390	323	·061	·038	...	87·84
2. Pilbara	6,413	9,791	·992	1·149	63·09	82·73
3. Ashburton	132	309	·020	·036	...	68·19
4. Gascoyne	25	...	·004	...	...	...
5. Peak Hill	1,738	2,108	·269	·247	19·81	22·77
6. East Murchison	120,160	127,786	18·596	14·991	20·60	18·24
7. Murchison	45,097	68,494	6·979	8·035	25·97	27·03
8. Yalgoo	7,694	6,808	1·191	·800	34·66	45·44
9. Mt. Margaret	64,943	95,503	10·051	11·204	31·15	31·36
10. North Coolgardie	11,014	22,403	1·704	2·628	61·77	38·78
11. Broad Arrow	13,637	19,582	2·111	2·297	50·14	49·18
12. North-East Coolgardie	2,167	2,165	·335	·254	60·64	47·85
13. East Coolgardie	306,949	398,531	47·504	46·753	28·95	31·26
14. Coolgardie	16,411	16,469	2·540	1·932	57·76	47·42
15. Yilgarn	28,492	49,533	4·410	5·811	58·14	37·62
16. Dundas	19,009	31,131	2·942	3·652	36·77	28·86
17. Phillips River	1,251	1,248	·194	·146	25·26	39·75
State generally	628	238	·097	·027	...	...
Totals and Averages	646,150	852,422	100·000	100·000	29·26	28·85

The total yield of 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.



Note:— Previous to 1906, Gold Produced, 14,871,687 Fine Ozs.
Peak Year 1903, Gold Produced, 2,064,801 . . .

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 1935 and 1936.

Goldfield.	1935.				1936.			
	Tons of Gold Ore raised and treated.		Fine ounces of Gold produced therefrom.		Tons of Gold Ore raised and treated.		Fine ounces of Gold produced therefrom.	
	Per man employed under ground.	Per man employed above and under ground.	Per man employed under ground.	Per man employed above and under ground.	Per man employed under ground.	Per man employed above and under ground.	Per man employed under ground.	Per man employed above and under ground.
	tons.	tons.	fine ozs.	fine ozs.	tons.	tons.	fine ozs.	fine. ozs.
1. Kimberley ... ..	...	...	...	...	...	...	...	...
2. Pilbara	54·31	30·95	37·20	21·20	66·01	38·53	68·47	39·96
3. Ashburton ... ..	...	...	...	...	...	...	...	...
4. Gascoyne ... ..	...	...	...	...	...	...	...	...
5. Peak Hill	276·03	122·18	62·95	27·86	176·69	95·14	50·19	27·03
6. East Murchison	470·60	259·04	113·83	62·60	515·99	281·07	111·02	60·48
7. Murchison	211·35	94·02	62·72	27·90	304·95	133·31	98·98	43·27
8. Yalgoo	83·45	35·92	33·85	14·57	73·43	30·46	39·35	16·33
9. Mt. Margaret	249·85	130·06	91·07	47·41	393·20	191·76	146·03	71·22
10. North Coolgardie	33·37	16·25	23·77	11·58	82·09	40·20	37·84	18·53
11. Broad Arrow	66·97	32·18	37·53	18·03	93·49	42·60	56·11	25·56
12. North-East Coolgardie	34·50	14·88	21·52	9·28	48·76	19·39	30·93	12·30
13. East Coolgardie	430·82	257·09	146·49	87·42	448·60	266·00	165·30	98·02
14. Coolgardie	37·20	16·96	24·50	11·17	40·11	18·25	23·43	10·66
15. Yilgarn	91·49	45·50	59·09	29·38	213·80	104·59	95·26	46·60
16. Dundas	128·05	70·73	55·36	30·58	182·11	106·76	61·89	36·28
17. Phillips River	25·45	12·88	15·07	7·63	40·30	20·62	18·91	9·67
Total Averages	259·74	133·37	87·88	45·26	307·39	158·77	105·15	54·31

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.

	Output of Gold.	Value.*	Percentage of Total.	
			Output of Commonwealth.	Output of Australasia
	Fine Ozs.	£		
1. Western Australia	846,208	3,594,460	54·339	49·146
2. Victoria	113,940	483,986	7·317	6·617
3. New South Wales	60,739	258,002	3·901	3·528
4. Queensland	121,174	514,714	7·781	7·037
5. Tasmania	17,600	74,760	1·130	1·022
6. South Australia	7,681	32,627	·493	·446
7. Papua	21,671	92,053	1·392	1·259
8. Northern Territory	7,583	32,211	·487	·440
9. Mandated Territory of New Guinea	360,669	1,532,024	23·160	20·947
10. New Zealand	164,575	699,070	...	9·558
	1,721,840	7,313,907	100·000	100·000

* Exclusive of Premium.

TABLE 6.

Dividends, etc., paid by Western Australian Mining Companies during 1936 and Total to date.
(Mainly compiled from information supplied to the Government Statistician's Office, by the Chamber of Mines of Western Australia.)

Goldfield.	Name of Company.	Bonuses and Profit Sharing Notes.	Capital returned.	Dividends.	
				1936.	Grand total paid to end of 1936.
		£	£	£	£
Peak Hill ...	Various Companies ...	...	...	...	160,666
East Murchison ...	Wiluna Gold Mines, Limited ...	...	...	233,333	1,206,666
Do. ...	Various Companies ...	...	...	...	437,968
Murchison ...	Triton ...	...	...	48,000	48,000
Do. ...	Various Companies ...	...	...	...	1,992,670
Mt. Margaret ...	Lancefield ...	...	...	100,000	100,000
Do. ...	Sons of Gwalia ...	...	...	97,500	1,469,738
Do. ...	Various Companies ...	...	...	...	376,213
North Coolgardie ...	do. do. ...	...	...	...	575,032
Broad Arrow ...	Ora Banda Amalgamated ...	...	...	10,000	10,000
North-East Coolgardie ...	Various Companies ...	...	...	...	89,854
East Coolgardie ...	Boulder Perseverance ...	(a) 23,129	...	26,214	1,698,144
Do. ...	Golden Horseshoe (New), Limited ...	...	(d) ...	27,500	137,500
Do. ...	Great Boulder Proprietary G.Ms., Limited ...	...	...	60,416	6,394,297
Do. ...	Lake View & Star, Limited ...	(b) ...	...	294,000	1,147,000
Do. ...	North Kalgurli (1912), Limited ...	...	...	68,750	212,500
Do. ...	South Kalgurli Consolidated, Limited ...	(c) ...	(e) ...	43,750	702,501
Do. ...	Various Companies ...	...	...	...	14,927,489
Coolgardie ...	do. do. ...	...	...	...	339,495
Yilgarn ...	Princess Royal G.M. Co. ...	...	...	9,375	22,475
Do. ...	Various Companies ...	...	...	...	517,899
Dundas ...	Norseman Gold Mines, No Liability ...	...	...	60,000	128,898
Do. ...	Various Companies ...	...	...	...	222,625
		£23,129	...	£1,078,838	£32,917,630

(a) In addition to £21,962 in 1935. (b) £42,000 in 1934. (c) £75,000 in 1932-5. (d) £55,000 in 1932.
(e) £93,750 in 1932-3.

TABLE 7.

Quantity and Value of Minerals, other than Gold, reported to the Mines Department during 1936.

Goldfield, District, or Mineral Field.	1936.		Increase or Decrease for Year as compared with 1935.	
	Quantity.	Value.	Quantity.	Value.
	tons.	£A	tons.	£A
BLACK TIN.				
Pilbara Goldfield (Marble Bar) ...	5	677	+ 4	+ 597
Greenbushes Mineral Field ...	22	2,784	+ 5	+ 424
ASBESTOS.				
State generally (West Pilbara) ...	159	3,479	+ 18	+ 590
GÝPSUM.				
Dundas Goldfield (Norseman) ...	...	...	- 706	- 177
Yilgarn Goldfield (Yellowdine) ...	455	455	- 32	- 32
State generally ...	6,206	7,114	+ 1,938	+ 890
FELSPAR.				
Coolgardie Goldfield (Coolgardie) ...	2,840	5,680	- 1,368	- 2,757
GLAUCONITE.				
State generally (Moora District) ...	219	1,095	- 89	- 445
TANTALITE.				
Pilbara Goldfield (Marble Bar District) ...	14	7,120	+ 7	+ 4,261
LEAD ORE.				
Northampton Mineral Field ...	1,535	2,228	+ 1,535	+ 2,228
ARSENIC.				
East Murchison Goldfield (Wiluna) ...	3,470	62,460	- 258	- 4,648

COMPARATIVE STATISTICAL DIAGRAMS

RELATING TO

OUTPUT AND VALUE OF GOLD AND OTHER MINERALS, LANDS LEASED FOR GOLD MINING IN WESTERN AUSTRALIA

AND THE GOLD PRODUCTION OF AUSTRALASIA FOR THE YEAR 1936

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

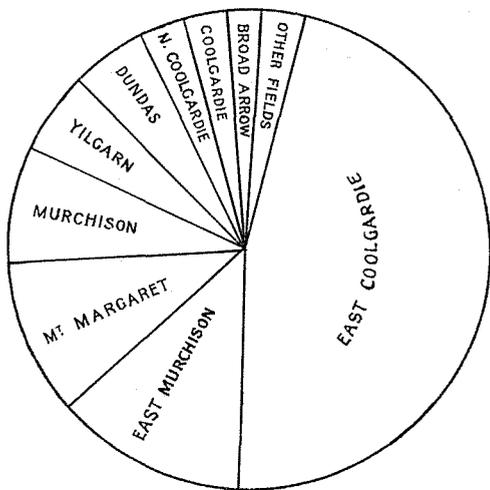


Fig. 2 Gold produced from various Goldfields as given by the Export and Mint Returns.

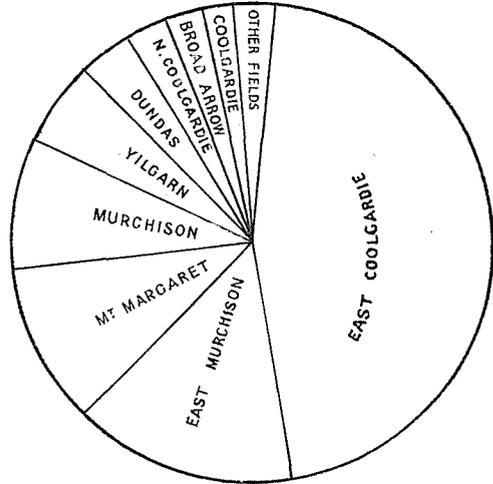


Fig. 3 Value of Gold and other Minerals.

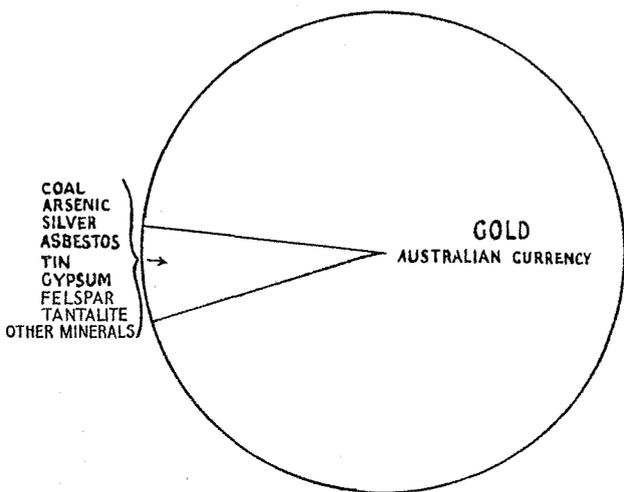


Fig. 4 Value of Minerals other than Gold.

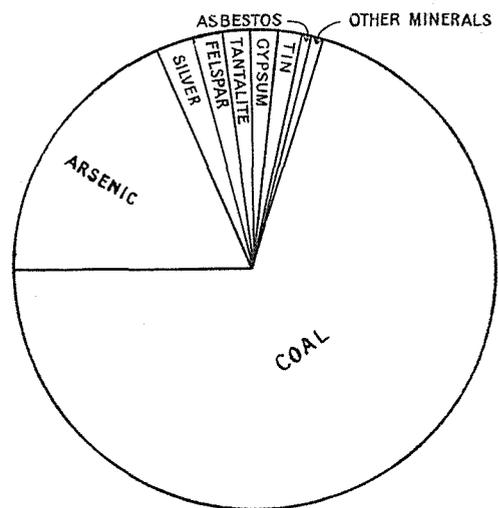


Fig. 5 Areas of Land leased for Goldmining on various Goldfields.

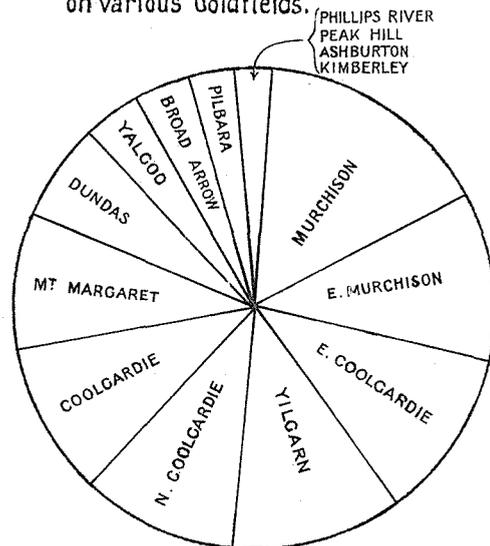
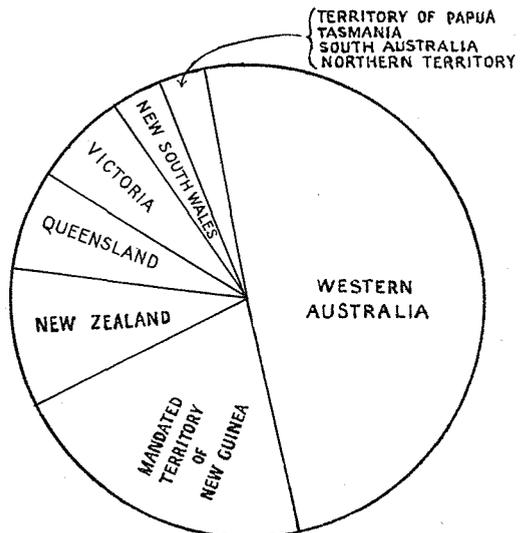


Fig. 6 Output of Gold in the States of Australia and the Dominion of New Zealand.



The averaged number of men reported to be employed showed an increase of 107, the number engaged in coal mining being given as 59 more than 1935. Twenty-five men were employed in the latter part of the year at the holdings at Yampi Sound. Owing to the altered method of treatment of Wiluna Gold Mines ore, a demand for lead ore was created, which is reflected in the increase of 22 men employed at Northampton and a reduction of 7 in the men on the recovery of arsenic at Wiluna, the refining plant having ceased operations at end of October.

Five more men were engaged in the production of tantalite, and one in raising felspar. Reduced numbers were recorded in winning tin (10), asbestos (4), and gypsum (4). Towards the close of the year a pronounced rise in the prices offering for all minerals resulted in inquiries for information regarding localities and holdings from which copper, tin, lead, and other minerals have been obtained in past years, and a decided increase in production seems probable during the year 1937.

TABLE 8.

Quantity of Coal raised during 1935 and 1936, 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	1935	537,188	318,013	146	543	989	780
	1936	565,075	331,565	166	602	939	736

The above figures indicate that the 1936 production and value exceeded 1935 by 27,887 tons and £13,552 respectively, whilst the average quantity of coal raised per man declined by 44 tons per man engaged. It may be assumed that a greater amount of exploratory and development work had been undertaken as the averaged number of men reported as being employed was 79 in excess of 1935.

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

TABLE 9.

Total Number and Acreage of Leases and Prospecting Areas held for Mining on 31st December, 1935 and 1936.

Description of Leases.	1935.		1936.	
	No.	Acreage.	No.	Acreage.
Gold Mining Leases on Crown Land	2,159	39,393	1,870	33,617
„ „ „ Private Property	21	462	20	456
Mining Leases on Crown Land	171	42,554	153	38,520
„ „ Private Property	4	100	5	112
Prospecting Areas	*3,108	62,702	† 2,013	46,452
	5,463	145,211	4,066	119,157

* Includes 1 Coal Prospecting Area of a total area of 3,000 acres. of a total area of 6,000 acres.

† Includes 2 Coal Prospecting Areas

The total number of leases held decreased by 302 and the area by 9,804 acres, as compared with the year 1935. The number of leases for Gold Mining decreased by 290 and the area by 5,782 acres.

The number of Mineral Leases decreased by 12 and the area by 4,022 acres.

The number of Prospecting Areas decreased by 1,095 and the area by 16,250 acres.

PART IV.—MEN EMPLOYED

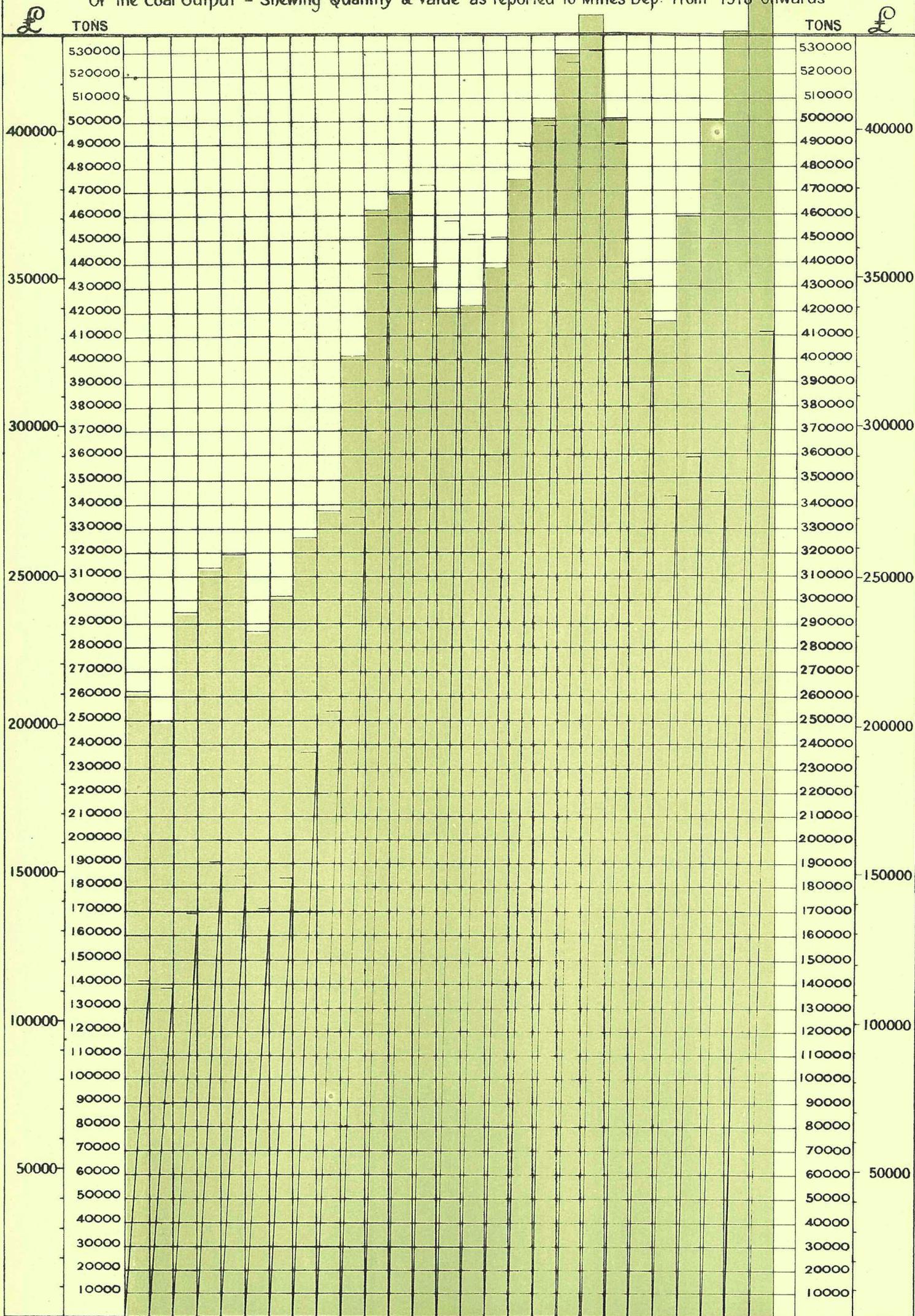
TABLE 10.

Average number of Men reported as engaged in Mining during 1935 and 1936.

Goldfield.	District.	Reef or Lode.		Alluvial.		Total.	
		1935.	1936.	1935.	1936.	1935.	1936.
1. Kimberley ... ..	... ..	13	3	5	6	18	9
2. Pilbara	Marble Bar	212	169	5	4	217	173
	Nullagine	67	71	...	1	67	72
3. Ashburton ... ..	... ..	3	7	3	3	6	10
4. Gascoyne ... ..	... ..	4	6	2	2	6	8
5. Peak Hill ... ..	... ..	61	78	...	...	61	78
6. East Murchison	Lawlers	151	172	...	...	151	172
	Wiluna	1,441	1,561	...	...	1,441	1,561
	Black Range	321	380	...	...	321	380
	Cue	535	571	38	26	573	597
7. Murchison	Meekatharra	430	423	...	...	430	423
	Day Dawn	147	88	10	17	157	105
	Mt. Magnet	457	453	...	5	457	458
8. Yalgoo ... ..	... ..	525	417	...	...	525	417
9. Mt. Margaret	Mt. Morgans	274	170	...	...	274	170
	Mt. Malcolm	484	494	13	11	497	505
	Mt. Margaret	604	666	...	...	604	666
	Menzies	409	596	14	15	423	611
10. North Coolgardie	Ularring	164	174	5	6	169	180
	Niagara	133	93	20	8	153	101
	Yerilla	226	311	4	6	230	317
11. Broad Arrow ... ..	... ..	718	740	24	26	742	766
12. North-East Coolgardie	Kanowna	146	117	9	7	155	124
	Kurnalpi	58	47	5	5	63	52
13. East Coolgardie	East Coolgardie	3,368	3,877	51	52	3,419	3,929
	Bulong	136	129	10	8	146	137
14. Coolgardie	Coolgardie	1,062	1,034	115	96	1,177	1,130
	Kunanalling	361	400	22	15	383	415
15. Yilgarn ... ..	... ..	915	1,040	53	23	968	1,063
16. Dundas ... ..	... ..	621	834	23	24	644	858
17. Phillips River ... ..	... ..	164	128	...	1	164	129
State generally ... ..	... ..	67	80	...	...	67	80
Total—Gold Mining		14,277	15,329	431	367	14,708	15,696
MINERALS OTHER THAN GOLD.							
Arsenic	Wiluna	27	20	...	...	27	20
Asbestos	Pilbara	7	4	...	...	...	...
	West Pilbara	7	6	...	...	14	10
Coal	Collie	689	768	...	...	689	768
Felspar	Coolgardie	9	10	...	...	9	10
Glauconite	Gingin	3	3	...	...	3	3
Gypsum	Yilgarn	4	2	...	...	...	...
	State generally	15	13	...	...	19	15
Iron Ore	Koolan ... ..	...	25	...	...	...	25
Lead Ore	Northampton	10	32	...	...	10	32
Tantalite	Pilbara	17	25	3	...	20	25
Tin	Greenbushes	50	40	...	...	...	...
	Pilbara ... ..	...	...	8	8	58	48
Total—Other Minerals		838	948	11	8	849	956
GRAND TOTAL		15,117	16,277	442	375	15,557	16,652

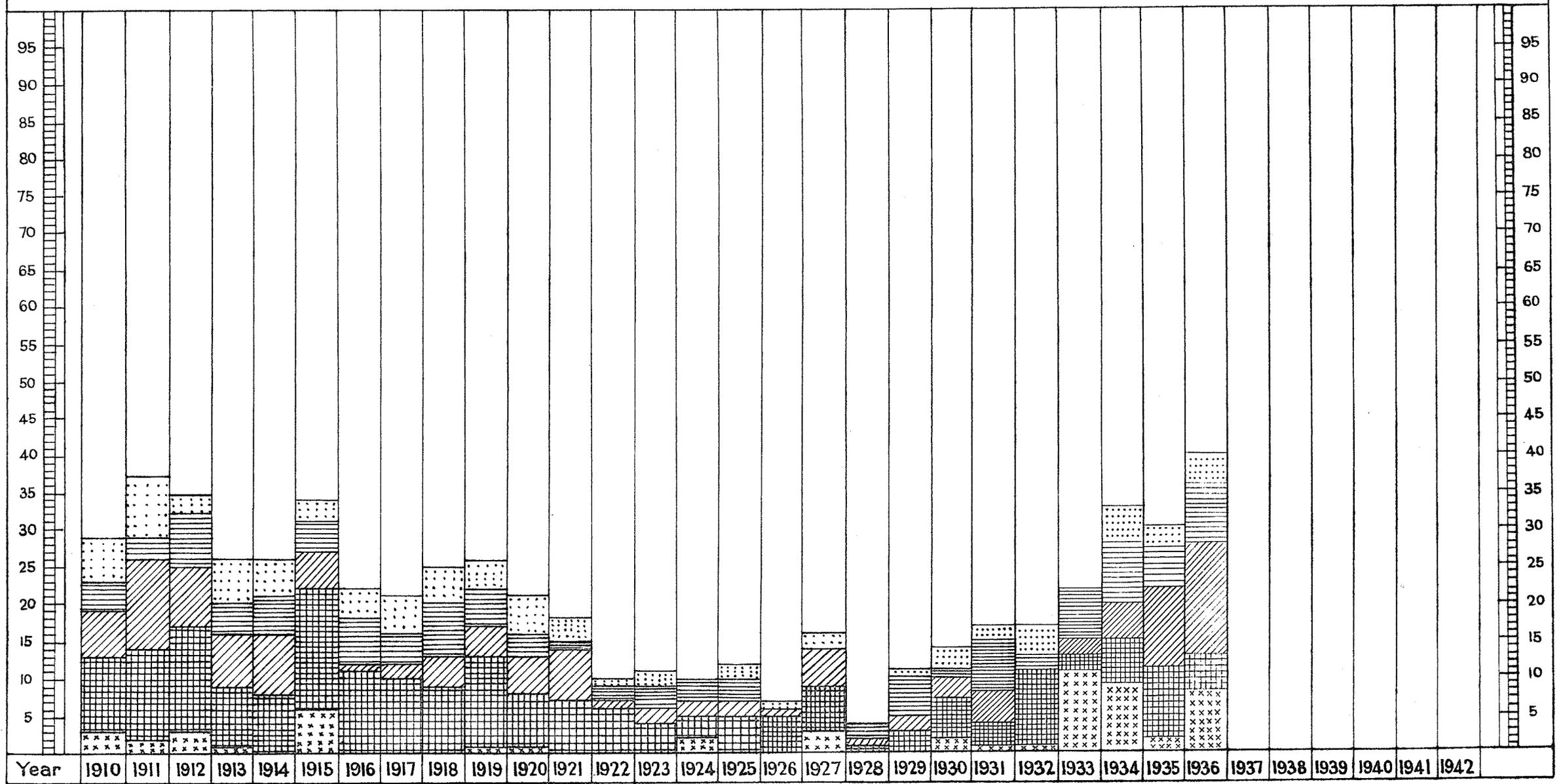
D I A C R A M

Of the Coal Output - Shewing Quantity & Value as reported to Mines Dept from 1910 onwards



Year																		Year																																																																					
Value	£	262166	113699	1910	249890	111154	1911	295079	135857	1912	313818	153614	1913	319210	148684	1914	286666	137589	1915	301526	147823	1916	326550	191822	1917	337039	204319	1918	401713	270355	1919	462021	350346	1920	468817	407117	1921	438443	381555	1922	420714	368949	1923	421864	363255	1924	437461	363203	1925	474819	394400	1926	501505	407967	1927	528420	420445	1928	544719	426706	1929	501425	394758	1930	432400	336178	1931	415719	270630	1932	458399	289806	1933	500343	278704	1934	537188	318013	1935	565075	331565	1936			1937	£	Value
Quantity	Tons	262166	113699	1910	249890	111154	1911	295079	135857	1912	313818	153614	1913	319210	148684	1914	286666	137589	1915	301526	147823	1916	326550	191822	1917	337039	204319	1918	401713	270355	1919	462021	350346	1920	468817	407117	1921	438443	381555	1922	420714	368949	1923	421864	363255	1924	437461	363203	1925	474819	394400	1926	501505	407967	1927	528420	420445	1928	544719	426706	1929	501425	394758	1930	432400	336178	1931	415719	270630	1932	458399	289806	1933	500343	278704	1934	537188	318013	1935	565075	331565	1936			1937	Tons	Quantity

DIAGRAM SHEWING THE NUMBER OF DEATHS FROM ACCIDENTS ARRANGED IN FIVE CLASSES, IN THE MINES OF WESTERN AUSTRALIA DURING THE YEARS 1910 AND ONWARDS.



Explosions

Falls of Ground

In Shafts

Miscellaneous Underground

On Surface Including Machinery

PART V.—ACCIDENTS.

TABLE 11.

MEN EMPLOYED IN MINES KILLED AND INJURED IN MINING ACCIDENTS DURING 1935 AND 1936.

A.—According to Locality of Accident.

Goldfield.	Killed.		Injured.		Total Killed and Injured.	
	1935.	1936.	1935.	1936.	1935.	1936.
1. Kimberley ... ..	...	...	...	...	...	...
2. West Kimberley ... ..	...	...	...	...	...	...
3. Pilbara ... ..	...	...	...	...	...	...
4. West Pilbara ... ..	...	...	...	...	...	...
5. Ashburton ... ..	...	...	...	...	...	...
6. Gascoyne ... ..	...	...	...	...	...	...
7. Peak Hill ... ..	...	...	...	...	...	...
8. East Murchison	4	4	111	141	115	145
9. Murchison ... ..	...	5	22	33	22	38
10. Yalgoo ... ..	...	...	7	...	7	...
11. Mt. Margaret	4	5	68	117	72	122
12. North Coolgardie ... ..	...	2	13	10	13	12
13. North-East Coolgardie	1	...	3	...	4	...
14. Broad Arrow	1	2	...	2	1	4
15. East Coolgardie	12	10	428	728	440	738
16. Coolgardie	3	5	4	14	7	19
17. Yilgarn	2	4	8	29	10	33
18. Dundas	1	...	2	6	3	6
19. Phillips River ... ..	...	1	...	1	...	2
MINING DISTRICTS—						
Northampton ... ..	...	...	...	...	...	...
Greenbushes ... ..	...	...	...	...	...	...
Collie	2	...	287	325	289	325
Swan ... ..	...	2	51	41	51	43
Total	30	40	1,004	1,447	1,034	1,487

From the above table it will be seen that the total number of fatal accidents for the year 1936 is 40, as against 30 in the preceding year. The number injured shows an increase of 443. In the report of the State Mining Engineer, published as Division II. of this report, these accidents are classified according to the causes.

B.—According to Causes of Accident.

	1935.		1936.		Comparison with 1935.	
	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.
1. Explosives	2	17	8*	15*	+ 6	— 2
2. Falls of Ground	9	65	5	66	— 4	+ 1
3. In Shafts	11	30	15	42	+ 4	+ 12
4. Miscellaneous Underground	5	683	8	1,052	+ 3	+ 369
5. Surface	3	209†	4‡	272‡	+ 1	+ 63
	30	1,004	40	1,447	+ 10	+ 443

* Includes 1 fatal and 2 serious at Quarries. † Includes 1 fatal and 39 serious at Stone Quarries. ‡ Includes 51 serious accidents at Stone Quarries.

Thirty-eight fatal accidents occurred at gold mines. The death rate per 1,000 men employed at gold mines was 2.48 as against 1.96 in 1935.

PART VI.—STATE AID TO MINING.

The number of State batteries existing at the end of the year was 24, with three leased. From inception to the end of 1936 gold and tin to the value of £9,071,818 18s. 0d., including gold premium estimated at £1,249,931 8s. 0d., have been recovered from State plants. 2,066,488.69 tons of auriferous ore have been treated and have produced £7,212,569 10s. 4d., plus estimated premium by amalgamation; £1,490,223 18s. 0d. by cyanidation; £265,266 2s. 3d. by slimes; £9,353 7s. 5d. from residues; and 81,786 tons of ore produced tin to the value of £93,834, and in addition £572 were recovered from residues.

During the year gold ore treated was 102,086.25 tons for 55,601.4 ozs. of bullion by amalgamation, producing 49,700 tons of payable tailing yielding 15,573.8 ozs., 36,045 tons of unpayable tailing yielding 2,613.65 ozs., and 6,421 tons refractory tailing yielding 1,176.65 ozs., making a total of 92,166 tons for 19,364.10 ozs.

The working expenditure for all plants was £114,485 12s. 8d. and the revenue £130,967 7s. 10d., which shows a profit of £16,481 15s. 2d. on the year's operations.

The capital expenditure since inception of the scheme has been £496,098 9s. 6d.; £374,763 1s. 11d. from General Loan Fund, £91,981 4s. 2d. from Consolidated Revenue, £16,397 4s. 1d. from Assistance to Gold Mining Industry, and £12,956 19s. 4d. from Commonwealth Assistance Metalliferous Mining.

The cost of administration for the year was £6,844 13s. 0d. as against £7,154 18s. 0d. for the year 1935.

The working expenditure from inception to the end of the year exceeds the revenue by £102,240 19s. 0d.

GEOLOGICAL SURVEY.

The work of the geological survey under this heading during 1936 is represented by the following reports, which are fully set out in the Annual Report of the Geological Survey.

The Ora Banda Amalgamated Gold Mine, Grant's Patch, Broad Arrow Goldfield.

Seahill's Felspar Quarry, Londonderry, Coolgardie Goldfield.

Boring for "Deep Leads," Greenbushes Tinfield, South-West Division.

Leinster Gold Mine, Mt. Sir Samuel, East Murchison Goldfield.

The systematic resurvey of the Southern portion of the Yilgarn Goldfield was completed after the detailed examination during 1936 of the following groups of mines:—Banker, Battler, Blackburne's, Burbidge, Centenary (Parker's Range), Cheriton's Find, Dulcie, Foundation Find, Harris' Find, Holleton, Kennyville, Magowan's Find, Mount Palmer, Mount Rankin, Nevoria, Olga, Southern Cross, Spring Hills, Toomey Hills.

Assistance under "Mining Development Act, 1902."

The following statement shows the sum advanced during the year 1936 under "The Mining Development Act, 1902":—

	£	s.	d.
1. Advancement in aid of Mining Work and Equipment of Mines with Machinery ...	2,831	12	4
2. Subsidies on Stone Crushed for the Public	272	6	2
3. Providing means of Transport Equipment and Sustenance to Prospectors ...	9,511	13	2
	<u>£12,615</u>	<u>11</u>	<u>8</u>

Other Assistance granted from the Vote, during the year on various matters, totalled ... 1,340 19 7

The Subsidies paid on stone crushed for the public amounted to ... 272 6 2

and are subsidies paid to owners of plants crushing for the public, the conditions being that they crush at fixed rates. The ore crushed during the year at these plants totalled 2,178½ tons.

	£	s.	d.
The Receipts under the Mining Development Act, exclusive of Interest payments, amounted to	4,217	15	5
and included—			
Refunds of Advances ...	729	5	1
Sales of Securities ...	64	6	6
Miscellaneous Refunds... ..	3,424	3	10
	<u>£4,217</u>	<u>15</u>	<u>5</u>

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 4,121, as against 3,969 total for the preceding year, showing an increase after all adjustments of 152 boilers.

Of the total 4,121 useful boilers, 2,097 were out of use at the end of the year; 1,981 thorough, and 111 working inspections were made, and 1,982 certificates were issued.

Permanent condemnations totalled 6, and temporary condemnations 27. There was 1 conversion. One boiler was transferred beyond the jurisdiction of the Act.

The total number of machinery groups registered was 12,925, against 11,435 for previous year, showing an increase of 1,490.

Inspections made total 10,250 and 4,140 certificates were granted.

Six hundred and eighty-six applications for engine-drivers' and boiler attendants' certificates were received and dealt with, and 591 certificates, all classes, were granted as follows:—

Winding Competency (including certificates issued under Regulation 40 and Section 60)	71
---	----

First Class Competency (including certificates issued under Regulations 40 and 45, and Sections 60 and 63)	15
Second Class Competency (including certificates issued under Regulation 40 and Section 60)	87
Third Class Competency (including certificates issued under Regulation 45 and Section 63)	121
Locomotive Competency	17
Traction Competency	2
Internal Combustion Competency	122
Crane and Hoist Competency	21
Boiler Attendants' Competency	122
Interim	1
Copies	9
Transfers	3
	<u>591</u>

The total revenue from all sources during the year was £8,634 7s. 3d., as against £7,824 6s. 8d. for the previous year, showing an increase of £810 0s. 7d.

The total expenditure for the year was £7,251 7s. 6d., as against £5,753 1s. 8d. for the previous year, showing an increase of £1,498 5s. 10d.

PART VIII.—SCHOOL OF MINES.

In this, the thirty-third year of the School's existence, the individual enrolment reached a maximum of 629, as compared with 476 during 1935, and constituted the highest enrolment in the history of the School. The year was a very strenuous one for the teaching staff, but all gave of their best to the work and the advancement of the students.

In the Metallurgical Laboratory the requests for assistance show no signs of diminishing. Forty-five investigations into the treatment of ores and metallurgical products were completed and reports furnished to the persons and companies seeking advice. In connection with this work, 1,766 assays for gold were done, also 158 grading analyses and 283 chemical analyses, not including routine tests of cyanide solutions. The assistance offered to prospectors was maintained and the number of free assays and determinations was:—

Assays for gold	1,128
Assays for other metals	9
Mineral determinations	111
	1,248

Correspondence classes in Mining I., Metallurgy I. and Assaying I. were inaugurated during the year and the enrolments were:—

Mining I.	57
Metallurgy I.	32
Assaying I.	24

These classes threw additional duties on certain of the staff, but they were conscientiously carried

out. A branch of the School was established at Wiluna in August and a strong local committee formed to advise the Department in connection with it. Classes were commenced under local instructors, drawn mainly from the technical staffs of the Wiluna and Moonlight Mines. The number of enrolments in the various classes was 241 and of individual students 165. This is very gratifying and it is hoped will be maintained. The extension of the classwork to Wiluna has been greatly appreciated, as it enables young men in this remote centre to equip themselves for advancement in the industry.

The students work to the ordinary syllabuses of the School and take the examinations. They are thus able to qualify for certificates and diplomas similarly to those attending the main school.

CONCLUSION.

In dealing with the various activities of the Department, I have commented only on the principal items. Detailed information is given in the reports of the responsible officers, published as Divisions II. to VIII. of this Report.

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

I have, etc.,

M. J. CALANCHINI,
Under Secretary for Mines.

Department of Mines,
Perth, 31st March, 1937.

DIVISION II.

Report of the State Mining Engineer for the Year 1936.

The Under Secretary for Mines.

Sir,

I have the honour to submit, for the information of the Hon. Minister for Mines, my report on the work of this Branch of the Mines Department for the year 1936.

STAFF.

There were several changes in the Inspectorial Staff during the year. Inspector H. P. Rockett, who was stationed at Cue, retired, and Inspector G. Matheson was appointed in his place.

Senior Inspector Phoenix retired at the end of the year, and Inspector A. W. Winzar was promoted to the position of Senior Inspector.

At an election for Workmen's Inspectors of Mines, Inspectors D. J. Leahy and R. J. Wallis for Kalgoorlie, and R. P. McMenemin, for Wiluna, were re-elected and two extra appointments at Leonora and Cue were filled by Messrs. H. F. Greyman and W. E. Boyce, respectively.

ACCIDENTS.

During the year, 40 fatal and 1,447 serious accidents were reported to this office (including 2 fatal

and 366 serious accidents in quarries and coal mines), compared with 30 fatal and 1,004 serious accidents in 1935 (including 2 fatal and 338 serious accidents in quarries and coal mines). These figures show an increase of 10 fatal and 443 serious accidents.

Gold mining fatal accidents totalled 38 as compared with 28 in 1935, an increase of 10, and serious accidents 1,081 as compared with 666 in 1935, an increase of 415. The number of men employed in gold mining increased during the same period from 14,708 to 15,696.

The number of serious accidents in coal mines showed an increase from 287 to 325, the number of men engaged in the work increasing at the same time from 689 to 798.

Table II, showing the locality and causes of fatal and serious accidents, is forwarded herewith for inclusion in your Annual Report, together with a diagram of fatal accidents year by year and their causes. (See Division I., Report of the Under Secretary for Mines.)

The following table shows the number of fatal accidents recorded during the last five years, and the death rate per thousand men employed:—

	1932.	1933.	1934.	1935.	1936.
Fatal accidents to men engaged in mining (exclusive of quarries)	16	22	30	30	38
Total number of men engaged in mining (average) ...	8,695	10,690	13,310	15,557	16,652
Accident death rate per 1,000 men	1.96	2.06	2.25	1.93	2.28
Fatal Accidents at Quarries	1	...	3	...	2

FATAL ACCIDENTS.

Brief particulars of the fatal accidents which occurred during the year are as follows:—

Explosives.

There were eight explosive accidents.

Giavanni Valenti, a miner employed by a tribute party on the Great Boulder Mine, charged six holes in the face of a shaft, 60 feet deep, in which he was working, lit the fuses and called to the hoist driver to pull him up. The driver could not get the hoist to operate, and failed in an attempt to pull the deceased up by hand. A chain ladder in the shaft was out of reach and could not be used by Valenti, who pulled the fuses out of five of the holes but failed to pull the sixth, which exploded and killed him. The use of the cartridge system of firing, which was made

compulsory later in the year, would have saved Valenti.

Francis Evinis was boring in the face of a rise on the Moonlight G.M. when an explosion occurred, killing him outright. It is to be presumed that he bored into an old hole containing fracture, but there was insufficient evidence to be quite certain what happened.

Alessio Azzola was firing out the face of a cross-cut in the Associated Shaft of the Lake View and Star Group when a premature explosion occurred. He was alone at the time and was dead when he was found after the explosion, and no evidence was available to indicate exactly how the accident occurred. It is considered that the use of the cartridge system would have saved this man's life.

Percy John Roberts was killed on the Wiluna Gold Mine while assisting to charge a diamond drill hole, 35 feet deep, with fracteur. He was replacing in the hole some fracteur which had previously jammed and been withdrawn. The evidence showed that he had a lighted cigarette in his hand at the time, but it is not clear what actually occurred. Three other men were seriously injured in the same explosion.

David Grant lit 13 fuses in the Gawler Shaft of the Paget Gold Mines but was unable to climb the chain ladder to safety and remained in the shaft while the charges went off. Surprisingly enough he was not killed outright, but died in hospital nearly two months later. This is yet another case where the use of firing cartridges would have saved a life, as all that would be necessary on finding that he could not escape would be to remove the master fuse.

Giovanni Tagliaferri was firing four holes in a drive on the Sons of Gwalia Mine. He lit up and was walking along the drive to safety when one of the holes exploded prematurely. Tagliaferri died in hospital two days later and the post mortem examination revealed a piece of steel embedded in his lung, which was the cause of death. The cause of the premature explosion is unknown, but it is thought possible that the butt of a hole previously fired may have been charged without cooling it down sufficiently.

Erie McLernon, while charging some holes at the bottom of a water shaft 100 feet deep on the Big Bell G.M., was killed by the premature explosion of one of the holes already charged. It is surmised that the fuse of this charged hole accidentally came in contact with the naked flame of McLernon's lamp, thus causing the explosion.

Giacomo Giudice, a powder monkey, was charging a deep hole in the face of the Darling Range Quarry when an explosion occurred, hurling him into the air and on to a heap of broken rock about 30 feet below. He was dead when picked up. Another man was so seriously injured that he was unable to give evidence at the inquest three months later. No evidence could be adduced to form an accurate opinion as to the cause of the explosion.

Falls of Ground.

There were five fatal accidents under this heading during the year:—

Charles Aguis was engaged shovelling broken ore into a pass in a stope on the Triton Gold Mine, when a piece of hanging wall of dimensions estimated at 14 feet by 10 feet by 3 feet thick came away and fell on him. The ground had previously been sounded and was considered safe. Aguis was a new hand and although a warning was called to him he apparently did not understand, as he made no attempt to move.

John Thompson, a prospector, was working alone in an old mine (the Democrat G.M., Meckatharra), and was buried by a fall of about 12 tons of earth. He was not found until about four days after the accident occurred.

Guiseppe Nicoli, a miner at the Celebration G.M., made several unsuccessful attempts to bar down a piece of bad ground on the hanging wall of the stope from a stage. He decided that it was not possible to dislodge it with the bar and descended from the stage when the piece of rock, estimated to weigh four to five tons, fell on him, killing him outright. A shoveller also received serious injuries by this fall.

Thomas Clews, a miner on Blackett's Mine, Kunanalling, was killed instantly, when a fall of about 7 tons in a stope came away from the hanging wall and caught him. He had bored out and was preparing to fire when the fall occurred. The management was instructed to use timber supports more freely in future in this class of country.

Donald Henry Ferguson was killed and one other man seriously injured by a fall of ground in a stope on the Ivanhoe Mine. The deceased and his mate were logging up a pass to make the stope safe, preparatory to barring down some bad ground on the hanging wall, when the ground unexpectedly fell on Ferguson and partially buried his mate.

Shaft Accidents.

There were fifteen men killed during the year owing to accidents in shafts.

Philip Henry Dawson, a timberman employed on the Lancefield Gold Mine, was carrying out repair work in the underlie shaft while the ore was being pulled from a lower level. His instructions were to work only while the skip was at rest and to step clear while it was in motion. He stepped to safety behind the ascending skip, but, apparently in a moment of aberration, stepped back in the track of the descending skip and sustained injuries to which he succumbed on the following day. Working in a shaft during haulage operations is considered a dangerous practice, and the manager of the mine was proceeded against under Section 57 of the Mines Regulation Act, 1906, and a fine was imposed.

A tragic accident resulting in the deaths of three men occurred at the Golden West G.M., at Kunanalling. The names of the victims were Ralph Douglas Young, Norman Waldo Lethridge, and Alexander Henderson. They were bailing water from a disused shaft. Young was driving a truck and the others were landing the water. One man had reason to descend the shaft, presumably to free an obstruction. He was apparently overcome by fumes and fell off the ladder into the water and was drowned. The second man then descended and met with a similar fate and was shortly followed by Young. All three men were gassed with sulphuretted hydrogen and their bodies were recovered with difficulty. In recognition of heroism displayed in rescue efforts in connection with this accident, the Royal Humane Society awarded bronze medals to W. A. Norris, E. Rathjean, R. Harrington and F. Harrington.

Enoch Portch, a skipman on the Ivanhoe mine, was at the loading bin below the 2,500ft. level, when he was struck on the head by a stone falling down the shaft, sustaining a fracture at the base of the skull from the effects of which he died later in the day. In his position at the loading station he should have been quite safe, but it would appear that he momentarily put his head in the shaft and was caught. At the time, he was evidently not wearing his safety helmet, which might have saved his life.

Edward Lewis was the victim of a peculiar fatal accident at Freeman's Find. He was lowered by windlass down a shaft 73 feet deep and, according to evidence, landed safely at the bottom. He put a few shovels full of dirt into the bucket and collapsed. He was taken 100 miles to hospital where it was found that he had fractured the base of his skull. He died on the following day.

Natale Donatti, a prospector, was found dead at the bottom of a vertical shaft about 120 feet deep. It is surmised that while climbing the ladders to the surface, Donatti fell and was killed.

Charles Robert Harvey was killed while ascending a vertical shaft at the Beryl Gold Mines on a kibble. The monkey, or guide for the kibble, caught in the skids of the sky shaft and remained there while the kibble was lowered to the bottom. Harvey and another man got into the kibble and signalled the driver to hoist to the surface. When halfway up the shaft, the monkey freed itself, crashed down the shaft and killed Harvey and injured the other man. A safety catch to prevent recurrence of this class of accident has since been devised.

Anthony O'Halloran, filling a kibble at the bottom of the main shaft of the Triton G.M. (depth 610 feet) was struck on the head by a stone estimated to weigh 10 to 12 lbs. and was killed instantly.

Ernest Frank Sutton was killed in the Neta shaft of the Paget Gold Mines. He rang the hoist signal to an uncertificated driver who attempted to haul him up by means of a Holman hoist. Sutton fell off the kibble and was killed. Prosecution proceedings were instituted against the driver, but, as he could not be located, they were dropped.

Vittorio Demetrius Nicoletti was employed cleaning the Bulletin shaft, Wiluna Gold Mines. Although instructed to go down on the top of the cage, he decided to climb down the shaft. Having completed the job he decided to return by the same method, but evidently missed his hold and fell 113 feet to the penthouse, sustaining fatal injuries.

Nicola Bergomelli died as a result of injuries sustained in the main shaft at the Wiluna Gold Mines when the winding rope broke at the shoe, letting a loaded skip fall from the surface to the penthouse 1,500 feet underground. Bergomelli was working at the face of the shaft below the penthouse and was struck by falling debris. He did not at first appear to be in danger, but died about seven weeks after the accident.

Jonathan Edwin Pratt was cleaning out the shaft of the Sons of Erin Gold Mine, about 10 feet below the 180ft. level. A trolley, weighing about 1 cwt., fell from the surface, struck Pratt on the head and killed him instantly. Pratt was working under a penthouse but the trolley in falling presumably struck something which deflected its course under the penthouse.

John Cannon, a prospector of Broad Arrow, decided to go down an old shaft 140 feet deep by means of a hemp rope attached to the standard of his windless. It would appear that the rope broke when he put his weight on it, and he fell to the bottom of the shaft, sustaining fatal injuries.

Abondio Betti, a prospector near Linden, fell 103 feet from the surface down a vertical shaft and sustained injuries from which he died the following day. His mates who were working in drives off the bottom of the shaft, heard him fall, but as there was no occasion for him to descend the shaft, or even to go near it at that particular time, the cause of the accident remained unexplained.

Miscellaneous Underground Accidents.

During the year there were nine fatal accidents classified under this heading:—

Gilbert Stuart Lang was rendered unconscious by fracture fumes, probably carbon monoxide gas, in the

Bohemia G.M. He collapsed and fell on his lamp, and when rescued was badly burnt. He died in hospital three days later.

Frederick Lancelot Beard was a diamond driller employed by the Lake View and Star, Ltd. He descended a winze about 90 feet deep by means of a Holman Hoist to inspect a site to commence a drill hole. On returning to the level by the same means the hoist rope appears to have ridden and slipped when he was about 12 or 15 feet from the level. He was jerked off the bucket and, falling to the bottom of the winze, was killed. The driver of the hoist, who was found to be uncertificated, was prosecuted and fined.

Ian Marshall, a surveyor on the Iron Duke G.M., while conducting a party of visitors underground, was caught in a rush of water from the bursting of an underground dam and received injuries from which he subsequently died. The three visitors also sustained severe injuries. As a result of this accident, the first of its kind in the State, a new regulation was framed dealing with the design and construction of pressure dams underground.

John Lowry Johnston was lowered down a winze on the Yellowdine Gold Development mine and was attacked by fumes. He rang for the kibble, but having got on it he could not hold on and fell back and fractured his skull before the kibble was raised. Death was practically instantaneous.

James Quigley, a trucker on the Chaffers mine, slipped and injured his side while pushing a truck. A cut finger, not reported, later became infected and septicaemia set in which caused his death a month subsequent to the accident.

Cesare Gossetti was found fatally injured at the bottom of a winze on the May Queen Gold Mine. His skull was fractured, apparently by a stone of about 10 lbs. in weight which appears to have come away from the side of the winze. Dampness in the winze has made it difficult to observe that this piece of stone was likely to fall.

David Wood Reid, a miner employed by the Lake View and Star, Ltd., had occasion to walk past an underground ore pass which had been uncovered in order to effect repairs. The pass was in a cuddy at the side of the crosscut, and there was ample room to walk past it. Reid had actually passed it several times during the shift, and knew what was going on. However, he fell into it and was fatally injured. The distance fallen was approximately 100 feet.

Marejan Babieh, a shoveller on the Chaffers Mine, sustained a fractured spine when the surrounding broken ore in a stope ran into an ore pass, taking him with it. He died about six weeks later. Certificates for bravery were awarded to Marinko Lalic and Ernest Thomas Winson in recognition of their disregard of personal danger displayed in extricating Babieh.

Surface Accidents.

There were three fatal accidents due to mishaps on the surface.

Ernest Edmund Roy Taylor died from shock due to extensive injuries received when he was caught by his overcoat on the countershaft of the battery at the Leviathan Amalgamated Gold Mine. There was no

evidence to show what he was doing at the time of the accident.

John Desmond Foxall, gas producer attendant at the Sons of Gwalia, Limited, was killed instantly by an explosion while he was removing the safety lute from a gas producer. The evidence proved that the lute should have been removed earlier.

Maurice Vernon Fitzgerald, an engine-driver employed at Pearsall's Battery, Mt. Magnet, was removing a belt from a winch to a countershaft when his foot caught in the belting and his leg was torn off. He died the next day from shock and haemorrhage.

Albert Dance, a machine man employed at the Roelands Quarry, fell from a ledge where he was operating his machine on to another ledge about 26 feet below, and received injuries from which he died later in the day. It is thought that he may have over-balanced while endeavouring to clear his air hose from some obstruction.

The following table shows all the fatal and serious accidents reported to this office during 1936, and are classified according to the gold or mineral field in which they occurred. The causes of accidents are also shown:—

	Explosives.		Falls of Ground.		In Shafts.		Miscellaneous Under-ground.		Surface.		Total.	
	Fatal.	Seri-ous.	Fatal.	Seri-ous.	Fatal.	Seri-ous.	Fatal.	Seri-ous.	Fatal.	Seri-ous.	Fatal.	Seri-ous.
1. East Coolgardie	2	4	2	11	1	16	5	588	...	109	10	728
2. Mt. Margaret	1	...	...	...	3	3	...	86	1	28	5	117
3. Coolgardie ... ..	...	...	1	...	4	4	...	7	...	3	5	14
4. North Coolgardie	1	...	...	2	1	1	...	6	...	1	2	10
5. North-East Coolgardie ... ..	...	...	...	...	...	...	...	...	...	...	...	...
6. Broad Arrow ... ..	...	...	...	1	2	1	...	...	...	...	2	2
7. Dundas ... ..	...	...	...	...	...	...	...	4	...	2	...	6
8. Yilgarn ... ..	...	2	...	...	...	3	3	17	1	7	4	29
9. Murchison	1	...	2	1	1	2	...	22	1	8	5	33
10. East Murchison	2	6	...	5	2	11	...	83	...	36	4	141
11. Peak Hill ... ..	...	...	...	...	...	...	...	...	...	...	...	...
12. Yalgoo ... ..	...	...	...	...	...	...	...	...	...	...	...	...
13. Northampton ... ..	...	...	...	...	...	...	...	...	...	...	...	...
14. Greenbushes ... ..	...	...	...	...	...	...	...	...	...	...	...	...
15. Swan	1	2	...	...	...	...	...	...	1	39	2	41
16. Phillips River ... ..	...	...	...	...	1	1	...	...	...	...	1	1
17. Collie ... ..	...	1	...	46	...	...	...	239	...	39	...	325
18. Pilbara ... ..	...	...	...	...	...	...	...	...	...	...	...	...
19. West Pilbara ... ..	...	...	...	...	...	...	...	...	...	...	...	...
20. Ashburton ... ..	...	...	...	...	...	...	...	...	...	...	...	...
Totals for 1936	8	15	5	66	15	42	8	1,052	4	272	40	1,447
Totals for 1935	2	17	9	65	11	30	5	683	3	*209	30	1,004

* Includes 51 serious accidents at stone quarries.

Winding Machinery Accidents.

Sixteen accidents to winding machinery were reported during the year, including two skip derailments, seven overwinds, three broken winding ropes, and four miscellaneous accidents.

On one mine, where the frequency of serious skip derailments has for some years caused some concern, only one serious accident of this type was reported for the year. This was due to disregard of automatic safety signals by the engine-driver, against whom disciplinary action was taken. Precautionary measures arranged by a conference between the management and departmental officials were responsible for safer driving.

All overwinds were fully reported on by the inspectors of machinery or investigated by the Engine-drivers' Board.

Broken ropes.—The breaking of a rope 140 feet above the shackle was probably due to a flaw in the rope. The bailing tank went to the bottom of the shaft, but no damage was done.

A winding rope broke near the shoe, allowing a loaded skip to fall from the surface ore bin to the penthouse below the 1,400ft. level. A miner working below the penthouse subsequently died of injuries re-

ceived as a direct cause to this mishap. The failure of the rope was probably due to corrosion caused by the hemp core of the rope being devoid of lubricant.

A rope was broken near the safety hook on account of the skip coming off the skids and jamming in the shaft. No serious damage was caused.

Miscellaneous Accidents.—While running a cage through the shaft before lowering men, the cage stuck and the rope coiled on top of it and became kinked. No serious damage was done, and the rope was replaced on the drum with the ends changed.

On another occasion the spring in a new rope and sensitive grippers on the cage were responsible for the cage hanging up in the shaft and the rope becoming kinked. No damage was done.

Owing to an indicator giving a false reading the safety hook entered the thimble, allowing a tank of water to fall to the bottom of the shaft. No damage was done to the shaft or head gear.

A safety hook fractured when a piece of ore became wedged between the skip and the wall plate of the shaft. The grippers acted immediately. The skip was then shackled direct to the rope, but the rope jumped out of the sheave and damaged some of the strands. A new rope was ordered and a safety hook of heavier metal installed.

ADMINISTRATION.

Amendments of Acts.

Mines Regulation Act, 1906:—Regulation 7—Addition of Clause (10). (Gazetted 17th March, 1936.)

Regulation 17 (Part 2, Clauses (2) and (3))—Cancellation of *Gazette* notice dated 11th May, 1934, and substitution of new Districts for Workmen's Inspectors. (Gazetted 29th May, 1936.)

Regulation 4.—Addition of General Rule (52)—Underground Dams. (Gazetted 10th July, 1936.)

Regulation 4.—Addition of General Rule 45A—Method of Firing Charges. (Gazetted 7th August, 1936.)

Regulation 7.—Amendments of Clauses (1), (2), (4), and (5); also Forms Nos 1, 2, and 6. Forms Nos. 17 and 18 in the Schedule deleted and new Forms Nos. 17, 18, 18A, and 18B inserted. (Gazetted 7th August, 1936.)

Regulation 4.—Amendment to General Rule (52)—Underground Dams (Gazetted 25th September, 1936.)

Regulation 17, Part 2.—Amendments to Clauses (1), (7), (8), (9), and (12)—Workmen's Inspectors of Mines. (Gazetted 6th November, 1936.)

Regulation 17b.—Additional Regulation—Posting up result of Inspections made by Inspectors. (Gazetted 4th December, 1936.)

Regulation 4.—Amendments to General Rule (1)—Ventilation of Mines. (Gazetted 4th December, 1936.) Disallowed by Legislative Council, 10th December, 1936.

Regulation 4—Additional General Rule (48a).—Misfires: additional General Rule (48b).—Maximum depth of hole where Nitro-Glycerine Compound used. (Gazetted 4th December, 1936.)

Regulation 4—General Rule (31a)—Additional General Rule.—Ropes to be fixed in rills and stopes. (Gazetted 4th December, 1936.)

Mining Development Act, 1902-1924.

Regulations under the Mining Development Act, 1902-1924, reprinted with amendments, in lieu of the regulations heretofore in force. (Gazetted 24th December, 1936.)

Coal Mines Regulation Act, 1902-1926.

Amendments to Regulations 52, 56, 57 and 58—Workmen's Inspectors. (Gazetted 6th November, 1936.)

Regulation 61—New Regulation.—Use of electricity in Coal Mines. (Gazetted 6th November, 1936.)

PROSECUTIONS.

During the year 22 prosecutions were undertaken under the Mines Regulation Act, 1906, of which two were dropped owing to inability to locate the offenders.

Of the remainder, three managers were proceeded against under Regulation 7 for employing men without the prescribed medical certificates. Fines were imposed in each case.

Under Section 32 there were eight prosecutions.

A manager was fined for neglecting to supply an approved canister for the transport of explosives.

Four men were prosecuted for failing to supply approved ladders to ensure safe means of exit. Three of these were fined and the fourth case dismissed.

Two men were fined for neglecting to use the canisters supplied to carry explosives.

A fine was imposed for taking a naked light into a magazine.

Under Section 44 a manager was proceeded against and a fine imposed for employing Sunday labour without a special permit.

Under Regulation 15 two men were fined for taking charge of underground hoists without certificates.

Two managers were prosecuted for allowing men to take charge of hoists without certificates, but both cases were dismissed.

Under Regulation 4 a manager was fined for causing men to work in a place where the wet bulb temperature exceeded 80 degrees Fahrenheit.

Under Section 57 a manager was proceeded against and fined for permitting the use of an unsafe ladder.

A manager was fined for allowing men to work in an underlie shaft whilst the skip was in motion.

A manager was fined for allowing an ore pass to remain unprotected.

UNDERGROUND SUPERVISORS.

During the year, Regulation 17A (Gazetted 29th November, 1935) came into force. The Board of Examiners for Underground Supervisors' Certificates of Competency held examinations in May and November, and granted 132 certificates of competency, including four without examination, issued on a reciprocal basis to holders of equivalent certificates in the Eastern States.

Certificates of Service were issued to 295 men who were employed as underground supervisors at the date on which the new Regulation was gazetted.

Copies of the papers set for the examinations for Certificates of Competency are attached to this report. (Appendix No. 3.)

EXEMPTIONS.

Two hundred and eighteen certificates were issued in accordance with the provisions of Section 31 (4) for exemption from the provisions of Section 31, Subsection 1 (b) of the Mines Regulation Act, 1906. One of these certificates was subsequently cancelled.

SUNDAY LABOUR.

Eight permits to employ men on Sunday were granted during the year.

Three of these permits were in connection with stripping and timbering a main shaft to avoid loss of time in subsequent working of the mine.

Permission was granted to four men to work on Sundays over a period of three months on electrical installation which work could not be done whilst haulage was in progress.

A permit was granted for six men to work one Sunday, fixing a new centrifugal pump underground to avoid loss of time in subsequent working.

Permission was granted for 12 men to work on Sundays for a period of three months to advance three drives sufficiently to connect them by winzes, in order to improve ventilation as quickly as possible and thus assist working conditions.

A permit was granted to employ ten men on Sundays in shaft sinking to keep down water.

LOAN AND SUBSIDIES.

The following monetary assistance was given to the mining industry:—

	£	s.	d.
Advances towards development work and equipment of mines	2,831	12	4
Providing transport and general assistance to prospectors	9,511	13	2
*Cartage Subsidies—Paid to prospectors on ore treated at State Batteries—... ..	...	...	...
Boring	700	0	3
Subsidies paid to privately-owned batteries	272	6	2
Miscellaneous Expenditure	640	19	4
	<u>£13,956</u>	<u>11</u>	<u>3</u>

*Cartage Subsidies are now paid from Consolidated Revenue Fund and for 1936 amounted to £16,064 15s. 6d.

The total expenditure was £13,956 11s. 3d. compared with £44,791 6s. 5d. during 1935, and £53,307 8s. 11d. during 1934. (Appendix No. 1.)

No expenditure was incurred during this year on "Advances on Ores."

VENTILATION.

Observations made during the year have indicated a still further improvement in conditions underground.

At the Lake View and Star, Ltd., on the Western Leases a very definite improvement has been maintained, largely due to the reduction of leakage by repairs to the Horseshoe main shaft, and the installation of a pressure fan at the 2,600ft. level.

The Great Boulder Proprietary, Ltd., was surveyed and a scheme drawn up for the improvement of the ventilation system. Considerable trouble has been experienced owing to frequent natural reversals of the air current. As the old passes through abandoned stopes have closed up, the resistance of the mine has increased and the repairing of the airways through the main shaft workings has become necessary. This work is now in hand. The old fan has been replaced by a new one driven by an air motor of modern design. These arrangements are of a temporary nature only, to serve until the Hamilton Shaft is connected with the main workings.

On the other mines in the Boulder district, which are worked by shrinkage methods, very little trouble has been experienced.

At the Sons of Gwalia, Ltd., high temperatures have been met with on the lower levels. A suggestion that the current of air be reversed is under consideration. The main ventilation way was transferred from the No. 26 to the No. 27 level during the year, but owing to the provision of a duplicate fan this work was carried out without interrupting the mine ventilation.

At the Lancefield (W.A.) Gold Mine, N.L., the installation of a fan of 100,000 cubic feet per minute capacity was completed early in the year. The efficiency of the arrangement is somewhat impaired by leakages in the main shaft, but the quantity of air circulating in the lower levels is sufficient and conditions are greatly improved.

The ventilation of the Wiluna G.M. was on a satisfactory basis during the early part of the year, but recent reports indicate a falling off in conditions. Experience on this mine has shown that ventilation on the system in vogue here is very difficult if exhausting methods are to be relied on. The ventilation shaft now in progress should enable the system to be seen at its best, and the experience gained should be of value in considering the ventilation of the Big Bell G.M.

The Moonlight mine will be worked on a system similar to that in use at Wiluna, and mechanical ventilation will be adopted.

Shaft and winze sinking in some of the smaller mines has improved ventilation. Cox' Find, Moonlight, Nevoria, North Kalgurli United and Yellowdine are all developing with good effect on ventilation.

Mechanical ventilation of dead ends has received a good deal of attention, and efforts are still being made to secure a more general use of large diameter pipes.

Foul gases have been reported on a few occasions and three men were killed by hydrogen sulphide. This gas is rare in Western Australia and its toxic properties are not well known. There was also a fatal accident due to a miner breathing the fumes after an explosion.

One prosecution was undertaken for a breach of the temperature conditions as set out in the Mines Regulation Act, 1906, and a fine was imposed.

GOLD MINING.

In 1936, the conspicuous advance in the goldmining industry of the State since 1929 became still more marked. The tonnage of ore treated and the value of gold won exceeded the figures of the previous year by 582,202 tons and £1,751,008 respectively. The price of gold, which reached a record figure in 1935, was slightly lower and the average value of ore treated remained practically unchanged.

A number of mines reached the productive stage during the year, and their entry into the ranks of the producers, combined with the comparative freedom from serious industrial troubles, is reflected in the greatly increased gold yield.

The following table illustrates the steady improvement in the industry since 1929:—

Year.	Tons Treated. (2,240 lbs.)	Gold Yield.	Estimated Value of Yield.	Value of Yield per ton.	Number of Men Employed.	*Average Value of Gold per oz., Australian Currency.	Average Yield per ton of Ore.
	tons.	fine ozs.	£A.	shillings.		shillings.	dwts.
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	15,696	174·27	6·84

* This value is computed at the weighted average price paid by the Perth Branch of the Royal Mint during each respective year.

OPERATIONS OF THE PRINCIPAL MINES.

East Coolgardie Goldfield.

On this goldfield, which includes Kalgoorlie, mining operations during the year maintained the upward

tendency of the past few years. Outputs and development footages showed a big increase on the preceding years. The development footages since 1932, tabulated hereunder, illustrate this increase:—

Year.	Shaft Sinking.	Driving.	Cross-cutting.	Rising and Winzing.	Diamond Drilling.	Totals.
1932	...	18,948	6,984	7,472	10,316	43,720
1933	...	26,671	18,868½	9,367	15,568½	70,897
1934	...	32,533	13,448	13,687	48,480	108,737
1935	...	32,467	14,511	14,044	43,219	105,048
1936	1,014	43,919	16,043	19,459	40,673	121,108

Lake View and Star, Ltd.—This company during the year has consistently maintained its monthly output of approximately 50,000 tons, and underground development has continued to be satisfactory.

In the Ivanhoe section the principal development has consisted of opening up the new lode below the 1,600ft. level. Drives are in progress at the 1,800, 1,900, and 2,100 feet levels in ore of fair width and good value. Stopping is being carried out between the 700ft. and 1,600ft. levels. Below the 1,600ft. is all new ground.

The No. 2 lode on the north is being worked in the Ivanhoe from the 1,300ft. to the 1,800ft. levels, and in the Horseshoe section from the 2,000ft. to the 3,100ft., extending into the Chaffers on lower levels.

Another shoot was developed on the Chaffers during the year from the 400ft. to the 1,200ft. level, averaging eight feet in width and showing normal values.

On the No. 3 lode the only work done was stopping; but intensive development is mapped out below the 2,600ft. level.

The No. 4 lode on the 3,400ft. level extends 1,000 feet in the Chaffers and 600 feet in the Horseshoe Lease, all in ore of normal value and an average width of 12 feet. The south end is at the limit of the shoot, but the north end is being extended.

The main shaft is being sunk at the rate of 40 feet per month, and is now 190 feet below the 3,400ft. level. Crosscuts will be put out at the 3,500ft. and 3,600ft. levels for a distance of about 200 feet to cut the No. 4 lode.

Connections were made between the Chaffers and the Horseshoe on the No. 1 lode at the 600, 800, 1,000 and 1,200 feet levels. Stopping and development is in progress between the 300ft. and 1,200ft. levels. This lode, which is the farthest west of the known ones, will be developed below the 1,200ft. level. The shoot is 600 feet long and five feet wide in good values.

Development work and stopping are in progress on Morrison's west lode in the Hannan's Star Lease above the 1,200ft. level. This level is connected with the Chaffers workings through which all ore mined is pulled.

An internal shaft on Hannan's Star is being sunk from the 1,100ft. to the 1,600ft. level, and the latter will be connected with Chaffers workings.

The above mines comprise the Western Group, which supplies roughly 38,000 tons of mill ore per month, 18,000 tons of which is hauled up the Ivanhoe shaft and 20,000 up the Chaffers. The whole of the

Western Group required constant attention to ventilation, and considerable expense has been entailed in this direction. Power fans are used for upcasting, and a future policy to control and improve the air flow is being developed.

On the Eastern Group, the most important development on the Lake View section occurred on the Central West Boulder lode at the 400, 500, and 600 feet levels. This lode is east of the main shaft, and runs into the Blue Gap. Values are opened up for a length of 400 feet with an average stopping width of six feet.

The Associated section was chiefly developed and stoped on the Cross lode between the 400ft. and 1,000 ft. levels, and in Tetley's shaft.

The following figures on the consumption of stores by the Lake View and Star, Limited, taken from one month's cost sheets, are of interest:—

Explosives.	Monthly.	Equivalent Yearly.
Gelignite	12,522 pkts.	335 tons
Fuse	226,251 feet	514 miles
Detonators	34,667	416,004
Firing cartridges	3,000	36,000
Fuse igniters	2,920	35,040

Over 30,000 tons of firewood are consumed annually, mainly for steam to run the winding engines.

On the surface continuous improvements are being carried out. The roasting section has given some trouble at times due to the leakage of sulphur dioxide fumes, but this is being gradually overcome. An additional van Tongereau dust collector is on order which, with other improvements and a better control of heat, should minimise the fumes nuisance. Experiments are now being conducted, with this object in view, which are confidently anticipated to produce good results.

The Great Boulder Proprietary, Ltd.—This important mine has had a very prosperous year. The monthly tonnage milled has been raised to 16,800 short tons, and extensive alterations are in hand, both underground and on the surface, to increase this to 28,000 tons monthly. A vigorous development policy has been mapped out and put into operation with this object in view. This development includes an internal shaft which is being sunk 320 feet south of the main crosscut from Hamilton shaft at the 1,800ft. level, and is now down to the 1,920ft. horizon. This shaft will be sunk to the 2,600ft. level and connect with the main shaft drive, and thence to Edwards shaft and be the main haulage. It will eventually be constructed through to the surface.

The ore treatment process which consisted of straking, flotation, roasting and cyaniding of flotation products was altered during the year by adding cyanida-

tion of the crude ore before flotation. This resulted in a saving of .5dwts. in flotation tails and 2.4 in calcine tails.

This mine is in a very flourishing condition with an excellent future.

Boulder Perseverance, Ltd.—A fair amount of development has been carried out on this mine. The lodes are numerous, and values inclined to be isolated and somewhat erratic. The east branch lode is a very fine body of ore, but the values are patchy and bulk on the low side. Possibly the stopes will supply average grade ore when beaten out, as did the Australia lodes adjoining.

Developments southward, towards the Lake View, have given some stoping blocks.

Most of the ore won for the year was taken from above the 1,500ft. level.

The mine is particularly well looked after, both underground and on the surface.

On the surface, improvements have been made to the change rooms and other buildings. The mill is giving satisfaction and a good extraction is claimed from pre-cyanidation before flotation, which is practised. A flue dust extractor is to be built to avoid possible losses.

South Kalgurli Consolidated, Ltd.—Developments on this mine were chiefly on known bodies of ore. A fair quota of the tonnage crushed was obtained from the Croesus Proprietary, which, according to report, will be closed down early in the present year.

On the surface a new grinding section is almost ready to operate. It consists of a tube mill and classifier and will handle the whole of the mill pulp, replacing the old pans and classifiers.

The normal tonnage was treated for the year and good extraction was obtained from the all-roast process.

Gold Mines of Kalgoorlie, Ltd.—This Company is working the Iron Duke, Australia East, Oroya and Blue Gap Leases.

On the Iron Duke the principal developments have been from No. 3 to No. 12 (1,050ft.) level. The Hincheliffe shoot is opening up well.

On the Australia East, developments are in progress from the surface to No. 5 level. A fair amount of high grade ore has been extracted above the No. 2 level and preparations are in hand to stope the surface block.

On the Oroya South-Blue Gap section development is in progress to the No. 11 level, and unwatering from No. 13 to No. 15 level (bottom).

The developments generally are very satisfactory, and stope preparation has advanced to the point where the erection of a new treatment plant is justified.

An electric winding engine and a new headgear were erected, the power plant extended and many improvements effected.

A yield of 14,230 oz. was obtained from 17,766 tons treated in the old Associated Mill.

North Kalgurli (1912), Ltd.—This mine had a successful year, developing and mining the Union Jack, Kalgurli and North Kalgurli Leases.

Very satisfactory results have been obtained from both development and stoping in all three sections.

This group of mines is very well controlled and much care is bestowed on all sections. The future prospects appear bright, as 10,000 to 12,000 tons per month are being treated at the Kalgoorlie Ore Treatment plant, and it looks as though this supply can be maintained.

Paringa Mining & Exploration Co., Ltd.—This company has been engaged for the year in a vigorous development policy. On the No. 2 level, north shaft, the east branch lode developed very well over a long distance, with good values. This lode is being opened up at Nos. 3 and 4 levels.

Developments on the different lodes to the 400ft. level were satisfactory with some rich sections. On the 520ft. level, where some faulting has occurred, prospecting is being done to locate the different lodes.

The ore reserves to date aggregate 108,000 tons worth 6 dwts., with a further 70,000 tons of probable ore. Foundations have been laid for a new treatment plant with a capacity of 4,500 tons per month. The plant will be of the oil flotation type.

This company also manages the Hannan's Amalgamated, which has put down bores on the Mt. Charlotte and Hannan's Reward Leases, with very satisfactory results. Preparations are now in hand for further exploratory work on these leases.

The *North Kalgurli United Mines, N.L.*, have had some satisfactory developments on the 500ft. level, 4 lodes having been opened up, of which three are in quite good values.

A new main shaft has been commenced, and will be sunk to cut the No. 4 lode at 500 feet.

The Broken Hill Proprietary.—At Hannan's North the main shaft was sunk to 1,000 feet and a crosscut put in at 950 feet. The lode was encountered and the little work done on it so far gives encouraging results. Stoping was done from the 800ft. level up, supplying normal grade ore to the mill.

The *Enterprise Mine* was acquired by the Boulder Perseverance, Ltd., at the end of the year. This mine is opened up to the 1,500ft. level and has good reserves of payable ore developed.

Hampton Plains Mines.

At the *Celebration Gold Mine* milling operations commenced during the latter half of the year, but the output of gold did not come up to expectations owing to dilution of the broken ore in shrink stopes. This system has now been abandoned and preparations are being made for mullocking the stopes.

The *Golden Hope*, which is being mined in conjunction with the Celebration, has supplied a quota of good ore to the mill.

The *White Hope* has been developing steadily throughout the year and is reaching the stage where treatment must be considered.

Coolgardie Goldfield.

The *Phoenix Gold Mines, N.L.*, have carried on with their development programme and have some very satisfactory and interesting developments, but not sufficient yet to warrant the erection of a treatment plant.

Tindals Gold Mines are also still in the development stage and a vigorous policy is being carried out.

Spargo's Reward, at Spargoville, has reached the stage of development to warrant the erection of a treatment plant. The mine is well developed to the 300ft. level and shows promise of becoming a consistent producer. The ore body is wide and carries moderate values. It is anticipated that a mill will be erected during the current year.

Yilgarn Goldfield.

Considerable activity still prevails on this goldfield.

The Southern Cross United Gold Mines.—Development has been pushed ahead on this group, which has now almost reached the stage of production. A start has been made on the erection of a 20-head mill and plant, designed to treat about 3,000 tons per month.

Ore reserves for about two years' production are in sight and it is anticipated that production will commence shortly after the middle of the current year.

Marvel Loch Gold Development, N.L.—This mine completed the installation of a plant of 4,000 tons per month capacity and commenced milling early in the year. For the last three months of the year the mill was working at full capacity, and, although the grade of ore treated was lower than anticipated, a working profit was shown over this period.

It is proposed to enlarge the plant to a capacity of 9,000 tons per month in the near future.

The Yellowdine Gold Development, Ltd., during the year joined the ranks of the producing mines and has had a successful year.

Following excellent and interesting developments, the erection of a 20-head mill and treatment plant was completed early in the year and started crushing in May, working up to a monthly output of 5,000 tons. The extraction by amalgamation was roughly $\frac{1}{2}$ ounce per ton, while the value of the tailings was a fraction over 8 dwts. The tailings treatment plant did not operate other than experimentally.

Edna May Amalgamated Gold Mines.—This group of mines, after a series of troubles succeeded in unwatering the Edna May Mine to the No. 4 Level and is successfully coping with the inflow of about 1½ million gallons per day.

Development has been commenced on three levels, attacking the deeps of the Edna May Central from the Edna May workings. It is anticipated that sufficient ore reserves will be opened up to commence production some time this year. A treatment plant with a capacity of about 4,000 tons per month has been completed and will commence operations as soon as sufficient ore reserves are opened up to ensure a regular mill supply.

A number of smaller mines in this goldfield are crushing with their own batteries and also putting through parcels for the public. Some very promising shows are being worked.

Dundas Goldfield.

The Norseman Gold Mines have made very satisfactory progress for the year. Over 70,000 tons of ore were treated and 44,000 tons of tailings were cyanided for a return of 21,420 oz. of fine gold. A vigorous development policy was continued and

£60,000 paid to shareholders in dividends. On the surface, the completion of the installation of a new agitation and filtration plant has resulted in improved extraction and reduced costs. This mine shows indications of being a steady producer for many years.

The Central Norsemen Gold Mines.—This group of mines, under the management of the Western Mining Corporation, joined the ranks of the producers in April, and to the end of the year had milled 22,364 tons of ore for a return of 5,852 ozs. of fine gold, an average of a little over 5 dwts. per ton. It is intended to increase the capacity of the plant in the near future from 3,000 to 6,000 tons per month. This group should in future be a regular contributor to the State's gold production.

The pipe line connecting the Goldfields Water Supply with Norseman was completed late in the year and will be of immense assistance to the mining industry in those districts through which it passes.

Broad Arrow Goldfield.

Ora Banda Amalgamated Gold Mines.—This group showed greatly increased productivity during the year, mining and treating 1,200 tons per month at an average head value of over 12 dwts. per ton. About 1½ years' supply of ore at this rate of crushing has been blocked out and favourable developments have occurred at the 400ft. level. Dividends were paid amounting to £20,000.

Ora Banda United Gold Mines have been developing a large low grade ore body of considerable width. It is estimated that the proved ore to date amounts to 500,000 tons.

North Coolgardie Goldfield.

The Sand Queen-Gladsome Mines at Comet Vale came into production during the year. The average monthly tonnage crushed since February has been from 700 to 800 tons for an average yield of 4½ to 5 dwts. per ton. About 110 men are employed.

Some encouraging developments have been met with and it is hoped that the plant will soon be running at its full capacity of 1,200 tons per month.

The Lady Shenton Gold Mine commenced treatment early in the year, but previous good reports as to value and quantity of ore reserves were not borne out by results. This mine produced and treated during the year between 5,000 and 6,000 tons of half-ounce ore, operating on a very reduced scale to that anticipated when the plant was installed.

The First Hit G.M., employing about 50 men, has been mining and treating about 300 tons per month of good grade ore for the year. The shoots of gold are too short for a high tonnage to be produced, but a better output than this can be expected. Work was seriously hampered by the drought and the consequent water shortage.

The Riverina G.M. has had some very satisfactory developments during the year and has reached the stage where it is considered that sufficient ore is in sight to commence production. Preparations are being made with this end in view and mining and treatment operations will start during the current year.

Puget Gold Mines of Edjudina.—This group of mines is still in the development stage. An excellent power plant has been installed and every endeavour appears to have been made to ensure comfortable

living conditions for the employees. An energetic development policy has been pursued over a length of about two miles of the productive country. Over 100 men are employed.

The *Edjudina Gold Mines at Porphyry* commenced crushing operations in February. Owing to various difficulties met with in the power and treatment units the desired output of 2,000 tons per month has not yet been attained. The mining to date has consisted of quarrying the ore out to a depth of about 20 feet, and carting to the primary jaw crusher. The product is broken down to 1/2-inch size in rolls and then passed through Marcey ball mills and over two sets of strakes.

The extraction by straking alone was not as satisfactory as was indicated by preliminary experiments, and a cyanide plant for the treatment of the tailings has been added. An average of about 70 men is employed.

Two small mines in this district that are worthy of mention are the Patricia and the Yilganie Queen, both of which have treated several large parcels of rich ore at the Yarri State Battery during the year. It is understood that the Yilganie Queen Syndicate intends shortly erecting a mill on its property.

Mount Margaret Goldfield.

The Sons of Gwalia, Ltd.—This important mine operated continuously throughout the year with the exception of a fortnight's stoppage due to a skip derailment. The Main Shaft is being sunk and is now down 4,630 feet. Larger skips were installed and slow banking gear and safety devices were put into commission, enabling the normal tonnage to be hauled at slower and safer speeds.

The Main South Drive at the No. 28 Level has been connected through to the south workings off Winze 1,010 feet South.

Developments in winzes show that values are satisfactory and living down.

On the surface, the fire service was extended; alarms were installed; and an air conditioning plant was completed.

The milling section operated satisfactorily and the water supply was augmented by crosscutting in one of the wells.

The whole of the mine shows that careful attention has been bestowed on ventilation and the safety of workings.

A total of 140,294 tons of ore was treated for 45,566 fine ounces, while 5,229 feet of development and 8,126 feet of diamond drilling were completed during the year.

Lancefield Gold Mine, N.L.—Great strides have been made on this mine during the year, both in production and in improved conditions underground. The installation of a fan having a capacity of 100,000 cubic feet per minute has made an immense improvement in the conditions and an ample supply of fresh air is now available in all parts of the mine.

In stoping, the distance between pillars has been reduced and great care is taken not to break the hanging wall. This has resulted in much safer working. Scrapers are in general use, eliminating the necessity for shovellers to work in the stopes.

Recent developments on the bottom levels indicate that the great width of the ore body is not diminishing at depth. On the No. 11 level, stripping in the

main north drive and a crosscut east have revealed a width of 42 feet on the level.

The main shaft has been sunk below the No. 12 level and development is proceeding at that level.

A diamond drill hole has cut the lode at a depth of about 2,000 feet, indicating a continuity of values to that depth.

As the values in the ore shoot are pitching rather flatly towards the north, it has been decided to sink an internal shaft, or inclined tunnel, from the No. 12 level, following the pitch of the ore. The angle of declination of this tunnel, it is estimated, will be 19 degrees, and it is intended to instal a belt conveyor by means of which the ore will be raised from the lower levels to a main ore bin at the No. 12 level. It is anticipated that this will be possible for at least 1,000 feet, and much dead work in driving in non-productive country will be eliminated.

The mill has run continuously and satisfactorily throughout the year, and the desired monthly output of 10,000 tons has been exceeded on several occasions.

The importance of this mine to the district is reflected in the fact that it provides employment for 300 men.

Gladiator Gold Mine.—This mine is rapidly approaching the production stage. The unwatering and cleaning up of old workings is practically complete and development is being energetically pushed ahead. Development and diamond drilling results are considered sufficiently encouraging to warrant the erection of a treatment plant in the near future.

King of Creation.—This mine was taken over early in the year by the Anglo-Australian Gold Development, Ltd. Production was started early in the year with a dry crushing plant fed by a flying fox from an open-cut. The capacity of this plant was estimated at 2,000 tons per month, but this figure has never been attained.

It is intended to change over to wet crushing for the current year.

All ore mined has been above the 100ft. level and has been very low grade. A start has been made to sink several winzes below this level. The result of this development should be very interesting.

Cox' Find.—The Western Mining Corporation erected a plant on this important new mine including a 10-head mill and cyanide plant, winding engine, power plant, change rooms and office buildings, and production has been in full swing since June. Up till the end of December 6,999 tons had been mined and treated for a return of 6,411 ozs. of fine gold.

Recent developments on the 200ft. level have proved the ore body to continue at that horizon both in width and value. Employment is provided for about 70 men.

East Murchison Goldfield.

Wiluna Gold Mines, Ltd.—In the main mine, the main shaft has been continued to the 1,800ft. level. The 1,600ft. level is being rapidly developed and stoping operations are in progress above the 1,400ft. level. Both east and west lode shears are being explored at and below the 1,800ft. level. A 9ft. x 9ft. air shaft is being sunk for ventilation purposes. A fan will be installed at the collar of this shaft and it is hoped by this means that a satisfactory ventilation system will be obtained for the whole mine.

At the Bulletin Mine the shaft has reached the 800ft. level, where exploratory work is in progress.

On the Happy Jack Lease, the shaft was deepened to the 275ft. level and exploratory work was completed at this horizon. The shaft is now being sunk to the 400ft. level to test the ore exposures developed at the 275 feet.

The treatment plant, which had been extended to treat ore from the Moonlight leases, operated at maximum capacity throughout the year. The smelting plant was completed and brought into operation in September, 1936. Portion of the gold-bearing calcine is being treated in the smelting section, but the change over to the all-smelting programme will not be completed until the current year.

Extensive plant construction was undertaken during the year. The power house was extended, and two additional 1,100 h.p. Diesel units erected. The extension in the milling section called for an additional water supply. This has been provided for by extending the supply system in the eastern basin and developing a new supply four miles to the west of the mine.

The average monthly output for the year was 48,500 tons of an average assay value of 5.2 dwts. per ton. The Bulletin Mine contributed an average of 6,000 tons per month. A small tonnage was won from developmental and prospecting work on the Happy Jack Mine. The average number of men employed during the year was 1,170.

The Moonlight-Wiluna Mine.—The Adelaide shaft was sunk 227 feet to a total depth of 705 feet. No. 3 level was opened up at the 630ft. horizon. A steel head frame and 200 ton shaft ore bin were erected.

The 250 h.p. Ward-Leonard winder was completed and put into operation during June, and a change made from cage to skip hoisting. The capacity of the skips is three tons.

Stoping was commenced during May, and by September a monthly output of 8,000 tons was attained.

Development figures for the year were as follows:—Shaft sinking 227 feet, driving 4,770 feet, crosscutting 648 feet, rising and winzings 2,852 feet, and diamond drilling 3,833 feet.

The Primary crushing plant, consisting of 30in. x 18in. jaw crusher (Ruwolt), with 100 h.p. motor; 4ft. Symons cone crusher, with 100 h.p. motor, gyratory screen magnet conveyor system; 200 ton storage bin, and sample plant were completed and crushing started towards the end of April. A total of 58,000 tons was crushed and transported to the reduction plant at Wiluna Gold Mines, Ltd.

A total expenditure of £175,030 was incurred during the year.

Youanmi Gold Mines.—During the year development figures were:—Shaft sinking 600 feet, driving and cross-cutting 4,129 feet, rising and winzings 420 feet, diamond drilling 515 feet. P. shaft has been unwatered down to 300 feet, and stoping and driving is in progress on Nos. 2 and 3 levels. A three-throw electric Ruwolt pump is installed on the No. 3 level, and the main shaft has been unwatered and reconditioned to a depth of 300 feet.

The power plant consists of two alternating sets, 800 h.p. vis-à-vis type, direct coupled to a m.v. alternator 500 k.w., and one combined Diesel engine and Reaver compressor.

The main shaft is equipped with 150 h.p. Ruwolt electric winder and P. shaft with a similar type of 100 h.p.

The treatment plant consists of a Ruwolt jaw crusher 30in. x 24in., Ross feeder and Symons cone crusher, two ball mills 6ft. 6in. x 6ft., and two tube mills 5ft. 6in. x 11ft. The plant is treating approximately 4,500 tons monthly.

The Emu Gold Mines at Lawlers have practically completed the cleaning up of the old workings, and are engaged in development and diamond drilling. Results have been encouraging, and arrangements are in hand for the erection of a treatment plant.

The main shaft has been sunk a further lift to the random of the 700ft. level. A number of small shafts are being sunk along the line of lode with the object of picking up values located by diamond drilling.

This mine at present provides employment for about 120 men.

Murchison Goldfield.

Triton G.M.—Development for the year amounted to shaft sinking 227 feet, driving and cross-cutting 1,619 feet, rising and winzings 1,021 feet, and diamond drilling 436 feet. This work was carried out on all levels, but was chiefly directed to the opening up of the mine to greater depth.

Electric locomotive haulage was in operation on the 300ft. level and has given a satisfactory performance. The tonnage treated amounted to 77,757 tons for a return of 27,700 fine ozs. The average number of men employed was 184.

Big Bell Gold Mine.—During 1935 this ground was thoroughly sampled and in January, 1936, the option was exercised and construction work began.

Designs were drawn and all material ordered for a counter current decantation cyanide mill capable of handling 1,000 tons of ore per day. The design embodies the latest features of metallurgical practice and the machinery is all of the most modern type. The buildings are to be all steel frame work covered with galvanised iron.

All excavations for mill buildings are complete and all concrete foundations for structures and machinery have been poured. A large quantity of machinery is on the site and ready for installation.

The erection of the power house is completed and No. 1 engine is set up. A compressor of 2,000 cubic feet capacity, driven by a 400 h.p. motor is set up. A cooling tower and circulating water system for the power house is practically complete.

A craneway and outside gantry altogether 800 feet in length connect and serve mill, machine shop and power house. A 15-ton electric crane, 46 feet span, is installed and working.

A two-storey concrete office building is complete and occupied. Quarters for 250 men in the form of 125 huts and a boarding house capable of accommodating 225 men are completed. Various staff residences are also complete.

In December the Railway Department completed the laying of rails from Cue and freight is now being delivered direct to Big Bell, although further ballasting is necessary.

The main shaft, a five compartment one, was sunk and timbered to a depth of 80 feet. The development is well advanced, some of the glory hole rises having been completed.

Six wells have been sunk, practically assuring an ample water supply for domestic and milling requirements. It is estimated that 500,000 gallons per day will be required.

It is anticipated that milling operations will commence late in 1937.

Hill 60 Gold Mine.—Development work was carried out during the year comprising 1,537 feet of driving and crosscutting, 539 feet of winzing and rising and 344 feet of diamond drilling. The tonnage treated for the year was 50,000 for a return of 10,440 ozs. of fine gold. The ore, after passing through a 14in. by 10in. jaw crusher and being further broken down to lin. mesh by a set of rolls, is fed into a 6ft. by 5ft. Ruwolt Ball Mill. The discharge passes over corduroy strakes where about 30 per cent. of the gold is recovered. The strakes discharge is passed into a Dorr Classifier and the overflow treated in agitating vats and passed through a Moore type filterpress.

Yalgoo Goldfield.

Rothsay Gold Mines.—There were no underground operations on this property during the year, pending the installation of a new treatment plant. Work was commenced on this plant towards the end of the year.

Pilbara Goldfield.

The Comet Gold Mine, near Marble Bar, was acquired late in the year by the Great Boulder Mining and Finance, Ltd. This is probably the most important find for the year, phenomenally rich values having been encountered down to the 60ft. level. It is claimed that the average value of the ore to date is over 5 ozs. to the ton.

A 10-head mill was acquired and put into commission at Marble Bar to treat the oxidised ore by amalgamation only. The residues, containing half of the gold content of the ore, are paddocked for future treatment by cyaniding. The even distribution of fine gold and continuation of high values in the sulphide ore are considered favourable indications of the probable persistence of gold values at greater depths.

The Lalla Rookh Gold Mine was taken up by the Meekatharra Gold Mines, Ltd., and commenced operations in August, 1936. The two shafts were reconditioned to water level and a compressor with 110-120 h.p. National engine installed.

Unwatering started early in November and was completed by the end of the month. The unwatered parts of the mine were sampled, but no development work was done to the end of the year.

COAL MINING.

Coal was produced during the year from five mines, all situated at Collie, viz.:—The Proprietary, Co-operative, Cardiff, Stockton, and Griffin.

The total output from these mines was 565,075 tons, valued at £321,564, an increase of 36,221 tons over the production for 1935. The average number of men employed was 768, being 79 more than the average number for the previous year.

One serious industrial dispute at the Co-operative Mine resulted in a cessation of work on all the mines for a period of 10 days.

Development work on all the mines has been satisfactory and a fair area of coal bearing country has been proved. A considerable amount of faulting has been encountered, retarding progress to a great extent by reducing the available number of working places.

Boreholes ahead of the workings have proved the continuation of the coal seams beyond these faults at workable depths.

METALS AND MINERALS OTHER THAN GOLD AND COAL.

The production of metals and minerals other than gold and coal, although comparatively small, showed a slight upward general tendency. Arsenic from the Wiluna Gold Mines was again the most important of these, the total value being £62,460, or £4,648 less than in 1935.

As shown in Part 11, Table 1 of the Report of the Under Secretary for Mines, there were increases in the value of production of tantalite, lead, felspar, gypsum, and asbestos, and also in the quantity, though not the value of silver.

GENERAL.

The value of the Gold Mining Industry to the State will be appreciated from the following figures:—

Value of gold exported	£7,373,539
Value of wool exported	£4,593,430
Value of wheat exported	£3,027,593

It is pleasing to be able to record that the value of the gold won in 1936 was no less than £1,751,008 in excess of that in 1935, whereas in 1929 the total value of gold won was only £1,580,426.

The increase for the year under review was due partly to the increased production of the principal producers and partly to the fact that a number of additional mines reached the productive stage. Amongst these may be mentioned:—The Youanmi G.M., the Moonlight Wiluna, the King of Creation, Cox's Find, Yellowdine Gold Development, Marvel Loch, Sand Queen, Edjudina, Celebration, and Lady Shenton and Central Norseman.

The important find of the year was the Comet Mine at Marble Bar, which up to the present has proved to be phenomenally rich.

Extensive development work has been carried out and considerable plant construction has been in evidence, notably at the Wiluna Gold Mine, where the existing cyanide plant has been replaced by a smelter and at the Big Bell Mine where a large modern plant is in progress.

There is every reason to anticipate that our maximum production has not been reached and that the output for 1937 will be higher again than that for 1936.

I will conclude by again expressing my appreciation of the work performed by my staff and the assistance rendered by all officers of the Department.

RICHARD C. WILSON,
State Mining Engineer.

APPENDIX No. 1.

MINING DEVELOPMENT EXPENDITURE.

	£	s.	d.		£	s.	d.	£	s.	d.
Advances outstanding, 31st December, 1936 :				Interest paid prior to 1936	...			26,539	15	6
Advances authorised prior to 1936	...	241,790	4	5	Interest paid during 1936	...		203	11	0
Advances authorised during 1936	...	1,890	0	0				£26,743	6	6
		£243,680	4	5						
Principal Moneys Advanced :				Interest outstanding at 31st				7,926	6	2
Prior to 1936	...	217,225	1	7	December, 1935	...				
During 1936	...	2,831	12	4				£8,558	16	0
		£220,056	13	11	Interest outstanding at 31st					
Principal Moneys Repaid (including Sale of				December, 1936	...					
Securities)—										
Prior to 1936	...	53,827	2	1	Principal Moneys Advanced	...		220,056	13	11
During 1936	...	729	5	1	Less Principal Moneys re-					
		£54,556	7	2	paid	...	54,556	7	2	
					Less Bad Debts written off	150,761	6	5		
Bad Debts written back and amounts trans-								205,317	13	7
ferred—					Principal outstanding at 31st					
Prior to 1936	...	150,683	10	2	December, 1936	...		14,739	0	4
During 1936	...	77	16	3	Interest outstanding at 31st			8,558	16	0
		£150,761	6	5	December, 1936	...				
								£23,297	16	4

APPENDIX No. 2.

Coal Mines Regulation Act, 1902-1926.

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

Office of the State Mining Engineer,
Mines Department,
Perth, 10th April, 1937.

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 1936.

Examinations for Certificates.

April Examination.—One candidate sat for the examination for First-class Certificate of Competency, and on consideration of the papers, the Board decided that his papers warranted a certificate being issued to him.

October Examination.—Three candidates sat for the First-class Examination, and the Board decided that First-class Certificates of Competency should be issued to the three candidates.

Meetings.—Two meetings of the Board were held, viz., on 17th April, 1936, and 29th October, 1936, to

consider the papers; Messrs. R. C. Wilson (Chairman), F. G. Forman, and J. McVee being present at each meeting.

Copies of the papers set for the examinations during the year are attached to this report. These papers were exchanged with kindred boards in England and the Eastern States.

We have the honour, etc,

RICHARD C. WILSON,
State Mining Engineer (Chairman).

F. G. FORMAN,
Government Geologist (Member).

JAS. McVEE,
Inspector of Mines, Collie (Member).

The Coal Mines Regulation Act, 1902-1926.
EXAMINATION FOR FIRST CLASS CERTIFICATE
OF COMPETENCY.

Subject: ARITHMETIC.

6th April, 1936: 9 a.m. to 11 a.m.

(1) A mine pump lifts 450 gallons per minute while running. After the pump has been standing 3 hours it runs 10 hours to reduce the water in the sump or standage to the same level as at the beginning of the 3 hours stoppage. What is the feeder or growth of water per minute? (Possible Marks, 17.)

(2) A dealer buys 100 tons of coal at 38/6d. per ton; of this he sells 81 tons at 45/9d. and the balance at an average of 27/3d. per ton. Find what percentage

profit he makes on the transaction, and the average profit per ton. (Possible Marks, 17.)

(3) Calculate the quantity of coal in an area of 5 acres 3 roods 20 poles in a seam dipping 1-9 and 6 feet thick. Specific gravity 1.280. (Possible Marks, 16.)

(4) A small coal box 140 feet long, 42 feet wide, and 24 feet high is filled to a point when the peak of the coal is level with the top of the box and up to 11 feet from the top all along both sides and ends. What is the tonnage of small coal stored, assuming that a cubic foot of coal weighs 50 lbs.? (Possible Marks, 17.)

(5) A man worked a certain number of days in a month. Half the time he averaged 15/- per day, one-quarter the time he averaged 18/- per day, and in the

remaining 6 days he earned £5 12/-. What was his pay for the month, and what was his average daily earnings? (Possible Marks, 17.)

(6) A colliery produces 950 tons of coal per shift with an average wages cost of 10/6d. per ton. The introduction of conveyors has reduced the number of men employed by 50, whose average wage was 11/3d. per shift. What is the percentage reduction of the wages cost effected by the change? (Possible Marks, 16.)

Subject: GEOLOGY.

6th April, 1936: 11 a.m. to 1 p.m.

- (1) Define the following:—
Syncline; unconformity; contemporaneous erosion; heave of a fault; cleat.
Illustrate your answers with diagrams. (Possible Marks, 15.)
- (2) Describe the various types of coal. What do you know of their occurrence in Australia? (Possible Marks, 20.)
- (3) Describe and illustrate with diagrams the various effects of faults on sedimentary strata. (Possible Marks, 25.)
- (4) Describe the geology of some coal-field with which you are familiar. (Possible Marks, 20.)
- (5) What is the importance of fossils in the search for and development of coal or other minerals? Name and briefly describe the characteristic fossils of the Collie Coal measures. (Possible Marks, 20.)

Subject: MACHINERY.

6th April, 1936: 3 p.m. to 5 p.m.

- (1) Give a list of the fittings and mountings that it is usual to have on a Lancashire boiler, including everything that is attached to the boiler shell, and state briefly the purpose of each item. What is a deadweight safety valve? (Possible Marks, 17.)
- (2) Describe the various steps that can be taken to economise the consumption of steam and coal at a colliery. Mention the kinds of plant that are installed for that purpose, and briefly describe any two of them. (Possible Marks, 17.)
- (3) Show, by sketches, how you would mount a screen 20 feet long and 4 feet wide so as to enable it to shake or reciprocate lengthwise. Show also the mechanism for producing the shaking. (Possible Marks, 16.)
- (4) How would you instal a lin. diameter wire rope on a new level endless rope haulage system? The engine is near the shaft bottom, and the return wheel is about 1,000 yards inbye. (Possible Marks, 16.)
- (5) What kind of pumping plant would you adopt for raising 100 gallons of water per minute to a height of 150 feet? The plant is to be placed in a remote part of the workings in a damp situation, and will have to stand idle at intervals whilst a large standage fills from a small feeder. Either electric power or compressed air is available. Give reasons for your choice. (Possible Marks, 17.)

- (6) In connection with electric power—
(a) How can you obtain direct current at 440 volts from a 3-phase 50 cycle current at 3,300 volts?
(b) How can you obtain 3-phase 50 cycle alternating current at 400 volts from 3-phase 50 cycle current at 3,300 volts?
(c) How can you obtain 25 cycle current from 50 cycle current, both being 3-phase at, say, 660 volts?
- Describe, in a few words, each type of plant you mention. (Possible Marks, 17.)

Subject: MINING OF COAL.

7th April, 1936: 10 a.m. to 1 p.m.

- (1) Write a report on the different methods of hauling coal underground from the face to the gantry. State the advantages and disadvantages of each method. (Possible Marks, 25.)
- (2) A district in a mine which has been sealed off in consequence of a fire is to be re-opened and recovered. What considerations should be taken into account before re-opening the district, and what precautions should be taken during the operations? (Possible Marks, 25.)

(3) If you have to work two seams of coal each 6 feet thick with 40 yards of shale and sandstone intervening, the upper seam being at a depth of 350 yards from the surface, state which seam you would work first, and also after what interval of time you would commence to work the second. Give reasons for your answers. (Possible Marks, 25.)

(4) What considerations would influence you in deciding the system of working coal, longwall or bord and pillar. Sketch the different methods of supporting the roof in a longwall face. (Possible Marks, 25.)

(5) The roof in a roadway is very heavy, and the bars are badly broken—the size of the roadway is squeezed to 8 feet wide and 4 feet 6 inches high. Show in detail how you would enlarge to 12 feet wide and 7 feet high, and how you would protect the workmen during the operation. Traffic to be sent along the road by a single line of rails for 7 hours each day. (Possible Marks, 25.)

(6) State fully the precautions you would take, both in the working faces and on the roadways, to reduce as far as possible accidents due to falls of roof and sides. (Possible Marks, 25.)

(7) Name the materials which are most liable to ignite easily or spontaneously that are in common use in coal mines, and state what precautions should be taken to prevent such dangers. (Possible Marks, 25.)

(8) In a seam 14 feet thick you have the choice of working—

- (a) Taking the lower 6 feet forward and bringing back the tops.
(b) Taking the lower coal forward, subsequently the top coal in the same direction.
(c) Working the top coal forward slightly in advance of the bottoms.

Which method would you adopt as the safest? (Possible Marks, 25.)

Subject: SURVEYING.

7th April, 1936: 2 p.m. to 4 p.m.

- (1) State the adjustments of a Dumpy level and a theodolite. Give reasons for each adjustment and the order in which they are made. (Possible Marks, 30.)
- (2) From the following data, draw up a page of a level book, reduce the levels, and show checks on your calculations:—

Back Sight.	Inter-mediate Sight.	Fore Sight.	Distance.	Remarks.
9.02	feet.	BM. RL 106.08
	6.76	...	0	
7.84	...	4.32	75	
	3.27	...	100	
	9.04	...	134	
	7.53	...	150	
2.02	...	1.65	185	
	5.71	...	200	
4.63	...	7.34	240	
	2.08	...	300	
	...	7.45	362	
			400	B.M.

- (Possible Marks, 25.)
- (3) From the data given in Question 2 determine graphically the cut and fill required at the various points on a grade between the two bench marks. (Possible Marks, 25.)
- (4) Describe how you would set out on the ground, and show full calculations for, a circular curve of 20 chains radius, with chords of 1 chain. The angle of intersection of the tangents is 120 degrees. (Possible Marks, 25.)
- (5) The centres of two shafts, A and G, are joined by the traverse set out below. Calculate the length and azimuth of the line joining the two centres.

Line.	Azimuth.	Distance. Links.
AB	357° 26'	71.6
BC	352° 32'	355.5
CD	315° 20'	189.8
DE	23° 43'	420.5
EF	47° 37'	327.7
FG	52° 19'	86.0

(Possible Marks, 25.)

(6) What are the magnetic bearings of the lines in the traverse in Question (5), assuming that the magnetic declination is $4^{\circ} 30'$ west?; assuming that the magnetic declination is $3^{\circ} 20'$ east?

(Possible Marks, 20.)

Subject: VENTILATION AND DANGEROUS GASES.

8th April, 1936: 10 a.m. to 1 p.m.

(1) Name and describe the three principal appliances made use of in splitting and distributing the air in a mine, excluding brattice cloths of every kind from the category, as their use at various points will be taken for granted. Having split the air, how would you proceed to ascertain whether the two or more splits into which you have divided it were sufficient for their respective districts, and if you found one or more to be insufficient, how would you remedy the defects?

(Possible Marks, 25.)

(2) Owing to the gradual extension of the workings of a mine, the efficiency of the ventilation is falling off, and the cost increasing. State what investigations you would make and what remedies you would apply to improve matters.

(Possible Marks, 25.)

(3) It is proposed to make a permanent air crossing not far from the pit bottom. Sketch in plan and sectional elevation the type you would construct, giving principal dimensions and kind of material you would use in construction.

(Possible Marks, 25.)

(4) The fan drift is 12ft. 6in. x 10ft. 6in. wide. If the average velocity of the air is 1,200 feet per minute, calculate the quantity. If the water gauge is 4 inches, what is the horse-power of ventilation? What horse-power would you instal to ensure that the fan gives this quantity?

(Possible Marks, 25.)

(5) Describe the physical and chemical properties of Carbon Monoxide. State how it is formed in general, and how it may be formed in mines. How does its presence in the air affect men who breathe it, and how can its presence be best detected?

(Possible Marks, 25.)

(6) Describe minutely how you would proceed to remove firedamp from a large area of workings which has, owing to some special cause, become completely filled with that gas. Make use of sketches, where necessary, to illustrate your meaning.

(Possible Marks, 25.)

(7) What is the cause of spontaneous heating of coal? How is the presence of heating detected, and what steps should be taken immediately heating is discovered?

(Possible Marks, 25.)

(8) Describe the steps to be taken by a foreman or deputy on receiving a report of the presence of inflammable gas in a working place in his district.

(Possible Marks, 25.)

Subject: COAL MINES REGULATION ACT, 1902-1926.

8th April, 1936: 2 p.m. to 4 p.m.

(1) What are the requirements of the Coal Mines Regulation Act, as to reporting accidents fatal, serious, and minor, in or about a mine?

(Possible Marks, 22.)

(2) To what scales may colliery plans be made? State the information to be shown on such plans.

(Possible Marks, 21.)

(3) In what manner have the provisions of the Coal Mines Regulation Act and Regulations to be made known and published?

(Possible Marks, 21.)

(4) How are stoppings between the Main Intake and Main Return airways to be constructed to comply with the Act?

(Possible Marks, 21.)

(5) Describe the provisions of Regulations as to the capacity and nature of the accommodation to be provided at mines at which facilities for taking baths, and drying clothes, have to be provided.

(Possible Marks, 22.)

(6) When approaching old workings which contain dangerous accumulations of water what precautions should be taken?

(Possible Marks, 22.)

(7) What are the provisions of the Coal Mines Regulation Act, with respect to the payment of wages to workmen?

(Possible Marks, 21.)

Subject: ARITHMETIC.

Wednesday, 21st October, 1936: 9 a.m. to 11 a.m.

(1) A water sump at the shaft bottom is 25 feet deep and 20 feet in diameter. No. 1 Pump can fill it in 12 hours, and No. 2 Pump can fill it in 14 hours. What is the unfilled cubical contents of the sump after both pumps have been running $5\frac{1}{2}$ hours?

(Possible Marks, 17.)

(2) A dam has a catchment area of 15 square miles. How many gallons of water will flow into this dam as the result of 2.64 inches of rain, allowing 15 per cent. of the rain water to soak into the ground?

(Possible Marks, 16.)

(3) On a mine plan drawn to a scale of two chains to an inch, a point A is 12 inches due East from the shaft; a point B is 9 inches due South from the same shaft. What would be the length of a drive to connect A to B and what is the area of the triangle thus formed?

(Possible Marks, 17.)

(4) A week's output of 7,560 tons is obtained from solid and pillar workings in equal proportions. The total amount paid for hewing was £1,212 15s. 0d. What are the respective tonnage rates if pillar coal is 3d. per ton less than solid coal.

(Possible Marks, 17.)

(5) A haulage rope cost £220 and was used for three years of 240 days each. The coal hauled averaged 440 tons per day. What was the cost of the rope per ton of coal hauled?

(Possible Marks, 16.)

(6) In a coal-bearing area of 300 acres there is a clean seam 13 feet 6 inches thick. The specific gravity of the coal is 1.28. Calculate the quantity of coal in the area. Assuming that 25 per cent. of the coal is lost in mining, what is the tonnage obtained?

(Possible Marks, 17.)

Subject: GEOLOGY.

Wednesday, 21st October, 1936: 11 a.m. to 1 p.m.

(1) Describe briefly the nature and occurrence of the following rocks:—Granite, epidiorite, conglomerate, laterite, sandstone, shale. Write brief notes on the occurrence of these in the Colliie area.

(Possible Marks, 20.)

(2) If a fault were met with in a coal seam, how would you determine its nature and the direction of displacement? Illustrate the various possibilities with diagrams.

(Possible Marks, 20.)

(3) Define the following:—Strike, anticline, unconformity, cleavage, throw and heave of a fault.

(Possible Marks, 20.)

(4) Write notes on the origin and classification of coals.

(Possible Marks, 20.)

(5) Write a brief comparison of the geology of the Colliie Coalfield with the Newcastle Coalfield in New South Wales.

(Possible Marks, 20.)

Subject: MACHINERY.

Wednesday, 21st October, 1936: 3 p.m. to 5 p.m.

(1) Make a sketch showing a main and tail system of haulage with three branch roads. Show how each branch rope is operated and also the arrangements for the return wheel and the flat on the inbye end. The seam of coal is nearly level.

(Possible Marks, 17.)

(2) A direct rope haulage cannot deal with the required output, and it is not desirable to increase the rope speed or the number of skips on a set.

Still maintaining the same system, what arrangements would you make in order to increase the output, the incline being of sufficient width to allow an extra track to be laid? Give details of the lay-out of the gantry for this purpose.

(Possible Marks, 17.)

(3) What is meant by "priming," "pitting," and "grooving," where steam is generated and used? State the cause of these evils, and say what can be done to remedy them.

(Possible Marks, 16.)

(4) How would you instal a wire haulage rope 3 inches in circumference on a new level endless rope haulage road. The hauling gear is at the shaft bottom and the return wheel is 1,200 yards inbye.

(Possible Marks, 16.)

(5) You have two districts in a mine each consisting of thirty 8-yard bords 8 feet 6 inches high. You propose to instal electric coal cutters and borers to cut and bore all the coal. The districts are three-quarters of a mile from the surface, and no electric current is at present underground. Give you views on the plant necessary to do the work you require. (Possible Marks, 17.)

(6) Describe an endless rope haulage engine, the power being either steam or electric. (Possible Marks, 17.)

Subject: MINING OF COAL.

Thursday, 22nd October, 1936: 10 a.m. to 1 p.m.

(1) An important road in constant use is 200 yards long, 7 feet high and 14 feet wide and is supported by timber. Above the timber are soft strata 6 feet thick lying under hard sandstone. As the soft strata are giving considerable trouble it is decided to lift the road so that the sandstone becomes the roof of the road. Explain in detail how you would do this. (Possible Marks, 25.)

(2) Two dip headings meet a large down throw fault running at right angles to their direction. How would you prove the extent of the fault, and what data would be of service to you in so doing? In which heading would you carry out this work? (Possible Marks, 25.)

(3) An endless rope haulage is hauling from the full dip on a grade of 1 in 10. At one point it is necessary to take the coal from two districts from headings directly opposite one another. Show by sketches the lay-out of tracks. (Possible Marks, 25.)

(4) Show by sketches how you would timber a main roadway 12 feet wide and 8 feet high, where—

- (a) Roof and sides are friable.
(b) Sides and floor hard with friable roof.
(c) Sides hard with friable roof and floor.

(Possible Marks, 25.)

(5) A vertical shaft 8 feet by 5 feet and 150 feet deep has to be enlarged for its full depth to a finished size of 14 feet by 8 feet. Sketch and describe the method of re-sinking and re-timbering the shaft. (Possible Marks, 25.)

(6) Describe fully how you would put down a bore hole 50 yards deep from an underground roadway whose normal dimensions are 10 feet wide by 6 feet high. Give details of the various tools you would require. (Possible Marks, 25.)

(7) Describe the different methods with which you are acquainted of putting down a bore hole from the surface starting at 10 inches and going down to a depth of 700 feet. (Possible Marks, 25.)

(8) A district under ground under your charge shows an abnormally large number of accidents from falls of roof and sides. You are instructed to investigate and report on the cause and the means which could be adopted to reduce the accident rate. Explain how you would proceed to investigate and write a report on the result of your investigations. (Possible Marks, 25.)

Subject: SURVEYING.

Thursday, 22nd October, 1936: 2 p.m. to 4 p.m.

(1) A and E are two plumb lines hanging in separate shafts. The true azimuth of the line AE at the surface is $345^{\circ} 15'$. From the data below which represents an underground traverse joining the two shafts, calculate the true azimuth of the lines in the traverse.

Line.	Distance.	Assumed Azimuth.
AB	985 feet	150°
BC	540.4 feet	90°
CD	1,210 feet	45°
DE	327.3 feet	300°

(Possible Marks, 25.)

(2) Describe and illustrate with a diagram the laying out of a circular curve of 20 chains radius, with chords of 1 chain, the angle of intersection of the tangents being 110° . It is not possible to set out the whole curve from the first tangent. Give the deflection angles for the first three sites and for the short chord at the end. (Possible Marks, 25.)

(3) State the requirements of a dumpy level which call for the making of adjustments, and describe fully how you would make the line of collimation coincide with the axis of the telescope. (Possible Marks, 25.)

(4) From the following data in a level book reduce the levels and show checks of your calculations.

Station.	Back Sight.	Inter-mediate Sight.	Fore Sight.	Distance.	Remarks.
BM ...	9.71	...	...	feet.	Height of BM
...	...	3.15	...	100.0	100.34 feet.
...	7.43	...	0.23	200.0	
...	...	4.17	...	300.0	
...	11.72	...	1.76	350.0	
...	...	3.56	...	400.0	
...	...	...	6.38	500.0	

(Possible Marks, 25.)

(5) A, B, and C, are three points, on a seam the reduced levels of which are 435, 500, and 670 respectively. A to B is N. 35° W. 350 feet; B to C is N. 87° E. 275 feet. Find graphically the strike and dip of the seam. (Possible Marks, 25.)

(6) The azimuths of the three sides of a triangular enclosure, of which the side AC measures 940 feet, are respectively as follows:—

AB	347° 25' 30"
BC	77° 25' 30"
CA	227° 25' 30"

Calculate the length of the sides AB and BC and the area of the enclosure in acres. (Possible Marks, 25.)

Subject: VENTILATION AND DANGEROUS GASES.

Friday, 23rd October, 1936: 10 a.m. to 1 p.m.

(1) If a fan is passing 120,000 cubic feet of air per minute through a mine with a water gauge of 1.5 inches what would be the water gauge if the fan was speeded up to pass 180,000 cubic feet of air per minute? (Possible Marks, 25.)

(2) Owing to the gradual extension of the workings, the ventilation of a mine is found to be barely satisfactory at times. State as fully as you can what investigations you would make, and what results you would anticipate from each of these investigations. State what steps you would take to improve matters. (Possible Marks, 25.)

(3) A main road in an 8ft. seam of coal is 12ft. wide, the roof consists of 4 feet of strong sandstone above which is a coal seam with several bands of stone in it. It is desired to construct an air-crossing across the main road, to pass 50,000 cubic feet of air per minute at a velocity of 10 feet per second. Sketch the size of air-crossing you would build to carry the above quantity of air, and state the materials required for its construction. (Possible Marks, 25.)

(4) In some places booster fans are used in the mines to supplement the main ventilating fan. Give fully your views on the advantages and disadvantages of these booster fans. State where you would place them, and how you would drive them. (Possible Marks, 25.)

(5) State the different causes which tend to increase or decrease the quantity of fire damp produced in a mine at any given time. From what source is fire damp derived. (Possible Marks, 25.)

(6) Describe the various gases met with in coal mines, and state how you would proceed to test a working place for fire damp. (Possible Marks, 25.)

(7) In some mines when winning headings are being driven, sudden outbursts of gas occasionally occur. What is the cause of these outbursts? What would you do to prevent or minimise the effects? (Possible Marks, 25.)

(8) Do you consider that explosions can occur in collieries in which fire damp has never been detected? If so, what are the conditions necessary? Discuss fully what steps you would take to counteract such a happening. (Possible Marks, 25.)

Subject: COAL MINES REGULATION ACT,
1902-1926.

Friday, 23rd October, 1936: 2 p.m. to 4 p.m.

- (1) An overcast has to be made over a dry and dusty haulage road and shots have to be fired in the brushing. What are the provisions in the Act relating to the firing of the necessary shots? (Possible Marks, 21.)
- (2) Explain the requirements of the Coal Mines Act as to the provision of means of ingress to and egress from the mine, and particularly the exceptions permitted. (Possible Marks, 22.)
- (3) Draw up a list of the inspections and examinations underground that are required by the Coal Mines Act. (Possible Marks, 22.)
- (4) To what scale may Colliery Plans be made? State the information to be shown on such plans? (Possible Marks, 21.)
- (5) What does the Act require with regard to—
 - (a) Division of a mine into parts, and
 - (b) The provision of manholes? (Possible Marks, 21.)
- (6) How should accumulations of water and sealed areas be approached to comply with the Act? (Possible Marks, 21.)
- (7) State the provisions of the Coal Mines Act regarding the storage and treatment of Explosives above and below ground. (Possible Marks, 22.)

APPENDIX NO. 3.

Mines Regulation Act, 1906.
(Regulation 17A.)

EXAMINATION FOR CERTIFICATE OF COMPETENCY AS UNDERGROUND SUPERVISOR.

Subject: MINING.

20th May, 1936.

Time allowed—Three hours.

Eight questions only to be answered.

- (1) Compare the various methods of taking the water out of a mine, and state the conditions under which you consider each method suitable. (Possible Marks, 25.)
- (2) Describe, with sketches, the usual machine cuts used on the Western Australian Goldfields for sinking, driving, and stopping. Show also the order of firing the holes bored. (Possible Marks, 25.)
- (3) A vertical three-compartment shaft is to be sunk from 1,000 feet to 1,200 feet. How would you carry this out without stopping the hoisting of ore from the 1,000 feet and upper levels? (Possible Marks, 25.)
- (4) A wide stope has been opened up for a length of 1,000 feet. Describe the method of filling—
 - (a) flat back system;
 - (b) rill stope system. (Possible Marks, 25.)
- (5) You are instructed to sink a prospecting shaft 6 feet by 4 feet in an isolated locality. Give a list of tools and equipment, number of men you would take with you, and describe the work briefly. (Possible Marks, 25.)
- (6) In driving hard ground the drive is 7 feet by 5 feet and is being driven on the lode formation. Give details of a suitable rock drill. Show how you would bore a cut and to what depth each hole should be bored. Describe the method you would adopt in charging and firing the holes. What explosive would you use? Give your reason. (Possible Marks, 25.)
- (7) Describe a shrinkage and sand-filled system of mining ore. (Possible Marks, 25.)
- (8) If the hanging wall of a lode channel 12 feet in width is found to be soft, what precautions would you recommend for its safe working? (Possible Marks, 25.)
- (9) At what speed does an ordinary fuse burn, and what, in your opinion, causes misfires? (Possible Marks, 25.)
- (10) What apparatus is required to ventilate a dead end, and how should it be placed? (Possible Marks, 25.)

Subject: MINING LAW.
20th May, 1936.

Time allowed—One and a half hours.

All the questions to be answered.

- (1) What provision is made in the Regulations for the safety of men working alone? (Possible Marks, 17.)

- (2) What is the permissible rate of burning of safety fuse? How should fuse be tested to ascertain the burning rate? (Possible Marks, 17.)

- (3) State the requirements of the Mines Regulation Act in regard to storage and handling of explosives in mines. (Possible Marks, 17.)

- (4) State the requirements of the Mines Regulation Act in connection with dust, health, and sanitation in mines. (Possible Marks, 17.)

- (5) What action should be taken by a mine manager in the case of—

(a) an accident causing loss of life or personal injury;

(b) driving to connect to an old mine full of water? (Possible Marks, 16.)

- (6) What does the Act require in the case of a pass hanging up? (Possible Marks, 16.)

Subject: MINING.

13th October, 1936.

Time allowed—Three hours.

Eight questions only to be answered.

- (1) Describe the methods you would adopt in preparing and working a flat back stope. (Possible Marks, 25.)

- (2) Give sketches of the timbering in the following, showing clearly the method of cutting the joints:—

(a) a shaft frame set;

(b) a square set for a level;

(c) an ordinary set for a level.

(Possible Marks, 25.)

- (3) Describe, with sketches, the arrangements you would make for hoisting and disposing of the load of a kibble in an underlay shaft, and how you would ventilate the shaft? (Possible Marks, 25.)

- (4) Explain, by means of a diagram, how you would bore the cut in a drive in hard ground. Give the depths of the holes in each round and state the quantity of explosive you would use. (Possible Marks, 25.)

- (5) Explain how you would take out the last stope under the floor of a level, and, with the aid of a sketch, explain how you would secure the level timbers. (Possible Marks, 25.)

- (6) State how you would sink the first 100 feet and open out a plat for a shaft 12 feet by 4 feet inside timbers. What method would you adopt in (a) hard country, (b) soft country? (Possible Marks, 25.)

- (7) A shaft has been sunk and timbered with frame sets; one of these sets has been damaged and requires replacing. State how you would do it. (Possible Marks, 25.)

- (8) What are the sources of dust found in mine air? How may mine air be kept free from dust? Is exhausting or blowing-in the better method of ventilating dead ends? Give your reasons. (Possible Marks, 25.)

- (9) Compare the advantages and disadvantages of shrinkage, flat back and rill stopping and caving systems. (Possible Marks, 25.)

- (10) What are the causes of high temperatures in mines? How may high temperatures be prevented? (Possible Marks, 25.)

Subject: MINING LAW.

13th October, 1936.

Time allowed—One and a half hours.

All questions to be answered.

- (1) What are the provisions of the Act with regard to dust prevention when boring? (Possible Marks, 17.)

- (2) What does the Act require to be done when firing development ends or stope faces? Explain by means of sketches. (Possible Marks, 17.)

- (3) What quantity of explosive may be stored in a mine and under what conditions? (Possible Marks, 17.)

- (4) How should ladders be fixed in a shaft? When and how must winding ropes, cages, etc., be examined? (Possible Marks, 17.)

- (5) What provisions must be made to obtain proper ventilation of underground workings? (Possible Marks, 16.)

- (6) When is blasting permitted? What exceptions may be made to this rule? How may fuses be ignited and how may they not be ignited? (Possible Marks, 16.)

DIVISION III.

Report of the Superintendent of State Batteries.

The Under Secretary for Mines.

I have the honour to submit for the information of the Hon. Minister my report on the operations of the State Battery System for the year ended December 31st, 1936.

The output since inception to the 31st December, 1936, is as follows:—

Tons of Ore Milled—2,066,488.69.	
<i>Production at Par—</i>	
	£
By Amalgamation	6,265,454.09
„ Sands	1,186,497.67
„ Slimes	265,266.11
„ Residues	9,353.37
Total at Par	£7,726,571.24
<i>Gold Premium—</i>	
By Amalgamation	947,115.27
„ Sands	302,816.14
Total Australian Currency ..	£8,976,502.65

Tons of Tin Ore Milled—81,786.	
<i>Production—</i>	
By Black Tin	93,833.96
„ Residues	572.20
	£9,070,908.81

For the second year in succession the tonnage crushed exceeded the hundred thousand mark, but was some eight thousand tons lower than the previous record year due to the rebuilding of several of our larger mills, but advantage was taken to overtake rather large accumulations of tailings and tailing tonnage handled increased some nine thousand tons. The total of the tonnage milled and tonnage cyanided increased from 210,397 tons in 1935 to 212,629 tons in 1936.

HEAD VALUE OF ORE TREATED.

Excluding incompleated crushings 102,086¼ tons crushed yielded by amalgamation 55,601.4 ozs. of bullion, estimated to contain 47,107.4 fine ozs., equal to 9.228 dwts. per ton.

The average value of tailing was 3.79 dwts., giving a total head value of 13.018 dwts. worth 55s. 3d. with gold at 85s. per oz., as against 55s. in 1935.

RECOVERY.

The whole of the tailing was not treated during the year and a small percentage is untreatable, but allowing the average extraction of 78 per cent. actually obtained on the tailing value of 3.79 dwts., we get a recovery of 2.95 dwts.

The total recovery is as follows:—

	dwts.	%	dwts.
By Amalgamation	9.228	= 71.1	13.018
By Tailing	2.95	= 22.4	"
Total Recovery	12.178	= 93.5	"

The estimated recovery for 1935 was 92.8 per cent.

ESTIMATED VALUE OF PRODUCTION.

The gold recovered by amalgamation is handled by the respective owners and for statistical purposes is valued at the average price of 72s. per oz. fine gold at 85s. per oz. With an average premium of 105 per cent. for the year added to the estimated recovery of £200,165 by amalgamation, the output in Australian currency would be as follows:—

	At 85/- per oz.	Australian Currency.
	£	£
Recovery by Amalgamation	200,165	410,338
Recovery by Tailing Treatment	74,376	152,668
	£274,541	£563,006

A comparison with the two previous years is—

	1934.	1935.	1936
	£	£	£
	510,876	556,310	563,006

RECEIPTS AND EXPENDITURE.

Expenditure on working, including all administration charges other than capital, was £114,485 12s. 8d. Revenue amounted to £130,967 7s. 10d. and the surplus was £16,481 15s. 2d., as against a surplus of £9,911 14s. 5d. in the previous year.

The increased surplus over working expenditure is due to greater tonnage of tailing treated and higher recovery.

MILLING.

The Inspector of State Batteries reports as follows:—

Excluding two leased plants, one 20-stamp, five 10-stamp and fourteen 5-stamp batteries were in operation.

The total number of hours these batteries were engaged and compared with the same period of the preceding year is as under:—

	Jan.-Dec., 1936.	Jan.-Dec., 1935.
Hours run including stoppages	93,781	101,955.75
Hours run excluding stoppages	81,834	87,163.00

The average duty per stamp was 4.42 tons per 24 hours, compared with 1935—4.42 tons per 24 hours.

The average duty of the several types of batteries is as under:—

	1936.	1935.	
20 Stamps	4.32	4.73	tons crushed per 24 hours.
10 „	4.52	4.00	„ „ „
5 „	4.34	4.52	„ „ „

The tonnage milled and its cost compared with the preceding year is as follows:—

Year.	Tons.	Cost per Ton.	Decreased Tonnage.	Percentage.	Increased Cost per Ton.
1936	102,086.25	s. d. 14 0.1	6,273.75	5.78	s. d. 0 2.8
1935	108,360	13 9.3	Increased 10,906	11.19	0 1.6

		1936.		1935.	
		£	s. d.	£	s. d.
Expenditure	...	71,570	17 5	74,659	17 4
Revenue	...	48,133	12 10	51,498	4 5
		= 9/5.15		= 9/6.06	
Loss	...	£23,437	4 7	£23,161	12 11

Hereunder is shown how the above was incurred at the three different types of batteries.

1936.									
Type.	Tons Crushed.	Total Cost.	Cost per Ton.	Revenue.	Revenue per Ton.	Loss.	Loss per Ton.		
		£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	s. d.		
20-Stamp	18,825.50	9,287 15 8	9 10.4	7,892 7 7	8 4.6	1,395 8 1	1 5.7		
10-Stamp	26,188.25	15,683 12 6	11 11.7	14,388 18 7	10 11.8	1,294 13 11	0 11.8		
5-Stamp	57,072.50	46,426 5 7	16 3.2	24,696 18 8	8 7.8	21,729 6 11	7 7.3		

1935.									
Type.	Tons Crushed.	Total Cost.	Cost per Ton.	Revenue.	Revenue per Ton.	Loss.	Loss per Ton.		
		£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	s. d.		
15-Stamp	16,870	8,888 4 3	10 6.4	7,479 1 10	8 10.4	1,409 2 5	1 8.0		
10-Stamp	33,410	20,223 7 8	12 1.2	16,506 4 4	9 10.5	3,717 3 4	2 2.7		
5-Stamp	58,084	45,548 5 5	15 8.2	27,512 18 3	9 5.6	18,035 7 2	6 2.5		

Consumption of water per ton of ore crushed at those batteries where it has to be purchased from the Goldfields Water Supply Department is as follows:

Cost per 1,000 Gallons.	Battery.	First Quarter.	Six Months.	Nine Months.	Twelve Months.
s. d.		gallons.	gallons.	gallons.	gallons.
4 0	Cue	482	346	231	311
4 6	Coolgardie	658	342	303	296
5 6	Meekatharra	481	362	323	299
3 6	Norseman	376	396	383	388
7 0	Ora Banda	351	284	275	262
7 0	Kalgoorlie	224	208	198	221

Fifty-three thousand two hundred and twenty-nine tons were crushed at the above batteries, the water consumed being 14,538,800 gallons, the average consumption per ton crushed being 273 gallons.

TAILING TREATMENT.

No treatment was undertaken at Youanmi, where the tailing is being accumulated, or at Jimble Bar, owing to lack of ore. At Mt. Ida, however, where

generally speaking, the tailing is very refractory, a number of tests were made, the results being sufficiently encouraging to justify the purchase of the 20-ton-a-day plant owned by the Timoni Gold Mining Company. This plant has been repaired and production commenced at the beginning of December with fairly satisfactory results.

Nineteen plants in all have been in operation during the year, the tonnage treated and the results obtained being shown hereunder.

1936.							
Tons Treated.	Head Value.	Residue Value.	Extraction.	Value Called.	Value Recovered.	Surplus.	Cost per ton.
110,543.5	dwt. 4.07	dwt. .92	% 77.39	£ 74,108.7	£ 74,425.16	£ 316.46	s. d. 7 9.1

1935.							
102,037	3.76	.90	76.1	62,041.4	61,357.89	683.51	7 1

The total value recovered showed a surplus of £316, or .42 per cent. on the amount called for by the theoretical extraction of 77.39 per cent., a really excellent effort.

		1936.		1935.	
		£	s. d.	£	s. d.
Expenditure	...	42,914	15 3	36,172	12 8
Revenue	...	82,833	15 0	68,849	2 10
		= 14/11.8		= 13/5.9	
Profit	...	£39,918	19 9	£32,676	10 2

Note.—£662 5s. 5d. batteries closed included in Expenditure.

VALUE OF TAILING PRODUCED.

* Most of the tailing produced was treated, the balance being the hold-over from the previous year.

Schedule 5 attached to this report segregates the tailings into three groups, payable, i.e., that over 2 dwts. 8 grs., for which the customer is paid; that under 2 dwts. 8 grs., and that segregated as refractory.

Copper districts like Marble Bar and Mt. Ida provide the bulk of this last-mentioned group.

A synopsis on the basis of 90 per cent. of tons crushed is as follows:—

Purchased—49,700 tons, average value 6 dwts. 6 grs. = 53.9 per cent.

Unpurchasable—36,045 tons, average value 1 dwt. 11 grs. = 39.1 per cent.

Segregated—Marble Bar and Mt. Ida—5,022 tons, average value 3 dwts. 8 grs. = 5.4 per cent.

*Segregated—Other Batteries—1,399 tons, average value 2 dwts. 8 grs. = 1.7 per cent.

*Note.—Part will be specially treated subsequently and owners paid on actual extraction.

Comparative Synopsis of Results at State Batteries for 12 Months ended 31st December, 1935 and 1936.

	1935.			1936.		
	Tonnage.	Expenditure.	Revenue.	Tonnage.	Expenditure.	Revenue.
Milling	108,360	s. d. 13 9.3	s. d. 9 6.8	102,086.25	s. d. 14 0.2	s. d. 9 5.1
Tailing Treatment ...	102,037	7 1	13 5.9	110,543	7 9.1	14 11.8

Receipts and Expenditure.

	Tonnage.	Expenditure.	Revenue.	Profit.	Loss.
Milling	102,086.25	£ s. d. 71,544 14 11	£ s. d. 48,133 12 10	£ s. d. ...	£ s. d. 23,411 2 1
Tailing	110,543.00	42,914 15 3	82,833 15 0	39,918 19 9	...
Tin Treatment ... ..	...	26 2 6	...	...	26 2 6
	212,629.25	114,485 12 8	130,967 7 10	39,918 19 9	23,437 4 7
Less Loss ... ..	...	...	...	23,437 4 7	...
Net Profit ... ..	...	...	...	£16,481 15 2	...

ERECTION AND RECONSTRUCTION.

Both Construction Engineers experienced a fairly busy time during the year, as the following will show:—

Bamboo Creek.—Owing to the failure of the Bonnie Doon Water Supply, the original Battery Water Shaft was again equipped and the well deepened considerably.

Coolgardie.—This mill was entirely rebuilt.

Cue.—New battery sills, standards, etc., were installed and the blacksmith shop was enlarged and now includes lathe and separate return scrubber water system. A prospectors' room was provided in addition to a very comprehensive overhaul of the plant.

Laverton.—The erection of a new 10-head mill complete with Fraser and Chalmers rock breaker 15in. by 9in., belt conveyor, etc., was undertaken.

Mt. Ida.—Mortar blocks, box, sills, No. 2 standard, and breech end of 27 H.P. Tangye Gas Engine were replaced and the engine room enlarged. The Timoni tailing plant was purchased, repaired and placed in commission.

Ora Banda.—A new power plant consisting of wood gas producer and 63 H.P. Crossley gas engine was installed and the conversion of the battery from 5 to 10 stamp undertaken, together with complete new system of dams.

Kalgoorlie.—New 80 H.P. Bates gas engine and the fourth unit of 5-head of stamps were installed, whilst the mortar blocks were renewed in the No. 2 unit.

Boogardie.—The old power plant was replaced with a complete new plant, consisting of wood producer plant and 63 H.P. Crossley gas engine. The conversion of the battery from 5 to 10 stamps was not proceeded with as originally intended.

Payne's Find.—Two miles of new 3-inch piping were laid from the well to the battery.

Peak Hill.—This plant was generally overhauled and new engine foundations installed.

Details of expenditure on the foregoing works were as follow:—

General Loan Fund—	£	s. d.	£	s. d.
Wages	3,324	4 5		
Government Utilities ...	3,283	9 11		
Other	5,054	8 10		
			11,662	3 2
Commonwealth Assistance, Metalliferous Mining—				
Wages	5,608	13 11		
Government Utilities ...	5,256	6 7		
Other	2,091	18 10		
			12,956	19 4
Total			£24,619	2 6

REPAIRS AND RENEWALS.

In addition numerous replacements by improved equipment were made at many batteries from revenue and charged against our working costs, the total expenditure being—

	£	s. d.
Milling	7,336	0 0
Tailing Treatment	907	0 0
	£8,243	0 0

CARTAGE SUBSIDIES.

The assistance given to customers of State and privately-owned batteries can be gauged by a perusal of the following comparative figures for the years 1933 to 1936 inclusive.

Year.	State Batteries.				Private Batteries.		Total.	
	Tons Crushed.	Tons Claiming Subsidy.	Percentage of Ore Crushed.	Amount Paid.	Tons Claiming Subsidy.	Amount Paid.		
1933 ...	91,616	35,617	38·8	£ 11,040 16 1	5,953	£ 1,911 17 0	£ 12,952 13 1	
1934 ...	97,454	43,163	44·2	12,193 2 8	11,459	2,846 10 6	15,039 13 2	
1935 ...	108,360	52,460	48·4	17,121 5 10	12,748	3,200 11 1	20,321 16 11	
1936 ...	102,086	43,946	43·05	12,416 2 6	13,541	3,648 13 0	16,064 15 6	

The subsidy paid to State Battery customers declined from £17,121 in 1935 to £12,416 and the percentage of ore on which subsidies were paid to the total ore crushed from 48·4 per cent. to 43·05 per cent., but subsidies to private plants increased from £3,200 to £3,648, the total amount paid at all plants being £4,237 less than in the previous year.

Cartage subsidies paid to State Battery customers were equal to 2s. 5d. per ton on the total tonnage crushed and 5s. 8d. per ton on the ore claiming subsidy.

The decreased payment was due mainly to the decreased tonnage crushed.

NEW REGULATIONS

New regulations came into force on the 1st February of this year with a view of curtailing the ever-growing cost, facilitating the policing of the regulations, a difficult matter when dealing with some fifty batteries in more or less isolated centres, and of placing the distribution on a more equitable basis. A comparison of the incidence of the old and new subsidies, using the crushings put through State Batteries for the six months ended December 31st last, is as follows:—

Subsidy Paid on Ore worth 15 dwts. per ton and over—Old Regulations.	Subsidy Paid on Ore worth 6 dwts. and under and Carted less than 13 miles.		Total Subsidy Paid—Old Regulations.	Total Subsidy Payable—New Regulations.
	Paid under Old Regulations.	Payable under New Regulations.		
£ s. d. 1,820 16 1	£ s. d. 256 11 0	£ s. d. 190 4 3	£ s. d. 7,559 16 5	£ s. d. 5,196 14 11

If the present regulations had been in force for the half year, the saving would have been £2,363 1s. 9d. and since owners of ore worth 15 dwts. are not eligible for subsidy inside a distance of 31 miles, approximately 80 per cent. of the amount saved would be on subsidies granted to holders of ore returning 15 dwts. or more per ton by amalgamation.

The abovementioned comparison shows that the owners of low-grade propositions situated under 13 miles from State Batteries would receive only some £132 per annum less than they did under the old regulations, but when it is considered that quite a number of such shows were disqualified because the tonnage crushed had exceeded the limits imposed by the old regulations, the subsidy paid in future on this heading will probably show an increase.

STAFF.

An alteration in the personnel has occurred during the past year. Messrs. R. E. Wann, Manager at Yarri; F. Thomas, Manager at Mt. Ida; K. Penrose, Assistant at Payne's Find; and H. Simon, Assayer at Kalgoorlie, resigned: K. Penrose going to the Prohibition Gold Mine, Meekatharra, and H. Simon to the Ora Banda Amalgamated, whilst the only addition to the staff was Mr. W. A. Longbottom, who was appointed as Assistant in the Payne's Find-Warriedar-Yalgoo Circuit.

Messrs. J. Halligan, of Norseman, E. Speering, of Peak Hill, and F. J. Breustedt, of Payne's Find, took their leave, whilst Messrs. A. H. Cook, of Laverton, Ed. Wann, of Coolgardie, and L. Thompson, of Yarri, unfortunately had to take sick leave.

The principal transfers during the year were as under—

L. Thompson from St. Ives to Yarri

E. G. McKenzie from Wiluna to Sandstone

whilst during the last half of the year a round of crushings was put through at Wiluna under the management of W. J. Weekley.

ADMINISTRATION.

	£	s.	d.
Salaries	3,088	11	9
Inspection, including Salary of			
Inspector	1,115	12	10
Insurance	2,319	6	4
Printing	121	2	1
Postage	100	0	0
Sundry Travelling, etc.	100	0	0
	£6,844	13	0

SUMMARY.

The tonnage milled, namely 102,086 $\frac{1}{4}$ tons, shows for the first time since 1928 a decrease in the preceding year's figure, but the combined tonnage milled and cyanided is some two thousand tons above the record figure of 1935. The rebuilding of our Coolgardie plant, the erection of the new 10-head at Laverton, and the addition of an extra 5-head of stamps and power plant at Ora Banda occasioned stops at each, which are more or less responsible for the decrease in the tonnage of some eight thousand tons for the year, though at time of writing there is a slackening off of supplies at several of our batteries, which can be mainly attributed to the number of mines now having their own plants. A contributing cause is also the erection of a 5-head battery at Leonora by private enterprise with assistance from the Government. A good deal of ore from Kookynie and other centres originally going to Kalgoorlie or Laverton now goes to the Leonora battery.

The average estimated extraction of 93.5 per cent. can be considered highly satisfactory.

2,251 parcels were treated at our different batteries, the average tonnage per parcel being 45.6 tons.

The average value of the ore treated was 55s. 3d. per ton, as against 55s. in 1935 with gold at 85s. per oz. and the total estimated recovery £563,000 Australian currency, as against £556,310 for the previous year.

GENERAL REMARKS.

Our Pilbara batteries, Bamboo Creek and Marble Bar, were kept busy, and though during the latter part of the year at Bamboo Creek crushing had to

be curtailed on account of the failure of the water supply due to extremely dry seasons experienced, Marble Bar ran practically full time and showed a marked increase in production. The average value for the 4,373 tons crushed for the year was 69s. 2d. per ton with gold at 85s. per oz. This high value is due in a great measure to the extremely high valued crushings put through from the new find known as Halley's Comet. The last crushing is worth quoting; 260 tons were crushed for a return of 845.85 ozs. by amalgamation and a tailing value of 117 dwts. 2 grs. per ton, the tailing payment alone being £8,360.

It is pleasing to think that our local State Battery has been responsible for the opening up of what is undoubtedly the most promising mine so far in the North-West.

Whilst the profit, £16,481 15s. 2d., is considerably higher than that of the previous year, I do not consider it will be maintained. The very high valued tailing treated at Marble Bar will not recur, and we will not treat proportionately such a large tonnage of tailing. In addition, the cost of all supplies is increasing, and this will have its incidence on the rate of wages.

The large expenditure in construction has kept the Head Office staff very busy.

Before closing this report, I should like to place on record my appreciation of the services of the Engineer for State Batteries, Mr. A. J. S. Wright, who retired at the end of the year after a service of thirty years.

D. F. BROWNE,

Superintendent of State Batteries.

6th May, 1937.

SCHEDULE 1.

Return showing Tons Crushed, Gold Yield by Amalgamation, Average per Ton in Shillings, and Total Value Without Premium for Year ended 31st December, 1936.

Battery.	Tons Crushed.	Gold Yield Bullion.	Value per Ton, in Shillings.	Total Value Without Premium.
		ozs.	s. d.	£
Bamboo Creek	2,410·00	1,504·05	44 11	5,414·58
Boogardie	5,884·75	3,403·00	41 8	12,250·80
Coolgardie	8,907·25	4,442·50	35 11	15,993·00
Cue	6,391·00	4,124·75	46 6	14,849·10
Kalgoorlie	18,825·50	9,303·60	35 7	33,492·96
Laverton	4,586·75	2,525·30	39 8	9,091·08
Marble Bar	4,370·50	4,586·15	75 7	16,510·14
Meekatharra	6,829·75	4,395·60	46 4	15,824·16
Mt. Ida	3,571·50	2,089·85	42 2	7,523·46
Norseman	3,714·25	2,636·95	51 1	9,493·02
Ora Banda	8,561·50	4,047·80	34 0	14,572·18
Payne's Find	4,403·50	2,856·55	46 9	10,283·58
Peak Hill	6,795·00	1,472·75	15 7	5,301·90
Sandstone	2,951·50	1,214·25	29 7	4,371·30
St. Ives	1,128·25	306·80	19 7	1,104·48
Warriedar	2,952·50	974·90	23 9	3,509·64
Wiluna	3,103·25	1,538·85	35 8	5,539·86
Yalgoo	2,530·75	950·95	27 1	3,423·31
Yarri	3,937·25	3,175·55	58 1	11,431·98
Youanmi	231·50	51·25	15 11	184·50
	102,086·25	55,601·40	39 3	200,165·03

SCHEDULE 2.

Tailing Treatment—Value of Recovery.

Battery.	Tons Treated.	Yield.	Value.	Premium.	Total.
		ozs.	£	£	£
Bamboo Creek	2,380	532·56	2,261·884	2,376·489	4,638·373
Boogardie	6,008	1,299·40	5,518·714	5,791·854	11,310·568
Coolgardie	14,179	1,989·69	8,449·192	8,887·312	17,336·504
Cue	8,334	1,174·70	4,989·022	5,228·787	10,217·809
Jimble Bar ... ..	...	...	...	...	...
Kalgoorlie	16,240	2,620·53	11,130·143	11,681·601	22,811·744
Laverton	5,570	735·74	3,120·691	3,302·050	6,422·741
Marble Bar	3,066	2,185·88	9,283·576	9,870·544	19,154·120
Mt. Ida	540	50·95	216·412	233·391	449·803
Meekatharra	6,212	1,113·75	4,729·856	4,966·671	9,696·527
Norseman	3,808	515·13	2,187·812	2,284·576	4,472·388
Ora Banda	8,532	1,173·16	4,982·605	5,217·708	10,200·313
Payne's Find	4,542	294·89	1,252·022	1,346·282	2,598·304
Peak Hill	7,770	478·70	2,033·061	2,143·751	4,176·812
Sandstone	4,266	588·42	2,499·156	2,640·943	5,140·099
St. Ives	2,184	208·75	890·307	929·604	1,819·911
Warriedar	3,180	463·40	1,968·401	2,082·045	4,050·446
Wiluna	6,470	1,299·40	5,520·533	5,803·354	11,323·887
Yalgoo	3,270	318·62	1,353·154	1,407·325	2,760·479
Yarri	3,990	468·58	1,990·119	2,097·850	4,087·969
Youanmi ... ..	...	...	...	...	...
	110,541	17,512·25	74,376·660	78,292·137	152,668·797

SCHEDULE 3.

Return showing Number of Parcels treated, and Tons crushed, at State Batteries for Year 1936.

No. of Parcels Crushed.	Battery.	Tons Crushed.	Yield by Amalgamation, Bullion.			Yield by Amalgamation, Fine Gold.			Gross Contents of Tailing (in- cluding Re- fractory Tails), Fine Gold.			Total Contents of Ore, Fine Gold.			Average per ton, Fine Gold.	Gross Value, per Ton.			
			ozs.	dwt.	grs.	ozs.	dwt.	grs.	ozs.	dwt.	grs.	ozs.	dwt.	grs.			dwt. grs.	£	s.	d.
37	Bamboo Creek...	2,410.00	1,504	1	0	1,274	18	0	496	12	0	1,771	10	0	14	17	3	2	5
136	Boogardie ...	5,884.75	3,403	0	0	2,884	12	0	1,600	7	0	4,484	19	0	15	4	3	4	4
208	Coolgardie ...	8,907.25	4,442	10	0	3,765	14	0	1,568	13	0	5,334	7	0	12	0	2	10	11
155	Cue ...	6,291.00	4,124	15	0	3,496	8	0	1,159	13	0	4,656	1	0	14	14	3	1	11
505	Kalgoorlie ...	18,825.50	9,303	12	0	7,862	14	0	3,291	11	0	11,154	5	0	11	20	2	10	3
131	Laverton ...	4,586.75	2,525	6	0	2,140	12	0	630	19	0	2,771	11	0	12	2	2	11	3
135	Marble Bar ...	4,370.50	4,586	3	0	3,887	10	0	2,757	15	0	6,645	5	0	30	10	6	9	2
124	Meekatharra ...	6,829.75	4,395	12	0	3,725	19	0	1,486	0	0	5,211	19	0	15	7	3	4	10
67	Mt. Ida ...	3,571.50	2,089	17	0	1,771	9	0	640	5	0	2,411	14	0	13	12	2	17	3
111	Norseman ...	3,714.25	2,636	19	0	2,235	5	0	759	7	0	2,994	12	0	16	5	3	8	9
106	Ora Banda ...	8,561.50	4,047	16	0	3,431	3	0	1,399	5	0	4,830	8	0	11	6	2	7	9
68	Payne's Find ...	4,403.50	2,856	11	0	2,421	8	0	421	15	0	2,843	3	0	13	2	2	15	6
55	Peak Hill ...	6,795.00	1,472	15	0	1,248	8	0	408	1	0	1,656	9	0	4	21	1	0	1
74	Sandstone ...	2,951.50	1,214	5	0	1,029	5	0	135	16	0	1,165	1	0	7	22	1	13	8
15	St. Ives ...	1,128.25	306	16	0	260	1	0	562	15	0	822	16	0	14	14	3	1	11
85	Warriedar ...	2,952.50	974	18	0	826	8	0	508	3	0	1,334	11	0	9	1	1	18	4
58	Wiluna ...	3,103.25	1,538	17	0	1,304	8	0	639	16	0	1,944	4	0	12	12	2	13	2
97	Yalgoo ...	2,530.75	950	19	0	806	1	0	577	14	0	1,383	15	0	10	22	2	6	4
77	Yarri ...	3,937.25	3,175	11	0	2,691	16	0	283	4	0	2,975	0	0	15	2	3	4	0
7	Youanmi ...	231.50	51	5	0	43	9	0	36	11	0	80	0	0	6	22	1	9	5
2,251	...	102,086.25	55,601	8	0	47,107	8	0	19,364	2	0	66,471	10	0	13	0.5	2	15	3
	Average ...	45.6	...	...	0	9	5.5	0	3	1.9	...	...	...	...	...	...	...	...	...
	Average Value	...	...	...	£1	19s.	3d.	£0	16s.	0d.	...	...	...	...	...	...	...	...	...

SCHEDULE 4.

Direct Purchase of Tailings.

Battery.	Tons Purchased.	Amount Paid.
		£ s. d.
Bamboo Creek ...	1,361½	2,069 0 4
Boogardie ...	4,270	6,704 8 11
Coolgardie ...	5,807½	5,897 8 11
Cue ...	3,269½	4,031 14 8
Jimble Bar ...	306¾	321 15 9
Kalgoorlie ...	9,264	9,684 5 0
Laverton ...	1,934	1,968 2 3
Marble Bar ...	3,034	11,693 4 10
Meekatharra ...	4,567½	4,702 10 10
Norseman ...	2,276¾	2,276 8 7
Ora Banda ...	4,168	4,360 13 10
Payne's Find ...	500½	563 8 9
Peak Hill ...	615½	1,316 8 6
Sandstone ...	1,698½	1,845 15 3
St. Ives ...	767½	350 19 5
Warriedar ...	2,216	1,888 3 11
Wiluna ...	2,505½	3,186 15 10
Yalgoo ...	677	424 4 3
Yarri ...	1,675	1,745 18 8
Youanmi ...	257¾	36 11 11
	51,172½	65,068 0 5

SCHEDULE 5.

Return showing Tailing payable and unpayable and Gross Contents for Year 1936.

Battery.	Tailing payable.		Tailing unpayable.		Refractory Tailing.		Totals.	
	Tons.	Gross Contents.	Tons.	Gross Contents.	Tons.	Gross Contents.	Tons.	Gross Contents.
		ozs. dwt. grs.		ozs. dwt. grs.		ozs. dwt. grs.		ozs. dwt. grs.
Bamboo Creek ...	1,584	452 16 0	585	43 16 0	...	...	2,169	496 12 0
Boogardie ...	4,055	1,492 13 0	1,242	107 14 0	...	...	5,297	1,600 7 0
Coolgardie ...	5,431	1,363 8 0	2,585	205 5 0	...	...	8,016	1,568 13 0
Cue ...	2,924	927 1 0	2,805	232 12 0	...	...	5,729	1,159 13 0
Kalgoorlie ...	9,806	2,778 13 0	7,214	512 18 0	...	...	17,020	3,291 11 0
Laverton ...	2,507	596 9 0	1,632	34 10 0	...	...	4,139	630 19 0
Marble Bar ...	1,927	2,530 17 0	257	20 1 0	1,749	206 17 0	3,933	2,757 15 0
Meekatharra ...	4,723	1,296 11 0	1,430	115 16 0	108	73 13 0	6,261	1,486 0 0
Mt. Ida ...	...	...	...	...	3,273	640 5 0	3,273	640 5 0
Norseman ...	2,466	689 0 0	877	70 7 0	...	...	3,343	759 7 0
Ora Banda ...	4,322	1,112 0 0	3,392	287 5 0	...	...	7,714	1,399 5 0
Payne's Find ...	876	181 9 0	3,089	240 6 0	...	...	3,965	421 15 0
Peak Hill ...	485	148 8 0	5,539	259 13 0	...	...	6,024	408 1 0
St. Ives ...	639	103 4 0	494	32 12 0	...	...	1,133	135 16 0
Sandstone ...	1,383	386 10 0	1,272	176 5 0	...	...	2,655	562 15 0
Warriedar ...	1,934	417 11 0	657	61 11 0	93	29 1 0	2,684	508 3 0
Wiluna ...	2,293	599 4 0	500	40 12 0	...	...	2,793	639 16 0
Yarri ...	1,417	321 3 0	1,149	88 16 0	966	167 15 0	3,532	577 14 0
Yalgoo ...	720	140 8 0	1,326	83 14 0	232	59 2 0	2,278	283 4 0
Youanmi ...	208	36 11 0	...	...	...	...	208	36 11 0
	49,700	15,573 16 0	36,045	2,613 13 0	6,421	1,176 13 0	92,166	19,364 2 0

SCHEDULE 6.—MILLING AND TIN.
Statement of Revenue and Expenditure for Year ended 31st December, 1936.

Battery.	Tonnage Crushed.	Management.	Wages.	Stores.	Total Working Expenditure.	Cost per ton.	Repairs and Renewals.	Sundries.	Gross Expenditure.	Cost per ton.	Receipts.	Receipts per ton.	Profit.	Loss.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.
Bamboo Creek	2,410-00	289 4 8	1,281 15 11	786 0 0	2,357 0 7	19 6·7	446 0 0	224 0 0	3,027 0 7	25 1·4	1,284 15 2	10 7·9	£ ...	1,742 5 5
Boogardie	5,884-75	316 13 0	2,008 15 8	909 0 0	3,234 8 8	10 11·9	335 0 0	403 0 0	3,972 8 8	13 6	2,685 15 9	9 1·5	...	1,286 12 11
Coolgardie	8,907-25	345 14 9	1,620 14 9	863 0 0	2,829 9 6	6 4·2	635 0 0	1,329 0 0	4,793 9 6	10 10·5	3,979 8 0	8 11·2	...	814 1 6
Cue	6,391-00	268 9 11	1,324 8 9	766 0 0	2,358 18 8	7 4·6	767 0 0	895 0 0	4,020 18 8	12 7	3,227 5 3	10 1·1	...	793 13 5
Darlot	...	...	...	...	...	...	...	2 5 0	2 5 0	...	...	...	...	2 5 0
Jimble Bar	...	...	52 11 4	40 2 4	92 13 8	...	...	41 0 0	133 13 8	...	...	...	...	133 13 8
Kalgoorlie	18,825-50	560 12 2	3,132 3 6	1,954 0 0	5,646 15 8	6 0	493 0 0	3,148 0 0	9,287 15 8	9 10·4	7,892 7 7	8 4·6	...	1,395 8 1
Laverton	4,586-75	290 2 1	1,330 18 0	546 0 0	2,167 0 1	9 5·3	354 0 0	345 0 0	2,866 0 1	12 5·9	2,265 17 8	9 10·5	...	600 2 5
Lennonville	...	...	...	...	...	...	...	1 12 6	1 12 6	...	11 5 0	...	11 5 0	...
Linden	...	...	...	...	...	...	...	...	...	...	140 15 0	...	139 2 6	...
Marble Bar	4,370-50	420 17 10	1,910 6 0	1,231 0 0	3,562 3 10	16 3·5	317 0 0	335 0 0	4,214 3 10	19 3·4	2,254 10 7	10 3·7	...	1,959 13 3
Meekatharra	6,829-75	334 19 1	2,295 0 3	1,009 0 0	3,638 19 4	10 7·8	140 0 0	988 0 0	4,766 19 4	13 11·5	3,143 8 3	9 2·4	...	1,623 11 1
Mt. Ida	3,571-50	310 18 9	1,692 2 11	770 0 0	2,774 1 8	15 6·3	102 0 0	392 0 0	3,268 1 8	18 3·5	1,872 10 7	10 5·7	...	1,395 11 1
Mt. Sir Samuel	...	...	...	...	...	...	...	9 10 0	9 10 0	...	64 2 0	...	54 12 0	...
Mulline	...	...	...	...	...	...	...	...	...	...	136 17 6	...	136 17 6	...
Mulwarrie	...	...	...	...	...	...	...	...	...	...	63 10 0	...	63 10 0	...
Norseman	3,714-25	434 4 2	1,627 13 4	614 0 0	2,675 17 6	14 4·9	613 0 0	610 0 0	3,898 17 6	20 11·9	1,901 15 4	10 3·2	...	1,997 2 2
Ora Banda	8,561-50	318 13 2	2,703 12 1	630 0 0	3,652 5 3	8 6·3	92 0 0	1,240 0 0	4,984 5 3	11 7·7	3,412 2 8	7 11·6	...	1,572 2 7
Payne's Find	4,403-50	349 1 11	1,825 4 11	840 0 0	3,014 6 10	13 8·2	414 0 0	421 0 0	3,849 6 10	17 5·7	2,246 1 10	10 2·4	...	1,603 5 0
Peak Hill	6,795-00	367 1 0	2,104 18 8	722 0 0	3,193 19 8	9 4·8	350 0 0	392 0 0	3,935 19 8	11 7	2,438 15 10	7 2·1	...	1,497 3 10
Pingin	...	...	...	...	...	...	...	...	...	...	10 0 0	...	10 0 0	...
Quinn's	...	...	...	...	...	...	...	...	...	...	10 0 0	...	10 0 0	...
Sandstone	2,951-50	264 17 2	1,135 18 10	509 0 0	1,909 16 0	12 11·2	480 0 0	374 0 0	2,763 16 0	18 0·5	1,521 5 3	10 3·6	...	1,242 10 9
St. Ives	1,128-25	108 6 0	475 14 0	412 0 0	996 0 0	17 7·9	196 0 0	286 0 0	1,478 0 0	26 2·4	526 1 6	9 3·9	...	951 18 6
Sandy Creek	...	...	...	...	...	...	...	...	...	...	2 8 6	...	2 8 6	...
Wiluna	3,103-25	114 5 10	785 13 2	431 0 0	1,330 19 0	8 6·9	490 0 0	298 0 0	2,118 19 0	13 7·8	1,504 5 0	9 8·3	...	614 14 0
Warrriedar	2,952-50	221 9 10	980 17 0	435 0 0	1,637 6 10	11 1	86 0 0	168 0 0	1,891 6 1	12 9·7	1,486 13 3	10 0·7	...	404 13 7
Yalgoo	2,530-75	253 14 3	807 4 1	329 0 0	1,389 18 4	10 11·7	68 0 0	185 0 0	1,642 18 4	12 11·7	1,308 7 10	10 4	...	334 10 6
Yarri	3,937-25	416 1 11	1,796 8 1	712 0 0	2,924 10 0	14 10·2	916 0 0	490 0 0	4,330 10 0	22 0	1,908 17 0	9 8·3	...	2,421 13 0
Youanmi	231-50	18 7 2	148 9 2	54 0 0	220 16 4	19 0·4	42 0 0	24 0 0	286 16 4	24 8·6	118 0 6	10 2	...	168 15 10
Total	102,086-25	6,003 14 8	31,040 10 5	14,563 2 4	51,607 7 5	10 1·3	7,336 0 0	12,601 7 6	71,544 14 11	14 0·1	47,417 2 10	9 3·4	427 15 6	24,555 7 7
Sundry Debtors, 1935	...	...	...	...	...	...	...	...	...	...	715 0 0	...	715 0 0	...
Tin Plant—Greenbushes	...	...	26 2 6	...	26 2 6	...	...	...	26 2 6	...	1 10 0	...	...	24 12 6
Total	102,086-25	6,003 14 8	31,066 12 11	14,563 2 4	51,633 9 11	...	7,336 0 0	12,601 7 6	71,570 17 5	14 0·2	48,133 12 10	9 5·1	1,142 15 6	24,580 0 1
Total Loss	...	...	...	...	...	...	...	...	...	...	...	...	...	1,142 15 6
														23,437 4 7

SCHEDULE 7.—TAILING TREATMENT.
Statement of Revenue and Expenditure for Year ended 31st December, 1936.

Plant.	Tonnage.	Management.		Wages.		Assays.		Stores.		Total Working Expenditure.		Cost per ton.	Repairs and Renewals.		Sundries.		Gross Expenditure.		Cost per ton.	Receipts.		Receipts per ton.		Profit.		Loss.								
		£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	£	s. d.	s.	s.	£	s. d.	s.	s. d.	£	s. d.	£	s. d.					
Bamboo Creek	2,380	224	2 10	723	18 2	...	...	295	18 8	1,243	19 8	10 5.4	...	105	0 0	1,348	19 8	11 4	2,488	5 10	20	10.9	1,139	6 2	...	...	...	...	...	...
Boogardie	6,008	222	10 7	1,195	7 5	21	1 9	421	0 0	1,859	19 9	6 2.3	...	210	0 0	2,069	19 9	6 10.6	5,317	0 2	17	8.2	3,247	0 5	...	...	...	...	...	...
Coolgardie	14,179	405	1 0	2,000	0 0	17	15 9	1,332	17 11	3,755	14 8	5 3.5	40	0 0	935	0 0	4,730	14 8	6 8	10,018	0 8	14	1.5	5,287	6 0	...	...	...	...	...	...
Cue	8,336	194	11 6	1,560	13 2	97	17 8	962	0 0	2,815	2 4	6 9	5	0 0	383	0 0	3,203	2 4	7 8.2	5,703	10 0	13	8.2	2,500	7 8	...	...	...	...	...	...
Jimble Bar ... ..	...	...	...	2	14 9	...	...	...	...	2	14 9	...	...	...	...	2	14 9	...	...	...	3	0 6	...	...	0	5 9	...	...	...	...	...	...
Kalgoorlie	16,240	285	13 8	2,081	8 9	144	0 0	1,318	0 0	3,829	2 5	4 8.5	44	0 0	1,424	0 0	5,297	2 5	6 6.2	13,135	18 7	16	2.1	7,838	16 2	...	...	...	...	...	...	...	...
Laverton	5,570	179	14 0	910	10 9	268	0 0	550	0 0	1,908	4 9	6 10.2	45	0 0	210	0 0	2,163	4 9	7 9.2	4,368	8 8	15	8.2	2,205	3 11	...	...	...	...	...	...	...	...
Marble Bar	3,066	149	2 4	770	5 9	...	...	381	0 0	1,300	8 1	8 5.7	16	0 0	170	0 0	1,486	8 1	9 8.3	4,628	14 9	30	2.3	3,142	6 8	...	...	...	...	...	...	...	...
Meekatharra	6,212.5	255	1 2	1,294	18 11	...	...	450	0 0	2,000	0 1	6 5.2	67	0 0	324	0 0	2,391	0 1	7 8.3	4,987	12 9	16	0.6	2,596	12 8	...	...	...	...	...	...	...	...
Mt. Ida	540	28	0 0	141	7 2	5	0 0	93	0 0	267	7 2	9 10.8	7	0 0	24	0 0	298	7 2	11 0.6	400	0 0	14	9.7	101	12 10	...	...	...	...	...	...	...	...
Norseman	3,808	144	19 2	715	18 11	20	17 0	506	0 0	1,387	15 1	7 3.4	68	0 0	250	0 0	1,705	15 1	8 11.5	2,040	17 1	10	5.4	335	2 0	...	...	...	...	...	...	...	...
Ora Banda	8,532	272	8 4	1,727	8 4	24	0 0	646	0 0	2,669	16 8	6 3.1	62	0 0	519	0 0	3,250	16 8	7 7.4	6,087	8 7	14	2.2	2,836	11 11	...	...	...	...	...	...	...	...
Payne's Find	4,542	79	5 2	644	8 7	...	...	588	0 0	1,311	13 9	5 9.3	12	0 0	144	0 0	1,467	13 9	6 5.5	2,423	14 0	10	8	956	0 3	...	...	...	...	...	...	...	...
Peak Hill	7,770	231	14 8	1,173	19 11	...	...	783	0 0	2,188	14 7	5 7.6	54	0 0	262	0 0	2,504	14 7	6 5.3	2,578	7 5	6	7.6	73	12 10	...	...	...	...	...	...	...	...
Sandstone	4,266	129	6 3	1,043	1 3	100	0 0	490	0 0	1,762	7 6	8 3.1	59	0 0	162	0 0	1,983	7 6	9 3.5	3,016	17 11	14	1.7	1,033	10 5	...	...	...	...	...	...	...	...
St. Ives	2,184	145	4 2	481	3 10	46	0 0	383	0 0	1,055	8 0	9 7.9	68	0 0	123	0 0	1,246	8 0	11 4.9	1,478	7 5	13	6.4	231	19 5	...	...	...	...	...	...	...	...
Warriedar	3,180	13	16 3	571	8 3	62	0 0	493	0 0	1,140	4 6	7 2	73	0 0	118	0 0	1,331	4 6	8 4.4	2,332	15 1	14	8	1,001	10 7	...	...	...	...	...	...	...	...
Wiluna	6,470	122	16 4	1,342	4 4	157	11 3	667	0 0	2,289	11 11	7 0.9	78	0 0	235	0 0	2,602	11 11	8 0.5	7,265	16 10	22	5.5	4,663	4 11	...	...	...	...	...	...	...	...
Yalgoo	3,270	14	17 3	605	5 3	38	1 9	423	0 0	1,081	4 3	6 7.3	50	0 0	125	0 0	1,256	4 3	7 8.1	2,144	9 11	13	1.3	888	5 8	...	...	...	...	...	...	...	...
Yarri	3,990	148	6 4	819	14 0	80	19 7	572	0 0	1,620	19 11	8 1.5	159	0 0	132	0 0	1,911	19 11	9 7	2,414	8 10	12	1.2	502	8 11	...	...	...	...	...	...	...	...
Batteries closed ... ..	...	...	...	...	...	...	...	662	5 5	662	5 5	...	...	...	...	662	5 5	...	...	...	...	...	...	...	...	662	5 5	...	...	...	...	...	...
	110,543.5	3,246	11 0	19,805	17 6	1,083	4 9	12,017	2 0	36,152	15 3	6 6.4	907	0 0	5,855	0 0	42,914	15 3	7 9.1	82,833	15 0	14	11.8	40,581	5 2	662	5 5	
Surplus	39,918	19 9

DIVISION IV.

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Annual Progress Report of the Geological Survey of Western Australia for the Year ended 31st December, 1936.

The Under Secretary for Mines.

I have the honour to submit for the information of the Hon. the Minister for Mines, my report on the operations of the Geological Survey for the year 1936.

STAFF.

The staff remains at the same numerical strength as last year; it consists of four field geologists, a technical assistant, a junior clerk and a messenger.

Mr. F. R. Feldtmann was retired under Section 56 (Ill-health) of the Public Service Act as from 31st March, 1936, after many years of loyal service, he having joined the staff of the Geological Survey on 1st March, 1911. On Mr. Feldtmann's retirement his position was filled by the promotion of Mr. Hobson, and the staff brought up to strength by the appointment on loan from the Education Department of Mr. G. H. Armstrong, who commenced duty on 3rd August.

FIELD WORK.

Government Geologist.—During January and February I carried out two trips of inspection with officers of the Country Water Supply Branch of the Public Works Department, with the object of ad-

vising on bore sites for water in the wheat belt. The Kondinin and Karlgarin area was examined in January, and Hyden and Bonnie Rocks area during February.

Early in February I accompanied the State Mining Engineer to Collie, where inspections were made of the progress of development work on the Co-operative Mine of the Amalgamated Collieries. At the end of February I made an examination of the quarry of the Clackline Firebrick Company with the object of assisting them in the development of the most suitable clays for the manufacture of their product.

From 29th February to 23rd March I attended, as a Member, a meeting of the Executive Committee of the Aerial, Geological and Geophysical Survey of Northern Australia which was held in Melbourne. At this meeting the programme of field work for the 1936 field season was decided on, and a report prepared on the operations of the Survey during the year 1935.

While in the Eastern States the opportunity was taken of inspecting certain pine plantations in New South Wales and Queensland at the request

of the Conservator of Forests. The plantations examined were on granite areas, and the inspection was made with the object of discovering if there were any geological reasons for the difference in pine growth on areas of similar geological constitution in the Eastern States and Western Australia.

During April a visit was paid to the Ora Banda Amalgamated Gold Mine at Grant's Patch. This was necessary in order to finalise a report which had been commenced late in the previous year.

Early in May I visited Seahill's felspar quarries at Londonderry, south of Coolgardie, with the object of advising on the best direction for development of this deposit.

From 31st May to 13th June I carried out aerial reconnaissance flights with the R.A.A.F. in the Pilbara, West Pilbara and Ashburton districts. These flights were necessary before the commencement of the programme of aerial photography laid down by the Executive Committee of the Northern Australia Survey, and were carried out by me because of the indisposition of the Survey's Senior Field Geologist, Mr. K. J. Finneane.

In July I inspected the progress of the geological survey of the southern portion of the Yilgarn Goldfield, and also made a brief examination of the so-called alluvial ground at Mount Palmer.

Early in August I again accompanied the State Mining Engineer to Collie to inspect the programme of development in the Co-operative Colliery, and to discuss the programme of deep boring on some of the eastern leases held by Amalgamated Collieries.

From 28th August to 19th September I visited Carnarvon, from which centre I made geological examinations at Winning and Woodleigh Stations, with the object of advising on the possibilities of obtaining artesian or sub-artesian water on those properties.

From 24th October to 9th November I accompanied the Hon. the Minister for Mines and the Under Secretary for Mines to Melbourne to attend the Interstate Mining Conference which was held at the Commonwealth Offices, Melbourne.

During November I paid a brief visit to Greenbushes to inspect the progress of boring operations which were being carried out by this Branch in search of deep alluvial tin leads.

During December I made examinations of the Lady Shenton Gold Mine at Menzies and the Leinster Gold Mine at Mt. Sir Samuel. Both examinations were made at the request of the mine managements with the object of assisting them in their development work. The report on the inspection of the Lady Shenton Mine has not yet been completed.

The remainder of my time was taken up with administrative and routine duties at head office.

H. A. Ellis, B.Sc., A.O.S.M., Geologist.—During January Mr. Ellis was engaged in Perth preparing for publication the plans of his recently completed geological survey of the Abbots mining centre, and in compiling survey information for the re-survey of the southern portion of the Yilgarn Goldfield and a visit of inspection to the alleged site of "Lasseter's Reef" near the Rawlinson Ranges in the extreme east central part of this State. He was also engaged in collecting samples of commercial mineral products from localities close to Perth.

During February and March he was engaged in field work on the re-survey of the Yilgarn Goldfield. From 11th April to 27th July he was in Central Australia attached to expeditions whose object was to locate the site of "Lasseter's Reef." During August and September he was engaged on the compilation of the reports and plans dealing with the Central Australian Expedition and with the preparation of a departmental exhibit which was included in the Exhibition arranged by the Western Australian Mining Association from 5th to 10th October. During the same period he made a visit to Greenbushes in connection with the proposed boring for "deep leads," and another to Southern Cross in order to inspect the programme of field work being carried out in the southern portion of the Yilgarn Goldfield.

After taking his annual leave late in October, Mr. Ellis completed his manuscript and plans dealing with Central Australia and returned to the Yilgarn Goldfield on November 25th, where he was engaged on field work until the end of December.

R. A. Hobson, B.Sc. (Hons.), Geologist.—During 1936 Mr. Hobson has been almost entirely occupied with the re-survey of the southern portion of the Yilgarn Goldfield. Up to 12th February he was at Head Office completing and compiling maps and plans of areas and mines examined in the Yilgarn Goldfield during 1935, and later in writing some notes on these for the Annual Report. Preparations were also made to recommence field work.

On 12th February he left for the Yilgarn Goldfield, and was engaged continuously on field work in that district until the end of October.

During November and December he was at Head Office completing and compiling map and plans of areas and mines examined during 1936.

While at Head Office, Mr. Hobson has from time to time made petrological examinations of rocks, and performed other duties which have arisen.

R. S. Matheson, B.Sc., Geologist.—During January and the early part of February Mr. Matheson was engaged at Head Office preparing material for the Annual Progress Report for 1935, and in carrying out office work connected with the Yilgarn Survey. For the following five months he was engaged continuously in field work connected with the re-survey of the southern portion of the Yilgarn Goldfield.

During July and August he was in charge of boring operations at Greenbushes, then he was engaged continuously during September and October on field work in the Yilgarn Goldfield. For the remainder of the year he was engaged at Head Office on drafting work connected with the inspection by himself of various mines and mining centres in the Yilgarn Goldfield.

G. H. Armstrong, B.Sc., Geologist.—Mr. Armstrong was appointed on loan from the Education Department on 3rd August, and during August, September and October was in charge of the boring operations for alluvial tin on the Greenbushes Tinfield. He returned to Head Office on 10th November and was engaged in compiling the results of the Greenbushes boring, and with petrological work

on rocks which had been collected during the year in the Yilgarn Goldfield. Mr. Armstrong was also engaged for a short time assisting with the card indexing of some of the publications of the Survey.

HEAD OFFICE.

Miss B. M. Bowley, B.Sc., Technical Assistant.—In addition to attending to enquiries from the general public and the ordinary routine work of the office, Miss Bowley assisted in the preparation of the Geological Survey Exhibit at the Western Australian Mining Exhibition held at Government House in October. The reorganisation of the collection in the Geological Museum has been continued, and is now nearing completion.

All technical records have been kept up-to-date, and current literature on Australian geology has been catalogued, and when time permitted, back numbers have also been cross indexed.

Reports following on the field work of the staff are attached except where such were made for purely departmental purposes.

In conclusion, I take this opportunity to express my appreciation of the work and loyal support of each member of the staff during the past year.

F. G. FORMAN,
Government Geologist.

THE ORA BANDA AMALGAMATED GOLD MINE, GRANT'S PATCH, BROAD ARROW GOLDFIELD.

(F. G. Forman, B.Sc.)

The principal leases of the Ora Banda Amalgamated Gold Mine are G.M.L.'s 1962W (Nicholson's), 1970W (Stevenson's), 1967W (Mackenzie's), and 1966W (Hall's).

Country Rock.—The country rock is an epidotized and zoisitized porphyritic dolerite, consisting of large (up to half an inch diameter) phenocrysts of basic felspar in a fine grained groundmass of grey or greenish colour. In certain areas the phenocrysts are not so large and are of a dark colour, so that the rock in the hand specimen appears to be a fine grained grey or greenish rock of even grain size. Under the microscope the two types are seen to be of essentially the same composition. The coarsely porphyritic rock is known locally as "Native Cat rock" or "Cat rock" because of its striking spotted appearance.

The porphyrite is generally massive and coarsely jointed, except in the vicinity of the shear zones which carry the ore-bodies and along certain fault zones of post-gold age, which cause breaks in the continuity of the lodes. The shearing in these cases has been intense and the porphyrite has been converted into a sheeted rock or schist.

Rock weathering and Secondary Enrichment of Gold.—The water level varies slightly in depth in different parts of the workings, from about 150 to 170 feet below ground level. The bottom of the zone of oxidation does not everywhere agree with the water level. This has been noticed in previous examinations of the Ora Banda district by A. M. Montgomery and J. T. Jutson, and is referred to by the latter in Geological Survey of Western Australia Bulletin 54, on the Mining Geology of Ora Banda.

The zone of oxidation and consequent rock alteration extends some distance below water level, suggesting that there has been a change in water level in the district during recent geological time. Examination of the mine workings shows clear evidence of secondary gold enrichment in all the upper levels. It is sometimes in evidence below present water level, secondary gold having been observed in the No. 2 east winze on Nicholson's lease at a vertical depth of about 230 feet. On the No. 3 levels (vertical depth 260 feet) in Nicholson's and Hall's leases, with the exception of a little staining by iron oxides in the quartz in the No. 2 east lode drive, no sign of secondary alteration is visible, and it appears that the conditions on these two levels should be representative of the sulphide zone. The values obtained at this depth should therefore be representative of those to be obtained with deeper development.

THE ORE-BODIES.

General Statement.—The ore-bodies are of the lode type, and consist of quartz veins and stringers in narrow shear zones in the porphyrite. There are two sets of shears with a marked difference in strike; one set striking south of east (105° - 117°) and the other north of east (70° - 77°). The most frequent shearing is that with a strike of from 105° to 117° , and it is in these shears that Nicholson's east lode and its extension through Stevenson's lease, Mackenzie's east lode, and Hall's lode, are located. Nicholson's west lode and Mackenzie's west lode lie in the other set of shears striking at 70° to 77° . An important cross shear at the western end of Hall's lode departs from either of these two directions, having a strike of 140° . The intersection of the shears mentioned above is considered to have governed the location and pitch of the various ore shoots at present developed. The lodes are frequently displaced by post-gold faults, the lode having been displaced to the left when followed along the strike. This type of faulting is particularly noticeable along Nicholson's west lode where the displacements have been greater and more frequent than elsewhere, but has affected all the lodes to some extent and should be borne in mind during lateral development when an ore-body is found to be cut off.

Nicholson's Lease 1962W.—On this lease two lodes are being worked, an east lode with an average strike of about 117° and an almost vertical dip varying in direction from north to south, and a west lode with an average strike of 70° and a dip to the north of 54° . The intersection of the two lodes is plainly marked by the sudden bend in the drives and is obvious from an inspection of the plan. The intersection pitches to the west and at the No. 3 level (V.D. 260 ft.) is almost opposite the main shaft.

The East Lode.—The east lode lies in a strong shear zone in which there are both horizontal and vertical components of movement. That the west side of the shear has moved eastwards relatively to the east side is indicated by the direction of fracture cleavage planes in the shear zone, which run diagonally across it. This is illustrated in fig. 1 where the direction of movement is indicated by arrows. That the shearing movement also had a vertical component is shown by the flutings with a westerly pitch, which are frequently visible on the major shear planes, and the irregularity of strike

and dip of the shear zone which would require both horizontal and vertical components of movement in order to allow them to be preserved.

The gold values occur in shoots or patches of irregular shape where the quartz veins or stringers are widest, and probably coincide with the more shattered and porous zones of the shear. One shoot is invariably connected to the next by a thin stringer or vein of quartz which lies along the main shear plane, and is important as an indicator in development work.

The western end of the east lode is its intersection with the adjoining west lode, the junction pitching northwards at about 50° . The pitch varies, however, from this average figure because of the frequent change in direction of dip of the east lode and because of the compound nature (a series of flat dipping shears with steep dipping breaks) of the west lode.

Taking the eastern end of the stopes as an indication of the eastern limit of ore of millable grade, it is found that the eastern end of the shoot pitches westwards, parallel to the intersection with the west lode, giving a horizontal shoot length of about 160 feet.

The east drive at the No. 3 level beyond the limits of the stoping has revealed low grade ore, and it is considered that further payable shoots might be exposed by further driving.

The West Lode.—The west lode shear has an average strike of 70° and dips to the north at 54° . At irregular intervals the main shear is intersected by a series of minor shears or faults of pre-gold age, which have caused a series of vertical displacements in the lode. These faults have an almost vertical dip varying from north to south. Their strike also varies; one, exposed in the No. 2 west winze 43 feet below the No. 2 level, strikes at 105° , while a second, exposed in the No. 3 level main west drive, strikes at 72° . It will be noticed that these two strikes approximate to those observed in the east and west lode shears themselves. The shears were probably formed by the same forces which produced the major lode shears, and they are therefore probably best considered as minor shears belonging to the same structural pattern.

The flat shears carry consistent gold values and constitute the west lode, while the steep minor shears or faults carry only spasmodic patches of ore. In the case of both the flat and steep series of shears the individual ore shoots are connected by a thin quartz vein (the indicator) which must be followed in development work.

Fig. 2 is a cross section of the west lode between the No. 2 and No. 3 level in the vicinity of the No. 2 west winze, and illustrates the structural features of the west lode shear pattern.

The breaking up of the west lode into a number of sections by the steep shears or faults mentioned above introduces a difficulty in development at depth, and this is illustrated by the west drive at the No. 3 level. This drive follows one of the faults which displace the lode, and it has been necessary in order to work the ore lying in the position B of fig. 2 to put in an intermediate drive above the No. 3 level. The west lode at depth should be found at an unknown depth below the No. 3 level and on the north side of the steep shear zone. The amount of displacement being unknown, it is clear that by sinking the shaft an arbitrary depth of say, 100 feet, and cross-

cutting to the lode, it is uncertain as to how much ore would be made available above that level. It is therefore suggested that the best method of exploration in depth below the No. 3 level is to sink a pilot winze to locate the top of the next section of the west lode and to determine its vertical extent. A suitable depth for the next level can then be decided on before deepening the main shaft.

The eastern limit of the west lode is marked by its intersection with the east lode. The extent of the present workings is insufficient to enable the pitch of the western end of the lode to be determined, but the westerly pitch of all the structural features in the lease suggests that the pitch of the lode should also be to the west. As the junction of the east lode and the west lode at the No. 3 level is only about fifteen feet east of the main cross-cut, it is therefore reasonable to suppose that the length of ore likely to be opened up by the west drive at this level should be equivalent to the whole length of the west lode as exposed at the Nos. 1 and 2 levels. The workable portion of the lode, however, will be some distance above the level of the drive as shown at B in fig. 2.

Surface workings on the west lode, well to the west of the main shaft workings, indicate that values might be found at depth beyond the present limits of the drives. Exploration in this direction appears justified, particularly as the condition of some of the shallow early workings indicates that the then owners did not fully understand the faulting system which repeatedly displaces the lode.

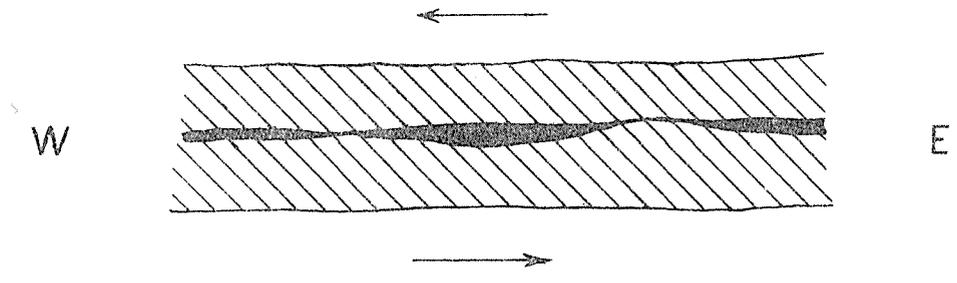
Stevenson's Lease 1970W.—Small rich bulges of quartz are reported to have been cut in shallow drives connected to Nos. 2, 3 and 4 shafts on this lease. These workings were examined, and judging by the position and direction of the drives, together with the appearance of the shears exposed in them, it is considered that they are all on the same shear, and that this is an easterly extension of the east lode shear in Nicholson's lease.

There is a considerable length on this shear still unexplored, lying between the drives from Nos. 2, 3 and 4 shafts, and between the No. 3 shaft drive and the eastern faces of the east lode drives in Nicholson's lease. This ground could be prospected cheaply by extensions from the existing workings.

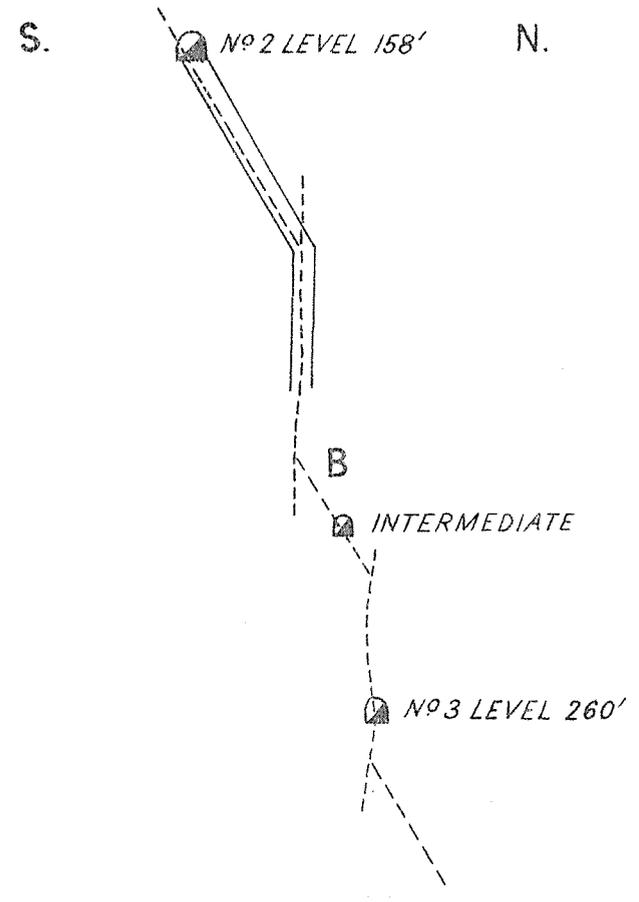
In the end of the north cross-cut from the No. 5 shaft a narrow shear dipping to the north at about 50° is exposed, and a sample of quartz taken from this position is reported to have given a high assay result. It is considered that this shear is possibly an easterly extension of Nicholson's west lode shear. The ground between this point and the main workings on Nicholson's lease does not appear to have been prospected. A line drawn from the end of the cross-cut from No. 5 shaft on the average bearing of Nicholson's west lode, passes north of the known position of the lode in Nicholson's lease. There is no available evidence to show whether Nicholson's west lode shear is of earlier age than the east lode shear, but if such be the case, then from the known direction of movement on the east lode shear (shown in fig. 1), the west lode should be displaced to the position indicated by the line from the No. 5 shaft cross-cut.

No. 1 shaft and the workings from it were not examined, but only occasional low values are reported from the drive which is said to be on a southerly dipping shear. It is difficult to correlate these workings with any known lode in the vicinity.

Figures to Accompany Report
ON
ORA BANDA AMALGAMATED G. M.



— FIGURE 1 —



— FIGURE 2 —

Mackenzie's Lease 1967W.—Uncertainty with regard to the conditions in this lease is caused by the small vertical extent of the workings, and the presence of timbering making it impossible to inspect the ore-body at critical points. However, the shape of the No. 2 level drive from No. 2 main shaft indicates the presence of two dissimilar strikes in the lode channel. The west drive has an average strike of 70° . The strike of the east drive at this level considered together with the corresponding drive at the No. 1 level from the No. 3 main shaft (Hall's) gives an average strike for the eastern section of the ore-body in Mackenzie's lease of 105° . Both the western and eastern sections of the ore-body dip to the north.

There is a close approximation between the two strikes observed in this lease and the strikes of the west and east lode shears in Nicholson's lease, and it is considered that similar structural conditions exist, *i.e.*, that the west drive from the No. 2 main shaft is on a lode occupying a shear which is distinct from and intersects a second lode shear which has been followed in the east drive. This view is supported by the observation of the manager, Mr. H. T. Kingdon, that the values obtained in the east drive were distinctly higher than those in the west drive, the change occurring fairly suddenly just west of the main cross-cut.

The vertical extent of the workings is insufficient to enable the average dips of the eastern and western ore-bodies to be obtained, but it is clear, from the difference in strike of the No. 1 and No. 2 level drives on the east lode, that the dip of this ore-body is not altogether constant. The pitch of the intersection of the west and east lode depends on the difference in dip of the two; and will be to the west or to the east, depending on whether the east lode or the west lode has the greater dip. It is probable that the pitches of the two ore-bodies will follow the pitch of this structural feature. The only dips observed at the No. 2 level were a dip of 80° to the north in the face of the west drive, and a dip of 55° to 60° in the face of the east drive. If these dips represented the average dips of the west and east lodes respectively, their intersection would pitch to the east, and the pitch of the ore-bodies would probably coincide. There is, however, insufficient evidence from which to make a definite decision.

Hall's Lease 1966W.—The ore-body on Hall's lease has an average strike of 105° and dips to the north at 63° . It has been opened up to the No. 3 level (V.D. 260 feet).

At the western end of the drives several small branch lodes have been followed for a short distance, but they have been found soon to lose their values. These branch lodes lie in a weak shear striking at about 140° and which intersects the main lode shear. At the intersection the country rock has been highly fractured and schisted, with the result that the gold bearing solutions have had full opportunity of easy circulation, and a bulge of ore has been formed of considerably greater width than is found elsewhere in the lode.

At the No. 3 level, two east drives have been started from the main cross-cut. The No. 1 east drive (that closer to the shaft) is considered to be the main lode at this level for the following reasons. Firstly, the winze sunk from the No. 2 level west of the main cross-cut followed the "indicator" continuously until it was met by the short rise from the No. 3 level. The "indicator" at this point was left on the hanging wall (north) side of

the rise and is therefore more nearly in line with the No. 1 east drive than with the No. 2 east drive. Secondly, the quartz exposed in the No. 1 east drive is similar in appearance to that exposed along the main lode at the Nos. 1 and 2 levels, the quartz in the No. 2 east drive being slightly stained in places with iron oxide. Thirdly, the dip of the lode between the Nos. 2 and 3 levels would require to steepen considerably beyond its dip in the upper levels in order to be in the position of the No. 2 east drive at No. 3 level, whereas the No. 1 east drive is in the correct position of the main lode, assuming that it maintains the dip observed in the upper levels.

The short ore-body opened up in the No. 2 east drive is considered to be the same as the short spur driven on at the western end of the No. 1 level, and which was on the southern or footwall side of the main lode. This spur has apparently been missed or considered not worth driving on at the No. 2 level.

The pitch of the intersection of the cross shear with the main lode at its western end is to the north-east and is obvious from an inspection of the plan. The pitch of the gold values in the main lode channel will probably be found to coincide with this structural pitch. Provided that the ore in the main lode at the No. 3 level is of millable grade, there should therefore be a considerable extent of ore yet available beyond the face of the No. 1 east drive.

The south cross-cut from the No. 3 shaft was examined carefully, but no trace of an easterly extension of Hall's main lode shear could be detected in its expected position. The short east and west drives off the north cross-cut from this shaft are on a narrow shear which may be the western end of a new shear zone, or may be the eastern extension of Hall's lode shear. If the latter be the case then the shear has suffered considerable displacement by faulting.

POSSIBLE UNDEVELOPED ORE-BODIES.

Attention has already been drawn to the possibilities of locating new ore shoots in the western end of Nicholson's west lode and the eastern end of Nicholson's east lode and its extension through Stevenson's lease; also to the possible eastern extension of Nicholson's west lode, a shear which is known to be auriferous to at least some extent from the location of values in the end of the north cross-cut from No. 5 shaft on Stevenson's lease.

Rich patches of alluvial gold have been worked on the north and south sides of the iron-stone capped hill, about a quarter of a mile west of Nicholson's lease on which the treatment plant is situated. The distribution of the alluvial patches makes it appear certain that the gold was shed from one or more ore-bodies located somewhere in the hill. A considerable amount of prospecting work has already been carried out on the hill by means of costeans, adits, and shallow shafts. The direction of a number of the prospecting workings which were briefly inspected suggests that the prospectors were searching for a north-south lode, as almost all the cross-cuts and trenches run in an east and west direction.

All the persistent shears observed in the developed leases strike either north of east or south of east, the actual strikes ranging from 77° to 117° .

It is likely, therefore, that if a payable ore-body exists under the battery hill, it will have a strike within these limits, and prospecting cross-cuts or trenches running generally east and west would most probably fail to locate it. The hill is therefore considered worthy of further prospecting, but all future cross-cuts should be driven in a north and south direction in order to cut possible east and west shears.

SCAHILL'S FELSPAR QUARRY, LONDON-DERRY, COOLGARDIE GOLDFIELD.

(F. G. Forman, B.Sc.)

This quarry, which is worked for the production of microcline feldspar, is excavated in an extremely coarse grained pegmatite dyke.

The pegmatite consists of quartz, microcline, a little albite and lepidolite. Quartz and microcline are the chief constituents and occur in large masses so that the mining of almost pure microcline without admixture of quartz is an easy operation.

The excavation, which measures approximately 100 by 50 by 15 feet, is situated in a part of the dyke which consists almost wholly of microcline. The quarry has reached its limit on the western side as surface exposures show the remaining dyke material on this side to consist almost wholly of quartz.

The southern end of the quarry, which is the shallowest, still shows a face of microcline feldspar, but the mineral is badly iron-stained and would have to be extracted as second grade material.

The eastern side of the quarry shows lower grade material than that obtained in the central portion. The microcline on this side is mixed with lepidolite mica and albite feldspar with some quartz, the boundary between the high grade material and the lower grade mixture dipping fairly flatly in a westerly direction. This has apparently been the controlling factor in deciding the depth of the quarry, but judging by the adjacent surface outcrops and from the general nature of the pegmatite dyke, there is good reason to believe that workable microcline could be obtained beneath the present bottom of the quarry; the low grade material forming the present floor being probably in the form of a thin irregular vein in the pegmatite mass. The dyke should be prospected at depth by a shaft sunk in the centre of the quarry floor.

In the northern face, where work is at present concentrated, the masses of quartz and microcline constituting the bulk of the pegmatite are more intimately mixed and of smaller dimensions than in the place originally worked. This has led the proprietor to suppose that the deposit would soon become exhausted in this direction. Inspection of the surface, however, shows that the pegmatite dyke extends some distance further to the north and, while that part of the dyke at present exposed in the north face of the quarry is less coarse grained than where originally opened up, there are at least two large masses of microcline still ahead of the face. These are being prospected by shafts and costeans.

It is suggested that the best method of continuing the quarry is by continued working of the whole of the north face. Greater labour will be required in order to expose the more scattered microcline masses

and to discard the useless quartz. This, however, is unavoidable and much to be preferred to the present method of working, which is to locate a mass of microcline and remove it bodily before looking for the next mass by tunnelling. If the present practice is continued the deposit will become unworkable because of the bulk of useless material left in the quarry and the high cost of extraction of the feldspar by underground methods. Prospecting ahead of the face by shaft sinking and costeaning is at present being done and should be continued.

It is unfortunate that those parts of the quarry which have been worked out have been used as a dumping ground for refuse from the face. There is probably much valuable feldspar below the floor of the quarry, and the refuse will need to be moved before this material can be worked or even thoroughly prospected.

SUB-ARTESIAN WATER POSSIBILITIES ON WINNING STATION, LYNDON RIVER, NORTH-WEST DIVISION.

(F. G. Forman, B.Sc.)

The greater part of Winning Station is underlain by rocks of Cretaceous age; Palaeozoic strata (Permian Carboniferous) outcrop over a relatively small area south of a line joining Windalia Hills and A.50. The distribution of the rocks is shown on the accompanying map of the area.

Wells already drilled on Winning Station, and on adjacent pastoral leases, indicate that the most useful artesian and sub-artesian horizon lies at the base of the Cretaceous Series in a greensand or sand-rock, but this horizon has not by any means been fully exploited.

The highest rocks of the Cretaceous outcropping on Winning Station are limestone and shales containing abundant Inoceramus fragments (Cardabia Series). These are underlain by the Winning Series, the upper part of which consists of light-coloured silt-stones, cherts and light grey shales. The lower part of the Winning Series consists of dark green and greenish grey shales and mudstones with thin bands of greensand. It is the lowest band of greensand at the base of the Winning Series from which useful supplies of stock water are obtained. Thin greensand bands carrying intensely salt water occur about 250 feet above the base of the Series. This fact has discouraged boring in a number of localities, particularly at the eastern portion of the property and in what is known as the "9-Mile Paddock."

The Cardabia Series outcrops only on the extreme western portion of Winning Station, west of the "12-Mile" and "Dud" Bores. In this Series there is a greensand lying immediately above a light coloured Inoceramus shale bed which carries small quantities of water, of a quality suitable for stock. This has been tested by two wells on Marilla Station immediately north of Winning, but the supply in both cases was inadequate. This greensand water could be obtained on Winning Station along the western boundary by boring to shallow depth (probably between 100 and 200 feet), but the supply obtainable is not likely to be great, and possibly insufficient for the purpose of watering stock.

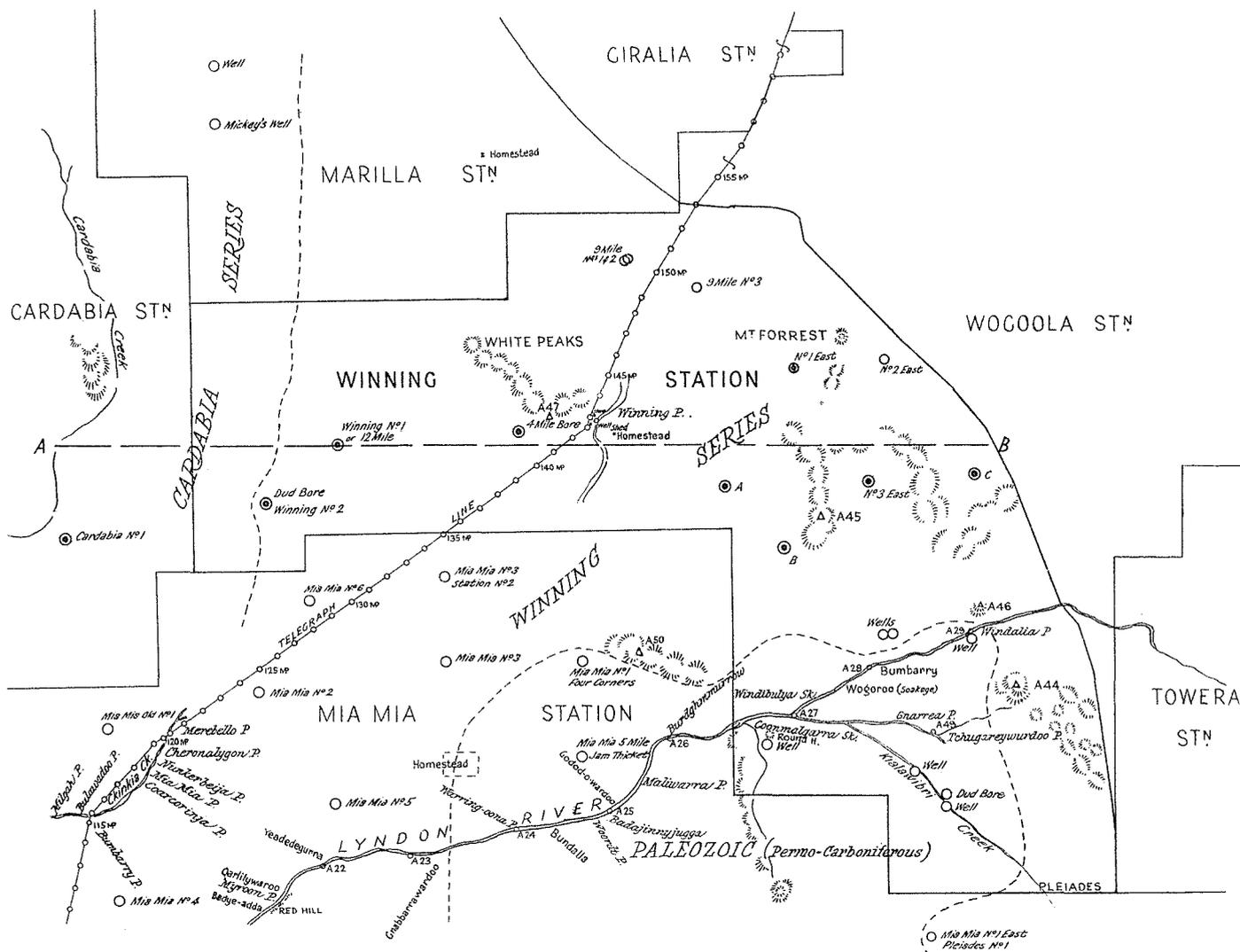
The accompanying cross section from west to east through the deeper bores on Winning Station shows that the Winning Series thins rapidly from west to

PLAN OF WINNING STATION

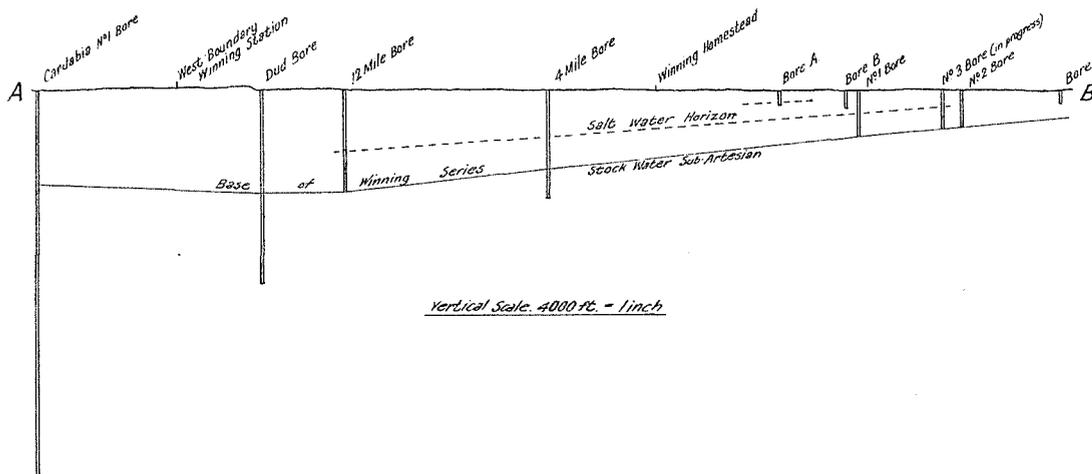
Showing Surface Geology and Distribution of Bores

To accompany report by F.G. Forman Govt. Geologist

SCALE



CROSS SECTION ON LINE A-B



east. At the "12-Mile" and "Dud" Bores, the Series is at least 1,045 feet thick, it has decreased in thickness to 800 feet at the "4-Mile" Bore, and in the vicinity of the Querrie Hills and Mt. Forrest it is only from 350 feet to 450 feet as shown by the No. 1 East and No. 2 East Bores in this vicinity. Generally speaking it may be said that, going westward from the vicinity of Querrie Hills, the depth to water increases at the rate of about 30 feet to the mile. Water in the No. 3 Bore should be found at a depth of about 450 feet; at Winning homestead the same water horizon should be met with at a depth of approximately 700 feet.

Mt. Forrest-Querrie Hills Area.—In this area the No. 1 East and No. 2 East Bores both obtained sub-artesian supplies at the base of the Winning Series at depths of 474 feet and 357 feet respectively. Having regard to the arrangement of the bed as shown in the accompanying cross section, water should be obtained at the No. 3 Site at approximately 400 feet. This depth has, however, already been passed, and it appears that some local folding is present causing the water-bearing horizon to be at a greater depth in this locality. I would expect water in No. 3 Bore at any depth below 400 feet, and almost certainly not deeper than 450 feet.

Three shallow unsuccessful bores marked on the plan "A," "B," and "C" have not gone deep enough to cut the water-bearing strata, although Bore "A" has met with salt water belonging to the same horizon as the salt water obtained in Nos. 1 and 3 Bores. Good water should be obtained in Bore "A" at a depth of approximately 350 feet; at Site "B" the water should be obtained between the depths of 475 feet and 525 feet; at Site "C" between 275 feet and 325 feet.

In stating the above probable depths to water a factor of uncertainty of 50 feet has been allowed because of the lack of accurate knowledge of the relative surface elevations of the bore sites. The depths given also assume that the water-bearing bed lies on an evenly sloping plane, and no allowance has been made for changes of dip which probably occur but to determine which, not sufficient data is available. The quoted figures are only approximate, and the failure to obtain water at these depths should not cause discouragement.

Nine-Mile Paddock Area.—In the Querrie Hills, Mt. Forrest Area, a salt water horizon occurs about 250 feet above the good water horizon at the base of the Winning Series. In the 9-Mile Paddock Area three shallow bores have obtained intensely salt water at depths between 100 feet and 150 feet, and a fourth bore obtained salt water at a depth of 32 feet. This salt water horizon is presumably the same as that met with in the Querrie Hills-Mt. Forrest bores, and on this assumption, good water should be obtained in the 9-Mile Paddock at a depth of approximately 400 feet. Some uncertainty, however, exists because comparison of the Winning 4-Mile Bore, Mia Mia No. 3 and Mia Mia No. 6 Bores suggests that the depth to good water in the 9-Mile Paddock is between 800 and 900 feet. As it is almost certain that the salt water horizon met with in the 9-Mile Paddock is the same as that cut in the Querrie Hills-Mt. Forrest Area, I would expect good water to be met with at the shallower depth (400 feet), but in the event of good water not being obtained in the

9-Mile Paddock at a depth of less than 600 feet, it is probable that the good water will not be met with until the greater depth (800 to 900 feet) is obtained.

The first test bore in this area should therefore be planned to go down to 600 feet, with a great probability of obtaining good water between 400 feet and 600 feet. In the event of this failing, it would of course be necessary to obtain a heavier plant than that at present in use, but the possibility of this being necessary is, in my opinion, remote.

Bannawong-Pleiades Area.—The paddocks in this area are underlain by Cretaceous Winning rocks on the eastern side along the Rabbit-Proof Fence, but it is doubtful whether any great thickness exists, and the possibility of obtaining sub-artesian water at the base is not as bright as elsewhere. Several tests within one or two miles of the Rabbit-Proof Fence would, however, be justified as the depth is not likely to be great, and one positive result would lead the way to the development of a number of similar supplies. The western paddocks in this area are underlain by older Palaeozoic rocks, and as a general rule, wells in sandstone areas are the most likely to meet with success. A Road Board well on Kialawibri Creek obtained a small supply of good water in a sandstone bed dipping westward. A station well on the same creek, two miles further north-west, has a very poor supply, which is obtained from a flat fissure in a shale band of the Lyons Glacial Stage of the Permo Carboniferous rocks. The rocks at both well sites dip westwards, but the angle of dip is not clear. It is certain, however, that the sandstone in the Road Board well passes underneath the shales of the Station well. This sandstone could be penetrated at the site of the Station well by boring, the depth necessary being governed by the angle of dip of the sandstone, which, unfortunately, is not known.

A bore at the Station well put down with the object of cutting the sandstone of the Road Board well is well worth while, as at this increased distance from the outcrop, the water supply in the sandstone will be under a greater pressure and therefore likely to give better supply. Further search for water in the older rocks would best be confined to boring in sandstone areas, with the object of obtaining supplies in porous sandstones such as those in the well near Windalia Pool and near Round Hill.

To obtain supplies in the western paddocks of Winning Station it will be necessary to bore to depths of between 800 and 1,100 feet as indicated on the accompanying cross section, the shallower water being obtained nearer the Homestead and the deeper water near the west boundary. There is a possibility, which has already been mentioned, of obtaining small supplies at a depth between 100 and 200 feet along the west boundary of Winning, but the supply is likely to be insufficient.

ARTESIAN AND SUB-ARTESIAN WATER POSSIBILITIES, WOODLEIGH STATION, MURCHISON DISTRICT.

(F. G. Forman, B.Sc.)

Woodleigh Station and the adjoining properties are, except for a narrow coastal strip which is covered by Tertiary and Post Tertiary rocks, entirely covered by rocks of Cretaceous age.

The Cretaceous rocks can be divided into two groups, an upper consisting of bright coloured shales, clays, and chalks or chalky clays; and a lower group of dark coloured (dark grey to black) shales and clays, with at or near the base thin beds of sands and sandstones. Occasional thin cherty beds are distributed through both the upper and lower groups.

Little of the Cretaceous rocks can be seen at the surface as the greater part of the country is covered by red sand and, in places, travertine, which effectively mask the underlying rocks. The upper group of the Cretaceous is, however, exposed fairly well in a group of low flat-topped hills on Yaringa and Yaringa South Stations, where it is seen to consist

predominantly of white or greenish clays or chalky clays. The lower group can only be studied by the examination of the logs of numerous bores put down in the search of water.

Near Mt. Curious, at the mouth of the Murchison River, a fairly complete section of both the upper and lower Cretaceous is exposed. This section (which was examined by the writer on an earlier trip) is, however, somewhat different to the sections cut in the numerous bores in the Wooramel District and north to the Gascoyne. An approximate section of the Mt. Curious beds is given below, the main difference between this and the sections cut in bores further north being the increase in the proportion of sandy beds towards the south.

—	Thickness, in Feet.	Nature of Strata.	Remarks.
Upper Group ...	100	Chalk	Fossiliferous; Inoceramus fragments; Ostrea sp; Spirulaea sp; Trigonosemus sp; spines and plates Cidarid; fish scales and teeth; Belemnite guards.
	50	Current-bedded sandstones with pebble bands	Fossiliferous; Inoceramus fragments.
	10	Chalk	
	25	Greensand	
	25	White and ferruginous, current-bedded sandstone	
	10	Brown argillaceous sandstone with thin streaks of gypsum	
	10	White and ferruginous current-bedded sandstone	
	7	Greensand	
	15	White and ferruginous coarse and fine-grained sandstone	
	5	Gritty chalk ... ..		Fossiliferous; Inoceramus fragments.
15	Greensand with brown sandy streaks	Fossiliferous; fish scales.	
Lower Group ...	Uncertain—100-200	Dark grey and green shales	Fossiliferous; Belemnite guards.
		Coarse-grained current-bedded sandstone	Possibly Kennedy Stage of Permo-Carboniferous.

In bore cores or sludge from percussion plants, the Upper Cretaceous group is readily identified by the presence of chalk and chalky clays carrying numerous fragments of Inoceramus; the lower group is just as certainly identified by the preponderance of dark grey to black clays and shales.

The Cretaceous rocks in this area rest on a series of sandstones and shales, probably the Kennedy Stage of the Permo-Carboniferous. This group is not exposed anywhere in the area examined, but can be readily identified by studying the logs of the deeper bores between the Wooramel and Gascoyne Rivers, the break from the dark shales and clays of the Cretaceous into the predominating sandy beds of the Kennedy Stage being in most cases distinct. The coarse current-bedded sandstones below the Cretaceous near Mt. Curious are tentatively referred to the Kennedy Stage.

The principal water-bearing beds of the district are the sands and sandstones at or near the basal Cretaceous rocks and the sandstones of the Kennedy Stage, the latter, however, having only been exploited in this area by a few of the deepest bores.

The majority of the bores on Woodleigh Station and all those on Yaringa South Station which adjoins Woodleigh on the west, obtain their water from the basal Cretaceous sands. Only Woodleigh

Nos. 4 and 9 Bores and possibly Woodleigh Nos. 1 and 2 Bores have penetrated to the Kennedy sandstone group, and none of them has been successful in obtaining useful water supplies below the base of the Cretaceous rocks. Several bores on Wahroonga Station, which lies north of Woodleigh, have, however, obtained flows in the Kennedy sandstones.

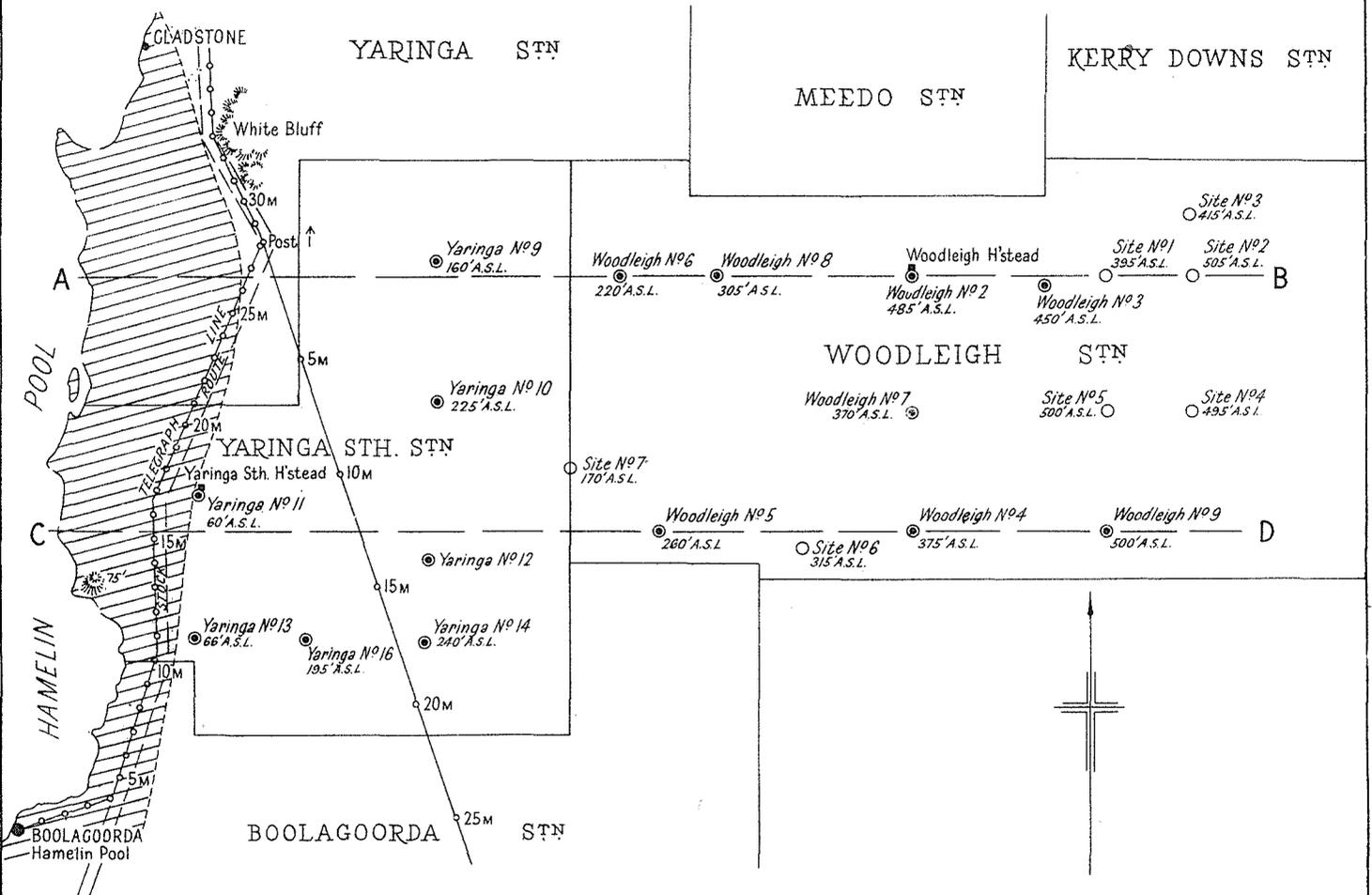
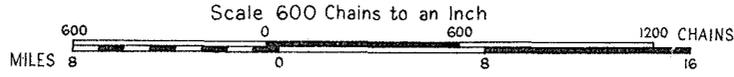
The accompanying cross sections from west to east through the principal bores on Yaringa South and Woodleigh Stations illustrate the water conditions which exist in this area. The upper dotted line in the sections represents the potential head of water in the basal Cretaceous aquifer, *i.e.*, the height to which water would rise in a bore cutting this horizon. Where the potential head line rises above the surface, artesian conditions exist, *i.e.*, water will flow at the surface from the bore at such a position. Where the line passes beneath the ground surface only sub-artesian water will be obtained, and where it cuts the line marking the base of the Cretaceous rocks or passes below that line, no water would be obtained.

A study of the sections will make it clear that no water is likely to be obtained from the basal Cretaceous aquifer, at any site on Woodleigh Station east of the line joining the sites of Nos. 3 and 4 bores, as the potential head line passes below the base

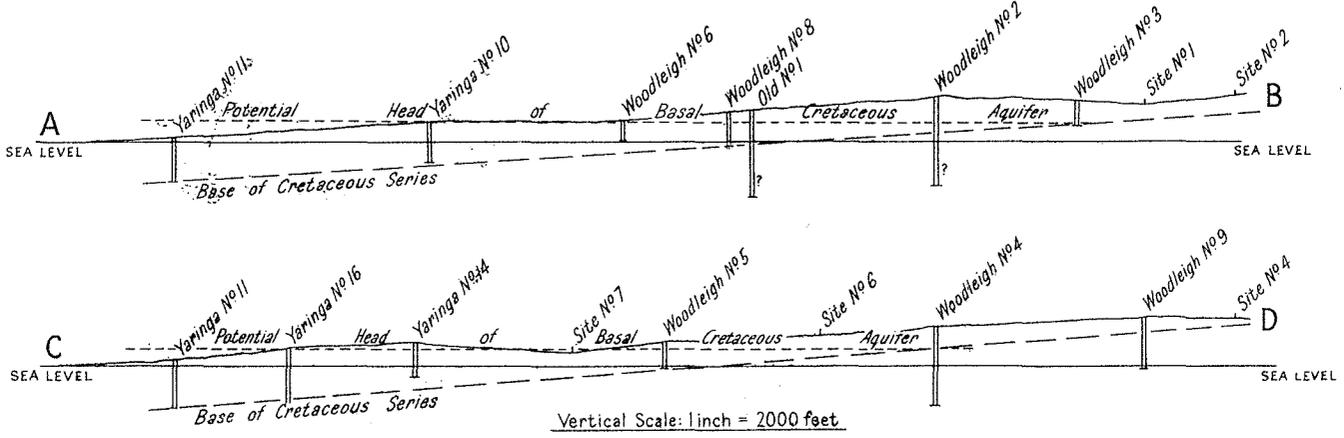
PLAN OF WOODLEIGH STATION

Showing Distribution of Bores and Bore Sites

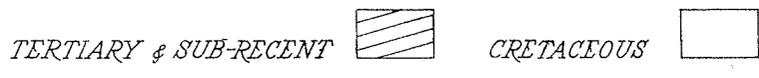
To accompany report by F.G. Forman Govt. Geologist



CROSS SECTIONS ON LINES A-B AND C-D



LEGEND



of the aquifer just east of these points. Sites 1, 2, 3, 4 and 5 are therefore clearly unsuitable places in which to bore for shallow water.

Sub-artesian conditions exist on Woodleigh Station west of the line joining the Nos. 3 and 4 bores, as may be seen from the sections. It should be noted, however, that a bore at site 7 would probably obtain artesian water at a depth of about 280 feet; the potential head line passing above the surface at this point. The water obtained would probably be of fair quality.

Bore No. 6 is one of the shallowest on the Station, and the supply from it could be improved by deepening to the basal Cretaceous aquifer. The water at this point should be of a fair quality. Owing to the fact that the elevations used in the preparation of the cross sections are only approximate (aneroid barometer elevations) it is uncertain if the No. 6 bore site is actually above or below the potential head line, but it is certain that if the bore were deepened, the water would rise at least very close to the surface.

Site No. 6 should yield a sub-artesian supply from a depth of 230 feet; the quality would probably be poor stock water* similar to that obtained from No. 7 bore.

That portion of Woodleigh Station west of the line joining Nos. 3 and 4 bores can be adequately watered by bores put down to the base of the Cretaceous, with depths varying with the elevation of the ground. At any site with a surface elevation of less than 180 feet, artesian water should be obtainable. Unfortunately such sites are rare on the property as the general elevation is 300 feet to 400 feet above sea-level. Site No. 7 has already been mentioned as a favourable location for a flowing bore.

The eastern portion of Woodleigh Station must depend for its water supplies on bores drilled to possible aquifers in the Kennedy sandstones, below the base of the Cretaceous rocks. The nearest points to Woodleigh Station on which the Kennedy sandstones have been exploited are the Nos. 1, 3 and 5 bore sites on Wahrenonga Station to the north. Wahrenonga No. 1 bore obtained flows from sandstones at depths of 144 feet and 343 feet below the base of the Cretaceous. No. 3 bore obtained flows at depths of 125 feet and 460 feet below the Cretaceous, and No. 5 bore obtained a flow from a depth of 136 feet below the Cretaceous.

Woodleigh No. 4 Bore was sunk to a depth of 800 feet below the surface, and beneath the basal Cretaceous beds penetrated chocolate and grey shales similar to those in Wahrenonga No. 3 Bore. These shales are regarded as a lateral variation in the Kennedy sandstone. A water horizon was cut between 752 feet and 758 feet. Salt water was obtained at the base of the Cretaceous in this bore, the water level standing at 228 feet below the surface. The standing level of the water after cutting the deeper aquifer at 752 feet was 240 feet, which makes it clear that the deeper aquifer has a lower potential head than the shallower one. These two waters were not separated during drilling operations and consequently it is almost certain that the upper salt water is mixing with the lower water, and this bore cannot be considered a fair test of the quality of the water in the deeper aquifer. At present it is unfit for stock, but it is pointed out that it is almost certainly contaminated by the upper salt water.

Woodleigh No. 9 Bore penetrated 343 feet below the base of the Cretaceous, which is not deep enough to reach the 752 ft. aquifer in No. 4 Bore, which is about 500 feet below the base of the Cretaceous.

The logs of Woodleigh Nos. 1 and 2 Bores are unreliable owing to the confusion of records, and it is now difficult to state the depths of either bore or the water conditions found at the lower levels.

The only useful evidence therefore of the presence of water below the base of the Cretaceous rocks on Woodleigh Station is afforded by No. 4 Bore, which, as previously pointed out, does not supply a conclusive test. Owing to the lack of knowledge of the surface elevations or the static heads of the flowing bores on Wahrenonga Station, it is difficult to form an opinion of the probable potential head of waters in the lower beds on Woodleigh, but Woodleigh No. 4 Bore does afford some evidence that useful water supplies might be present with a potential head of about 130 feet above sea level.

The only method of proving the presence or absence of useful deep water supplies on the eastern portion of Woodleigh Station and the surrounding country is by boring in search for aquifers below the base of the Cretaceous rocks. A position should be chosen east of the line joining Woodleigh Nos. 3 and 4 Bores at as low an elevation as possible, and a bore put down to at least 1,000 feet and preferably to 1,500 feet. The 756 ft. aquifer of Woodleigh No. 4 Bore should be expected between the depths of 700 and 800 feet, and a 1,500 ft. hole would provide for exploration for a depth of 700 feet below this.

BORING FOR "DEEP LEADS," GREEN-BUSHES TINFIELD, SOUTH-WEST DIVISION.

(F. G. Forman, B.Sc.)

An inspection of the alluvial ground of the Greenbushes Tinfield† by the writer in 1933, led to the conclusion that deep leads likely to carry payable tin might exist below the shallow alluvial ground worked in the past, particularly in the vicinity of the Phoenix East and Battler's Hope leases.

During April of this year, a further inspection was made and bore sites located by Mr. H. A. Ellis, of this Branch. Boring with a percussion power plant commenced in August on the first line of bores located by Mr. Ellis on the Battler's Hope leases. Information gained in the first few holes caused the abandonment of the original programme, the bore sites as finally selected being shown on the accompanying locality plan.

Six holes on the Battler's Hope leases and three holes immediately to the west of the Phoenix East lease proved the existence of deep alluvial ground below the level to which the leases and claims had been worked previously, but failed entirely to locate payable tin deposits in this deep ground.

Assays of the material from the upper part of the holes indicated extensions of the previously worked shallow ground, but the distribution of the bores and their number was insufficient to indicate the full extent of shallow alluvial tin or its average grade.

* Since writing this report I have been informed by Mr. A. Thomson, of Woodleigh Station, that there is a probable leakage of an upper salt water into the No. 7 bore. If this leakage were stopped, the quality of the water in No. 7 bore would probably be improved.

† G.S.W.A. Ann. Prog. Rept. 1933, pp. 13-15.

The object of the present programme was to search for deep alluvial, and the holes put down were located in what were considered the most favourable locations for this purpose. The failure of any bore to locate tin of anything approaching payable grade in what were judged to be the most favourable locations was considered to justify abandonment of the pro-

gramme, and consequently additional lines of bores to the east of the Phoenix East area and Poverty Flat and Elliot's Gully were not proceeded with.

The following are the logs of the bores together with the assay results from the samples obtained. The assays were carried out by the Government Mineralogist and Analyst.

BATTLE'S HOPE—No. 1 BORE.

Depth in Feet.	Succession of Strata.	Assay Values (lbs. per cubic yd.).	Sample No.
0' 0" to 6' 3"	1ft. 6ins. of sand overlying laterite ... ..	.028	G. 1 } G. 2 }
6' 3" to 11' 3"	Puggy kaolinised sediment ... ..	.05	G. 3
11' 3" to 16' 3"	do. do. do. ... ..	.008	G. 4
16' 3" to 21' 3"	do. do. do. ... ..	.01	G. 5
21' 3" to 32' 11"	Argillaceous alluvium ... ..	.009	G. 6

26ft. Ground Water Level.

32' 11" to 38' 0"	Argillaceous alluvium ... ..	.004	G. 7
38' 0" to 43' 0"	do. do. ... ..	.004	G. 8
43' 0" to 48' 0"	At 46ft. fragments of quartz and ironstone pebbles ... ..	.005	G. 9
48' 0" to 53' 0"	do. do. do. do. do. ... ..	.001	G. 10
53' 0" to 58' 0"	Argillaceous alluvium ... ..	.004	G. 11
58' 0" to 63' 0"	do. do. ... ..	.001	G. 12
63' 0" to 68' 0"	do. do. ... ..	.004	G. 13
68' 0" to 73' 0"	do. do. ... ..	.06	G. 14
73' 0" to 78' 0"	do. do. ... ..	.008	G. 15
78' 0" to 83' 0"	At 78ft. becomes sandy ... ..	.02	G. 16
83' 0" to 87' 0"	Gravelly. Fine wash ... ..	.23	G. 17
87' 0" to 92' 6"	Change at 88ft. to decomposed mica schist ... ..	.004	G. 18
92' 6" to 97' 6"	do. do. do. do. ... ..	.001	G. 19
97' 6" to 102' 6"	do. do. do. do. ... ..	.004	G. 20
102' 6" to 108' 0"	do. do. do. do. ... ..	.004	G. 21

BATTLE'S HOPE LINE—No. 2 BORE.

Depth in Feet.	Succession of Strata.	Assay Values (lbs. per cubic yd.).	Sample No.
0' 0" to 6' 6"	2ft. 6ins. of sand overlying laterite ... ..	.27	G. 22
6' 6" to 11' 6"	Laterite grading to kaolinised sediment ... ..	.44	G. 23
11' 6" to 16' 6"	Puggy kaolinised sediment ... ..	.78	G. 24
16' 6" to 21' 6"	do. do. do. ... ..	.02	G. 25
21' 6" to 26' 6"	Change at 23ft. 6ins. to argillaceous alluvium ... ..	.03	G. 26
26' 6" to 31' 6"	do. do. do. do. do. ... ..	.04	G. 27

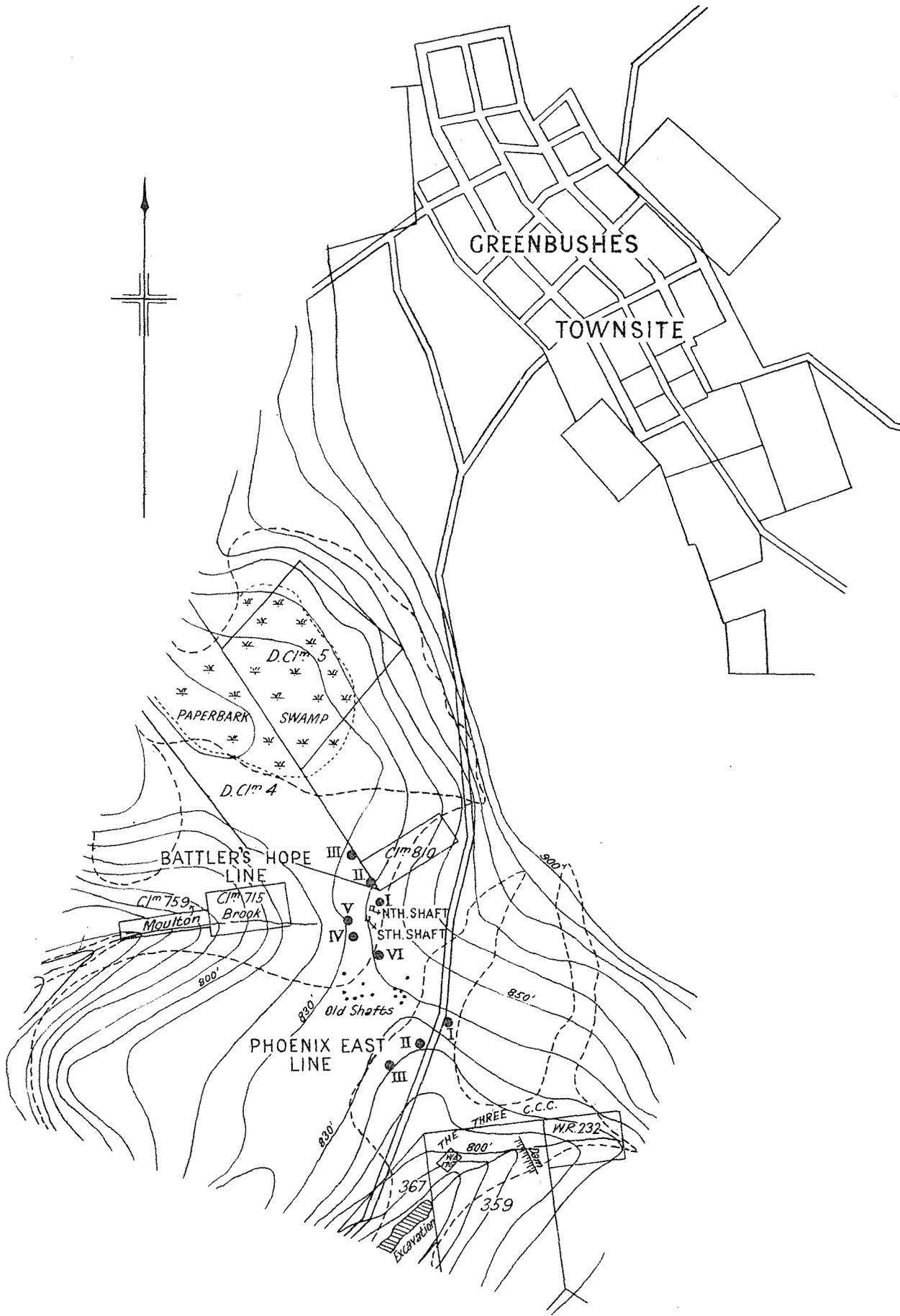
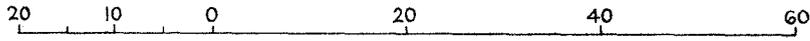
26ft. 6ins. Ground Water Level.

31' 6" to 36' 6"	Argillaceous alluvium with quartz and ironstone fragments ... ..	.01	G. 28
36' 6" to 41' 6"	do. do. do. do. do. ... ..	.01	G. 29
41' 6" to 47' 4"	Alluvium more gritty ... ..	.01	G. 30
47' 4" to 52' 4"	do. sample discarded ... ..	...	...
52' 4" to 57' 4"	do. ... ..	.07	G. 31
57' 4" to 62' 4"	do. ... ..	.01	G. 32
62' 4" to 67' 4"	Alluvium containing fine pebbles, quartz and ironstone ... ..	.009	G. 33
67' 4" to 72' 4"	do. do. do. do. do. ... ..	.009	G. 34
72' 4" to 77' 4"	Wash. Waterworn quartz pebbles ... ..	.009	G. 35
77' 4" to 79' 4"	Wash ... ..	.01	G. 36
79' 4" to 81' 4"	do. ... ..	.03	G. 37
81' 4" to 83' 4"	Granitic sand and chloritic fragments ... ..	.03	G. 38
83' 4" to 88' 4"	do. more micaceous ... ..	.03	G. 39
88' 4" to 93' 4"	Decomposed mica schist ... ..	.005	G. 40
93' 4" to 95' 3"	Micaceous schist ... ..	.005	G. 41

Bore completed 95ft. 3ins. Vertical Depth.

LOCALITY PLAN
OF
BORE SITES
GREENBUSHES TINFIELD

Scale 20 Chains to an Inch



BATTLE'S HOPE LINE—No. 3 BORE.

Depth in Feet.	Succession of Strata.	Assay Values (lbs. per cubic yd.).	Sample No.
0' 0" to 1' 0"	Fine sand and humus ... ..	.902	G. 42
1' 0" to 6' 0"	Sand at 5ft. becomes lateritised grit ... ..	.45	G. 43
6' 0" to 11' 0"	At 8ft. puggy kaolinised sediment	1.08	G. 44
11' 0" to 16' 0"	do. do. do. do. ... ..	.09	G. 45
16' 0" to 21' 0"	Change at 17ft. to red gritty alluvium ... ..	.047	G. 46
21' 0" to 26' 0"	Argillaceous alluvium ... ..	.02	G. 47
26' 0" to 31' 0"	do. do. ... ..	.008	G. 48
31' 0" to 36' 0"	do. do. ... ..	.005	G. 49
36' 0" to 43' 0"	do. do. ... ..	.02	G. 50
43' 0" to 48' 0"	Fine wash ... ..	.005	G. 51
48' 0" to 53' 0"	do. ... ..	.005	G. 52
53' 0" to 58' 0"	Alluvium changes at 36ft. 4ins. to wash ... ..	.016	G. 53
58' 0" to 63' 0"	Lateritic gravel ... ..	.019	G. 54
63' 0" to 68' 0"	Clay with mica and chloritic material ... ..	.004	G. 55
68' 0" to 73' 0"	At 72ft. gritty with quartz and chloritic fragments ... ..	.016	G. 56
73' 0" to 78' 0"	Granitic wash. Sample discarded ... ..	...	...
78' 0" to 82' 5"	Granite at 79ft. ... ..	.004	G. 58

Bore completed 82ft. 5ins. Vertical Depth.

BATTLE'S HOPE LINE—No. 4 BORE.

Depth in Feet.	Succession of Strata.	Assay Values (lbs. per cubic yd.).	Sample No.
0' 0" to 7' 0"	2ft. of sand, 2ft. of laterite ... ..	.117	G. 59
7' 0" to 12' 0"	Kaolinised sediment with sub-angular quartz ... ..	.13	G. 60
12' 0" to 17' 0"	do. do. do. do. ... ..	.52	G. 61
17' 0" to 22' 0"	do. do. do. do. more argillaceous ... ..	.01	G. 62
22' 0" to 27' 0"	do. do. do. do. more arenaceous ... ..	.02	G. 63
27' 0" to 32' 0"	do. do. do. do. sandy wash ... ..	.01	G. 64
32' 0" to 37' 0"	Sandy wash. Sample discarded ... ..	...	...
37' 0" to 42' 0"	Brown clay ... ..	.01	G. 65
42' 0" to 47' 0"	Clay with flakes of muscovite ... ..	.01	G. 66
47' 0" to 52' 0"	At 49ft. changes to ferruginous grit ... ..	.07	G. 67
52' 0" to 57' 0"	do. do. do. At 56ft. pebble wash ... ..	.05	G. 68
57' 0" to 62' 0"	At 57ft. change to clay ... ..	.04	G. 69
62' 0" to 67' 0"	Alluvium ... ..	.03	G. 70
67' 0" to 72' 0"	Alluvium with pebble phases ... ..	.03	G. 71
72' 0" to 74' 0"	At 71ft. dense clay. At 72ft. boulder wash ... ..	.24	G. 72
74' 6" to 79' 6"	Boulder wash. At 75ft. decomposed granite ... ..	.15	G. 73
79' 6" to 84' 6"	Denser. Granite ... ..	.02	G. 74

Bore completed at 85ft. 6ins. Vertical Depth.

This bore revealed the fact that the basal wash dips towards the south shaft. Bore No. 5 was set 150ft N.N.W. from No. 4 to test the behaviour of the supposed "lead" at right angles to the direction bored.

BATTLE'S HOPE LINE—No. 5 BORE.

Depth in Feet.	Succession of Strata.	Assay Values (lbs. per cubic yd.).	Sample No.
0' 0" to 3' 6"	Fine sand ... ..	.05	G. 75
3' 6" to 8' 6"	Laterite ... ..	.49	G. 76
8' 6" to 13' 6"	Change at 9ft. 6ins. to puggy kaolinised sediment ... ..	.52	G. 77
13' 6" to 18' 6"	do. do. do. do. ... ..	.115	G. 78
18' 6" to 23' 6"	do. do. do. do. more argillaceous ... ..	.02	G. 79
23' 6" to 28' 6"	do. do. do. do. do. do. ... ..	.01	G. 80
28' 6" to 32' 0"	do. do. do. do. more oxidised ... ..	.01	G. 81
32' 0" to 37' 0"	Sandy wash ... ..	.009	G. 82
37' 0" to 42' 0"	Fine pebble wash ... ..	.014	G. 83
42' 0" to 47' 0"	Clay with gritty phases ... ..	.014	G. 84
47' 0" to 52' 0"	do. do. ... ..	.007	G. 85
52' 0" to 57' 0"	At 53ft. sandy wash ... ..	.029	G. 86
57' 0" to 62' 0"	Sandy wash ... ..	.021	G. 87
62' 0" to 67' 0"	Clay at 63ft. ... ..	.02	G. 88
67' 0" to 72' 0"	Sandy wash ... ..	.078	G. 89
72' 0" to 77' 0"	Granitic wash ... ..	.034	G. 90
77' 0" to 82' 0"	Granite decomposed ... ..	.17	G. 91
82' 0" to 87' 0"	Granite ... ..	.07	G. 92
87' 0" to 92' 0"	do. ... ..	.005	G. 93

Bore completed at 98ft. Vertical Depth.

BATTLE'S HOPE LINE—No. 6 BORE.

Depth in Feet.	Succession of Strata.	Assay Values (lbs. per cubic yd.).	Sample No.
0' 0" to 6' 0"	1ft. 6ins. sand overlying decomposed laterite ... ..	.02	G. 94
6' 0" to 11' 0"	Puggy kaolinised sediment ... ..	.004	G. 95
11' 0" to 16' 0"	do. do. do. more argillaceous ... ..	.007	G. 96
16' 0" to 21' 0"	do. do. do. more sandy ... ..	.007	G. 97
21' 0" to 26' 0"	Sandy wash ... ..	.003	G. 98
26' 0" to 31' 0"	do. ferruginous ... ..	.001	G. 99
31' 0" to 36' 0"	Coarser grained. Changes at 35ft. to clay	1.35	G. 100
36' 0" to 41' 0"	Clay ... ..	.04	G. 101
41' 0" to 46' 0"	do. ... ..	.01	G. 102
46' 0" to 51' 0"	Clay with laterite fragments ... ..	.016	G. 103
51' 0" to 56' 0"	Changes at 54ft. to alluvium ... ..	.006	G. 104
56' 0" to 61' 0"	At 56ft. alluvium denser (clay) ... ..	.001	G. 105
61' 0" to 66' 0"	Alluvium. At 64ft. 6ins. an old lateritised surface ... ..	.002	G. 106
66' 0" to 71' 0"	Alluvium with laterite fragments ... ..	.003	G. 107
71' 0" to 76' 0"	Alluvium ... ..	.001	G. 108
76' 0" to 81' 0"	Alluvium. Micaceous clay at 81ft. ... ..	.005	G. 109
81' 0" to 86' 0"	Micaceous Clay ... ..	.004	G. 110
86' 0" to 91' 0"	do. do. Granitic wash at 86ft. ... ..	.048	G. 111
91' 0" to 96' 0"	Granitic wash ... ..	...	G. 112
96' 0" to 101' 0"	Granite at 98ft. ... ..	...	...

Bore Completed at 101ft. Vertical Depth.

PHOENIX EAST LINE—No. 1 BORE.

Depth in Feet.	Succession of Strata.	Assay Values (lbs. per cubic yd.).	Sample No.
0' 0" to 8' 6"	4ft 6ins. of sand overlying laterite ... ..	.23	G. 114
8' 6" to 13' 6"	Laterite ... ..	.30	G. 115
13' 6" to 18' 6"	do. ... ..	.24	G. 116
18' 6" to 21' 0"	Puggy kaolinised sediment. Sample discarded ... ..	...	G. 117
21' 0" to 26' 0"	do. do. do. with fragments of ironstone ... ..	.05	G. 118
26' 0" to 31' 0"	Change at 32ft. to light brown clay ... ..	.006	G. 119
31' 0" to 36' 0"	do. do. do. ... ..	.002	G. 120

Ground Water Level 35ft. 9ins.

36' 0" to 41' 0"	Argillaceous alluvium ... ..	.001	G. 121
41' 0" to 46' 0"	do. do. ... ..	.0004	G. 122
46' 0" to 51' 0"	Grey clay ... ..	.001	G. 123
51' 0" to 56' 0"	At 51ft. sandy wash ... ..	.002	G. 124
56' 0" to 61' 0"	do. do. ... ..	.003	G. 125
61' 0" to 66' 0"	do. do. ... ..	.017	G. 126
66' 0" to 71' 0"	do. do. ... ..	.004	G. 127
71' 0" to 76' 0"	do. do. Coarser at 76ft. ... ..	.001	G. 128
76' 0" to 81' 0"	At 78ft. greenish clay ... ..	.01	G. 129
81' 0" to 86' 0"	do. do. ... ..	...	G. 130
86' 0" to 91' 0"	do. do. denser ... ..	...	G. 131
91' 0" to 96' 0"	Changing to Greenstone ... ..	...	G. 132
96' 0" to 101' 0"	Greenstone	Assayed	...

PHOENIX EAST LINE—No. 2 BORE.

Depth in Feet.	Succession of Strata.	Assay Values (lbs. per cubic yd.).	Sample No.
0' 0" to 4' 0"	Sand ... ..	.42	G. 133
4' 0" to 9' 0"	6ins. sand passes into laterite ... ..	.29	G. 134
9' 0" to 14' 0"	Kaolinised sediment ... ..	.02	G. 135
14' 0" to 19' 0"	Puggy kaolinised sediment ... ..	.003	G. 136
19' 0" to 24' 0"	do. do. do. ... ..	.005	G. 137
24' 0" to 29' 0"	Grey clay ... ..	.006	G. 138
29' 0" to 34' 0"	At 30ft. sandy wash ... ..	.004	G. 139
34' 0" to 39' 0"	do. do. ... ..	.002	G. 140
39' 0" to 44' 0"	do. do. ... ..	.002	G. 141
44' 0" to 49' 0"	Coarse wash ... ..	.002	G. 142
49' 0" to 54' 0"	At 52ft. brown clay ... ..	.003	G. 143
54' 0" to 59' 0"	At 55ft. wash ... ..	.04	G. 144
59' 0" to 64' 0"	Sandy wash ... ..	.03	G. 145
64' 0" to 69' 0"	do. with small pebbles ... ..	.01	G. 146
69' 0" to 74' 0"	do. do. do. ... ..	.004	G. 147
74' 0" to 79' 0"	At 75ft. wash coarser ... ..	.008	G. 148
79' 0" to 84' 0"	Pebble wash in green clay ... ..	.03	G. 149
84' 0" to 90' 0"	do. do. ... ..	.001	G. 150
90' 0" to 95' 0"	do. do. ... ..	.004	G. 151
95' 0" to 100' 0"	Change at 103ft. to granitic wash ... ..	.008	G. 152
100' 0" to 105' 0"	Granitic wash ... ..	.008	G. 153
105' 0" to 108' 0"	Granite ... ..	...	G. 154

PHOENIX EAST LINE—No. 3 BORE.

Depth in Feet.	Succession of Strata.	Assay Values (lbs. per cubic yd.).	Sample No.
0' 0" to 6' 0"	5ft. sand overlying laterite ... ..	.37	G. 155
6' 0" to 11' 0"	Laterite at 9ft. becomes kaolinised sediment ... ..	.05	G. 156
11' 0" to 16' 0"	do. do. do. do. ... ..	.03	G. 157
16' 0" to 21' 0"	do. do. do. do. ... ..	.01	G. 158
21' 0" to 26' 0"	do. do. do. do. ... ..	.01	G. 159
26' 0" to 31' 0"	Sandy wash ... ..	.005	G. 160
31' 0" to 36' 0"	do. ... ..	.02	G. 161
36' 0" to 41' 0"	do. ... ..	.02	G. 162
41' 0" to 46' 0"	do. ... ..	.01	G. 163
46' 0" to 51' 0"	do. ... ..	.01	G. 164
51' 0" to 56' 0"	Coarser wash ... ..	.03	G. 165
56' 0" to 61' 0"	do. in clay ... ..	.01	G. 166
61' 0" to 66' 0"	Coarse wash ... ..	.01	G. 167
66' 0" to 71' 0"	Coarse wash at 69ft. becomes granitic alluvium ... ..	.01	G. 168
71' 0" to 76' 0"	Granitic alluvium ... ..	.32	G. 169
76' 0" to 81' 0"	do. ... ..	.01	G. 170
81' 0" to 86' 0"	do. ... ..	.002	G. 171
86' 0" to 91' 0"	At 90ft. becomes granite ... ..	.001	G. 172
91' 0" to 96' 0"	do. do. do. ... ..	.005	G. 173
96' 0" to 101' 0"	do. do. do. ... ..	.085	G. 174
101' 0" to 105' 0"	Granite (not sampled) ... ..	...	...

LEINSTER GOLD MINE—MT. SIR SAMUEL,
EAST MURCHISON GOLDFIELD.

(F. G. Forman, B.Sc.)

On the 17th December last, accompanied by Mr. Frank Atkins, I made an examination of the Leinster Mine, with the object of assessing the possibility of re-locating the reef below the existing bottom level (400 feet, vertical depth).

The mine has only recently been unwatered and the shaft reconditioned; the levels were found to be in excellent condition and easily accessible, but it was not possible to make an examination of the old stopes. Information supplied by Mr. Atkins enabled me, however, to gain an idea of the conditions which formerly existed in the reef.

The ore body in the mine was a quartz reef of lenticular habit about 300 feet in length, occurring as a metasomatic replacement in a shear zone of fine grained serpentinous greenstone. It strikes roughly north and south and has an almost vertical dip. Four levels have been driven at depths of approximately 100, 200, 300 and 400 feet. An examination of the Nos. 1, 2, and 3 levels made it clear that the reef had a decidedly northerly pitch of about 60°. The faces of these three drives were examined and the shear track could be seen to continue through the country rock, and the quartz reef, which has all been removed, apparently had quite blunt terminations. According to Mr. Atkins, who was employed on this mine when it was formerly worked, the reef on two occasions was found to have vertical blanks and gave out at a depth of 60 feet and was found again at a depth of 100 feet; it gave out at a depth of 220 feet and made again at 250 feet. The reef finally gave out at a depth of about 380 feet from the

surface and was not again located. On each occasion when the reef cut out, a narrow shear track continued in its place, and it was by following down on this shear that the reef was again located.

At the present bottom level, vertical depth 400 feet, a considerable amount of driving has been done both north and south, on a rather indistinct shear about 25 feet east of the shaft. A much more distinct shear track is visible in the walls of the main crosscut, 16 feet east of the shaft. Two west crosscuts from the north drive have intersected the same shear, and rises put up from the ends of these crosscuts on the shear track have broken into the bottom of the old stopes at a depth of about 380 feet. It seems certain, therefore, that this more distinct shear cut in both the west crosscut and the main east crosscut, represents the reef channel.

Mr. Atkins assures me that the behaviour of the reef when it cut out at 380 feet was similar in all respects to its behaviour when it was lost on the two former occasions at the 60 ft. and 220 ft. levels. As the reef was successfully re-located on both these occasions by sinking on the shear track, I can see no reason why it should not be re-located by similar methods below the 400 ft. level. It is impossible to form an estimate of the possible extent of the blank, but judging by the extent of the former blanks, I would not expect the present one to be much more than 50 to 60 feet in depth; it may, however, be greater. In my opinion the best method to prospect for the continuation of the reef at depth is to sink a winze on the shear track at the 400 ft. level in the most northerly of the two west crosscuts from the north drive. A winze from this crosscut would be preferable to one in the southerly crosscut, as there would be less chance of missing the reef because of its northerly pitch.

REPORT ON SOME OBSERVATIONS MADE
ON A JOURNEY FROM ALICE SPRINGS,
N.T., TO THE COUNTRY NORTH OF THE
RAWLINSON RANGES IN W.A., VIA THE
MUSGRAVE AND PETERMANN RANGES
IN 1936 (WITH PLANS).

(H. A. ELLIS, B.Sc., A.O.S.M.)

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PLANS.

Plate IV. Geological Sketch Plan of Portions of Central and Western Australia, showing Route followed by the Expedition.

Plate V. Geological Sketch Plan of Country in the Vicinity of the Petermann and Rawlinson Ranges, Central Australia.

PHOTOGRAPHS.

A collection of photographs of post card size, illustrating many of the topographic features of the country passed through, has been added to the Geological Survey Departmental Collection.

INTRODUCTION.

A claim to the discovery of a very rich gold-reef (popularly known as "Lasseter's Reef") in Western Australia, north of the Rawlinson Range and close to the Western Australia-Northern Territory border, in approximate Longitude 128° 10' E. and Latitude 24° 24' S., afforded the writer the opportunity for making the above journey.

As a representative of the Western Australian Department of Mines, he accompanied the expeditions financed by Border Gold Reefs, Ltd., Sydney, which were despatched under the leadership of the alleged discoverer and another person who purported to know where the "reef" was, to the alleged locality of the reef during the period April-July, 1936.

The results of these expeditions form the subject-matter of a separate report, but briefly stated, information was obtained which enabled a conclusion to be reached that the reef does not exist. The peculiar circumstances attendant upon accompanying an expedition into uninhabited desert country, when the leader of that expedition was the alleged discoverer of the non-existent gold reef, and had financial interests at stake and was being asked to substantiate his claim by showing the writer the "reef," seriously affected the nature of the scientific observations able to be made.

It is hoped, however, that even the incomplete observations which were made, will prove of value to those interested in geology and prospecting.

In view of the fact that considerable geological work has been done and much has been written on the country between Alice Springs and Erldunda

Station, reference will not be made to that section of the route traversed. The information given in this report will have reference only to that section of the country passed over between Pearce's Sheep Camp, situated some 70 miles west by south of Erldunda Station, and the alleged locality of the "reef" north of the Rawlinson Range, in approximate Longitude 128° 10' E. and Latitude 24° 24' S. in Western Australia

THE ROUTE TRAVERSED BY THE
EXPEDITIONS.

Two expeditions set out from Alice Springs to proceed to the West Australian Border, but both followed the same route. From Alice Springs, the main overland track between that town and Adelaide was followed as far south as Erldunda Cattle Station, a distance of about 150 miles. Ordinary four-wheeled motor transport was used, and sand-mats were carried but seldom used.

From Erldunda Cattle Station, a station motor-track was followed westwards for 70 miles to Pearce's Sheep Camp, across flat, well-grassed plain country with some salinas and small clay-pans and sand-ridges towards the western end of the track. Pearce's Sheep Camp is the most westerly occupied pastoral holding in this latitude, the country to the west, south-west and south in this portion of the Northern Territory, being not selected or forming portion of a large Aboriginal Reserve. Mt. Connor, a large table-topped remnant with sharply defined bluffs, forms a prominent land-mark about 20 miles distant W. 11° S. from the homestead.

From Pearce's Sheep Camp, the old tracks of the 1935 Border Gold Reefs Expedition were followed across flat and undulating red sandy-loam country, through thick mulga scrub, in a general southerly direction for a distance of about 45 miles to the vicinity of Erandirrinna Bluff, the most northerly portion of the Musgrave Ranges in this vicinity, situated about 6 miles north of the southern boundary of the Northern Territory.

The northern flank of the Musgrave Ranges was then followed in a general westerly direction to about the 131st Meridian of Longitude, the track following along the sandy loam flats bordering the somewhat tortuous northern front of these ranges in this latitude. This section of the route lies sometimes in the Northern Territory, and sometimes in South Australia. The main mass of the Musgrave Ranges terminates approximately in Longitude 131° E., and Latitude 25° 50' S., immediately to the north of the Mounts Morris and Woodward, and about 10 miles north of the southern boundary of the Northern Territory. The route in this locality passed immediately south of a low quartzite-capped hill named Quartz Hill, from which point Mt. Olga, Ayer's Rock and Mt. Connor are visible, bearing 321°, 1° and 70° true bearing respectively.

Westwards from this point rapid progress was able to be made in a general north-westerly direction across mulga and grass flats and occasional long stretches of sandy flat and undulating spinifex desert country, keeping fairly close in along the northern side of the Orlia Chain. The Orlia Chain consists, as the name suggests, of a chain of isolated hills and ridges stretching from the western end of the Musgrave Ranges to Mt. McCulloch, which topographically, is regarded by the writer as being the south-

GEOLOGICAL SKETCH PLAN

OF

PORTIONS OF CENTRAL AND WESTERN AUSTRALIA

Showing Route Followed by Expedition

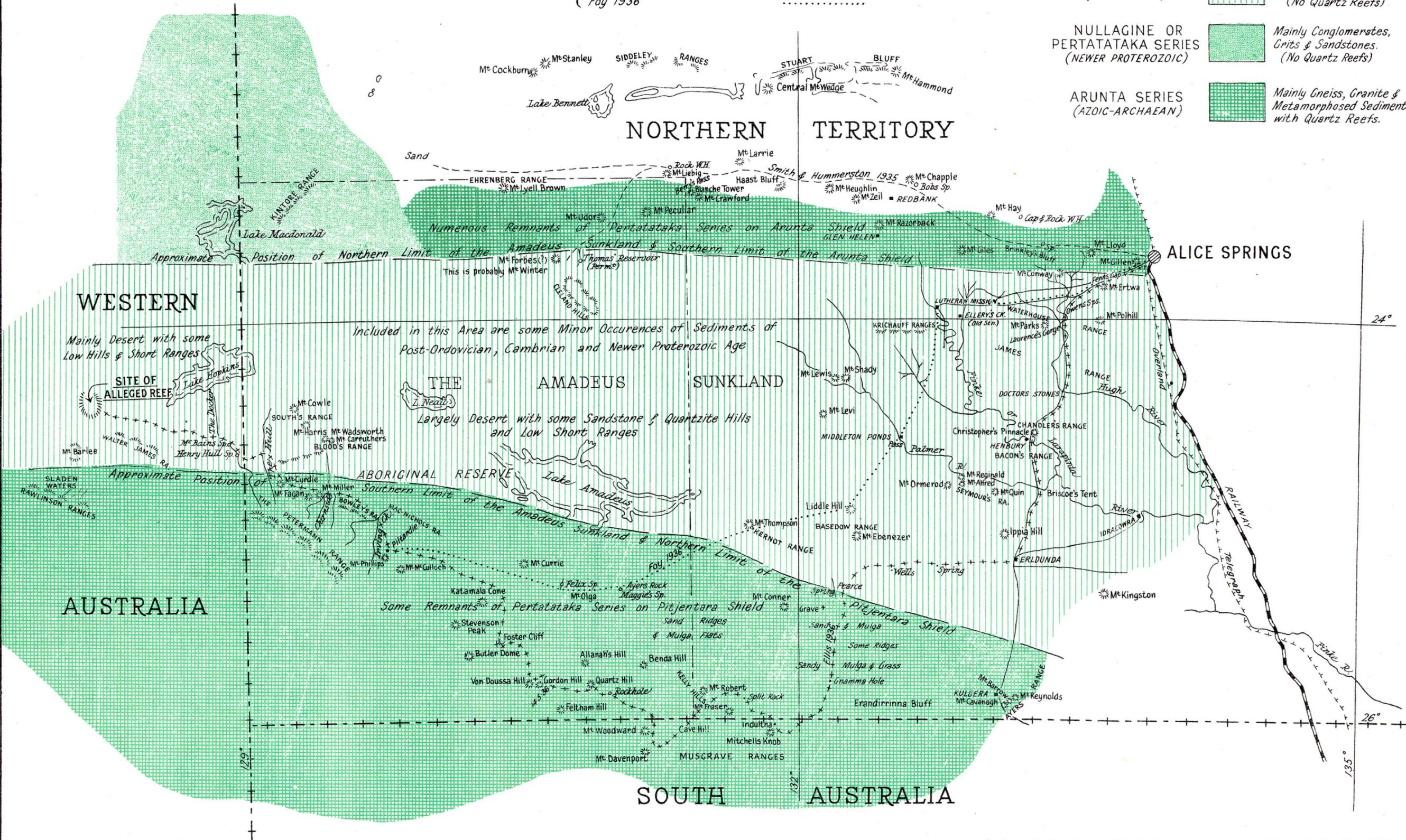
To accompany report by H.A. Ellis, G.S.W.A. Annual Report, 1936

Scale 3 1/2 Miles to an Inch

INDEX TO HATCHING

Routes { Smith & Hummerston 1935 ---
 Ellis 1936 +++
 Foy 1936

- LARAPINTA SERIES (ORDOVICIAN)  Mainly Quartzites, Shales & Sandstones. (No Quartz Reefs)
- NULLAGINE OR PERTATATAKA SERIES (NEWER PROTEROZOIC)  Mainly Conglomerates, Grits & Sandstones. (No Quartz Reefs)
- ARUNTA SERIES (AZOIC-ARCHAEOAN)  Mainly Gneiss, Granite & Metamorphosed Sediments with Quartz Reefs.



J.M.C. Deit 19/11/36
 Geology adopted from Dr Chewings' maps with some additions by H.A. Ellis, 1936
 From Northern Territory Map issued by Property & Survey Branch, Dept. of the Interior, Canberra 1934

eastern end of the Petermann Ranges. After leaving Quartz Hill, the track goes west to Gordon Hill, and on passing to the north of this conspicuous landmark, Foster's Cliff comes boldly into view in the north-west, and the track followed, passes close by this cliff on the southern side. From Foster's Cliff the remainder of the Ollia Chain (Butler's Dome, Stevenson's Peak and Katamala Cone) are seen away to the west as the route passes through sandy spinifex flats and sand-hill country some distance out from these features in a general north-westerly direction. After crossing the dry sandy bed of the Armstrong River, the south-eastern end of the Petermann Ranges is entered at Piltardie Rock-hole, the course having been a little north of west, on well grassed mulga flats between the Armstrong and Piltardie Rock-hole.

The hills now become more numerous, but good gravelly or sandy loam surfaces were available from Piltardie Rock-hole to Mt. Bowley Aerodrome, following a general north-west by west course as far as the Chirnside River, where a sharp turn to the south was made, and the track followed up the western bank of the sandy river bed to the Aerodrome. Leaving Mt. Bowley Aerodrome, a general north-west by west course was taken passing to the north of Mt. Miller and Mt. Curdie, and running along on the eastern and northern bank of the Hull River to the sandy crossing in its bed, just south of the gap in a quartzite range through which it emerges onto the desert to the north.

Continuing westerly from this crossing, around the northern flank of the Ruined Ramparts on very heavy sandy spinifex and desert-oak flats, the next point reached was Livingstone Pass the gap through which the Docker River leaves the Petermann Range on its north-westerly course out into extensive sandy loam flats. Going south through Livingstone Pass

and turning south-east by east, a dry watercourse was followed up to a water hole situated about 2 miles south-west of the Ruined Ramparts. There is a landing ground here known as the Ruined Ramparts Aerodrome, cleared by Mr. D. Mackay in 1930 during his Aerial Survey Expedition in the Petermann Range in that year.

Livingstone Pass is very close to the West Australian border, and after returning through this pass from the south side of the Ruined Ramparts, the sandy loam flats on the eastern side of the Docker River were followed north-west to the Docker Gap, and at about 7 miles out from Livingstone Pass on this course, it is estimated that the route crossed into Western Australia.

The dry sandy bed of the Docker River cuts through a strong quartzite range at the Docker Gap, and trends north-north-west out into true desert country to ultimately fade out some distance out from the hills.

At the Docker Gap, the tracks made by the 1935 Border Gold Reef Expedition ended, and as the locality in which the alleged "reef" had been indicated was situated some 56 miles by air-line W. 29° N. of this gap, a general north-west by west course was followed across sandy spinifex flats and many sand-hills to the sandstone ridges in the desert north of the Robert Range. These ridges proved to be the alleged "reef."

The return journey was made on the out-going tracks, hence no new country was traversed on the way in to Alice Springs.

The following table of distances between the more important places, and the waters used on this journey, is compiled from speedometer readings and therefore represents the distance along the track in each instance.

TABLE OF DISTANCES.

Places.		Miles measured along the track.
From.	To.	
Alice Springs	Owen Springs (water)	39.5
Owen Springs	Doctors Stones (water)	33.5
Doctors Stones	Henbury Station (water)	20.0
Henbury Station	Erdunda Station (water)	50.5
Erdunda Station	Collata Spring (water)	27.5
Collata Spring	Two Wells (water)	16.5
Two Wells	Pearce's Sheep Camp (water)	28.8
Pearce's Sheep Camp	Erandirrinna Bluff	45.0
Erandirrinna Bluff	Indultna Soak (water)	29.0
Indultna Soak	Quartz Hill	98.0
Quartz Hill	Gordon Hill	30.0
Gordon Hill	Foster's Cliff	22.0
Foster's Cliff	Armstrong River Crossing	41.0
Armstrong River Crossing	Piltardie Rock-Hole (water)	14.0
Piltardie Rock-Hole	Mt. Bowley Aerodrome	29.0
Mt. Bowley Aerodrome	Mt. Curdie	16.0
Mt. Curdie	Livingstone Pass	31.0
Livingstone Pass	Water Hole 2 miles S.W. of Ruined Ramparts (water)	7.0
Water Hole 2 miles S.W. of Ruined Ramparts	The Docker Gap	19.6
The Docker Gap	Locality of Alleged Reef	70.0
	Total	667.9

205-
mile
dry
stage.

It is thought that a few remarks on the general technique of travel with motor transport in desert country may not be out of place here, and the writer offers the results of his experiences in the paragraphs

below, hoping that they may prove useful to those who have not made journeys in the arid sandy regions of Central Australia.

The use of motor transport in this class of country is costly, and when not supported by camels, is unsafe. Large quantities of water are consumed by low-clearance vehicles, though trucks fare better on account of the height of the radiator above the general level of grass seeds. It becomes a very difficult matter to know what spare parts to carry, and though the obvious essentials such as a few spare tyres and inner tubes, main spring-leaves, axles, tail-shafts, universal joints and clutch linings will suffice to meet the probable replacements necessary on such travelling, many other parts of the vehicles are liable to give out under the very trying conditions they have to work under.

With the exceptions of those portions of the route lying between Pearce's Sheep Camp and The Musgrave Ranges, Mt. Bowley Aerodrome and Mt. Curdie, and The Docker Gap and the locality of the alleged "reef," the travelling surfaces were good, consisting mostly of open grass and spinifex plains, sandy loam mulga flats, or gravelly surfaces. Many dry, sandy watercourses, some up to 150 yards wide, had to be negotiated, and experience with motor transport in this class of travelling is necessary to avoid being bogged in the loose sandy gravel.

The secret of negotiating sand-hills and sandy crossings lies in possessing as much momentum as possible at the instant of entering them. Partially deflated tyres are an essential, and the engine needs to be in bottom gear during the approaching run up to the sand-hills or into the crossing. It pays to spend time making an approach to these obstacles rather than on or in them later on. A fast approach in bottom gear will take the vehicle a long way through the sand.

When progress is halted on a sandy patch, if possible, back the vehicle in its tracks and go forward again. The constant use of the hands or a shovel to scoop the sand from behind or in front of the wheels before starting in sand is absolutely necessary if the clutch lining is to be preserved.

It may be necessary to run up and back a sand-hill several times, cutting a little bit more track each time before the crest is finally reached. It is quite useless attempting to change gears after the sandy patch has been reached and the vehicle is losing momentum. Some types of sandy crossings and sand-hills are more easily negotiated with the greater momentum obtainable by using the second gear. This saves the radiator water but is applicable only to narrow crossings or short sand-hills.

Keeping the tyres hard in country where there is much dead timber on the ground minimises the danger of staking, and having them partially deflated in sandy, hummocky, spinifex country greatly aids progress. A thin layer of spinifex packed into the wheel tracks on the upper portion of the tracks on a sand-hill when it has been found necessary to back down from it once or twice, will give the wheels the additional grip to preserve momentum to carry the vehicle through the unbroken sand higher up. A long handled shovel and a forked mulga stick are excellent tools for gathering spinifex for this purpose.

When selecting a road through saucer-shaped sand-hills on which it is intended to return, due regard must be paid to the slopes on the side from which the return trip will be made. It is often easy to negotiate a sand-hill from one slope and impossible to return up the other slope even though a track has been cut down it on the outward trip.

The fitting of a small engine-operated air pump to a truck engine, with about 15 feet of armoured air hose as a lead from the pump, makes the inflation of tyres an easy process, and the knowledge that the tyres can be easily inflated again tends to the more frequent use of the most suitable tyre-pressures in the various classes of country encountered. With this air hose and a short piece of iron pipe for inserting in a mallee or "desert oak" charcoal fire, high temperature can be reached, and a weld can be made in a broken part if necessary. This air hose is also extremely useful for cleaning grass seeds from a radiator when used from the fan side. In a country where water is precious, good radiation is necessary in a car engine, and a piece of wire gauze of about 100 mesh to the square inch, wired in front of the radiator, saves a lot of grass seed and husks from entering the core spaces in the radiator, which prevent free air-circulation.

Not one clutch facing was burnt out on this trip, and this is attributed to the judicious handling of the vehicles, paying due regard to the hints given above.

A useful aid to progress in very heavy sand when it is impossible to make a good approach to it, is the use of sand mats. These consist of two lengths of coir matting, 18 inches wide and about 40 feet long. They roll up into a neat parcel and are easily carried on a load or on the bumper bar or mudguards.

When halted by sand, all four wheels are cleared in front and a length of mat laid down in the wheel tracks on both sides. The rear end of each mat must be tucked firmly under the front of the rear wheel and the mat stretched out so as to pass in front of the front wheel, under which it is tucked laterally as far as possible, taking care to have a bend in the mat immediately in front of the front wheel. When the rear wheels start to grip they pull the mat straight, and if the forward portion has been correctly tucked under the front wheels, this end becomes anchored by the weight of the car in front and the car moves forward on the mat.

The writer has tried other devices invented for use on wheels in sandy country in Central Australia, but the sand mats have proved the most efficient, and are in universal use by all users of motor transport in Central Australia to-day.

There are often several bad sandy patches close together, but separated by good surfaces. To save time, the mats need not be rolled up after the first patch has been crossed but can be tied on behind with a suitable tie and dragged behind the car to the next patch.

Engine sump oil needs frequent changing when much low gear work has to be done, since high engine temperatures are reached and the water in the radiator is frequently boiling. It is not an infrequent occurrence to have to travel for a week at a time with the engine in bottom, reverse, and second gear only.

CLIMATE, FAUNA AND FLORA.

Climate.—The average annual rainfall of the country between Alice Springs and the Rawlinson Range in Western Australia ranges from 0 to 10 inches. There are no recording stations over the

major portion of this area and the value of 10 inches is that applicable to the country in the immediate vicinity of Alice Springs. The rainfall is of the Summer type mostly, but occasional winter rains do sometimes fall both in Alice Springs and in the vicinity of The Petermann and Rawlinson Ranges. The entire area is subjected to prolonged droughts, when for several years no germinating rains will be known to fall.

In February of 1936, up to 5 inches of rain fell over the eastern portion of the area, but it was found that out in the western portion of the Northern Territory and in the eastern part of Western Australia, north of the Petermann and Rawlinson Ranges, the country had been subjected to a prolonged drought. Even the spinifex was browned off and was green only at the base.

In the summer months high temperatures and occasional high relative humidity prevail, and "dry" thunderstorms are of frequent occurrence. The bulk of what rain does fall in the western section of the area is precipitated during this season, mostly accompanying thunderstorms, and general rain is more the exception than the rule.

The winter months are normally free from rain and are characterised by bright sunshine, cold south-east winds, and cold nights and mornings. Heavy frosts are frequent both in Alice Springs and in the Petermann Range during June and July, and their occurrence is chiefly welcomed in so far as the cold conditions render the flies inactive. The flies in the summer time are extremely troublesome and add much to the already rigorous conditions attached to travel in this country.

Unquestionably, the most suitable time of the year for travelling in Central Australia is during the winter months, from May to September, when provision should be made for fairly cold conditions. Natural water supplies are then more likely to be more frequent and more copious after the usual summer rains, and climatic conditions are at their best while the flies are, though not altogether absent, in their least numerical strength.

Fauna.—Bird and animal life is, on the whole, scarce, though in the vicinity of the permanent waters, local concentrations of birds and animals are to be found. Among the birds seen on the journey and recognised were crows, eagles, sparrow-hawks, black cockatoos, wild turkeys, butcher-birds, emus, "wax-bills" (a variety of finch frequenting permanent waters in large numbers) and a bird which had the appearance and habits of a "Willy-Wag Tail" but seemed larger than those in the South-West of Western Australia. Two varieties of pigeons, one of which is locally termed a "rock pigeon," were seen near the various water supplies.

Animal life is scarcer than bird-life and the following animals were seen:—Kangaroos (red and grey), rock wallabies, a species of small marsupial inhabiting spinifex flats and locally termed a "desert rat," foxes, dingoes, wild cats (domestic species gone wild and much sought after by natives as a food) and rabbits.

No snakes were seen, and only small varieties of lizards were occasionally observed.

Numerous ant species were noted and a number of "trap-door" spider holes were also seen. Rabbits occur throughout the whole area, being parti-

cularly numerous in the Petermann and Musgrave Ranges. Their tracks were seen in the desert sand-hill country north of the Robert Range in Western Australia, and the rabbits which inhabit this locality must be producing a particularly hardy species, as succulent vegetation suitable for providing the necessary moisture for these animals is extremely scarce here.

Judging from the numerous warrens that have been dug out by the natives (the female aborigines do this work), the rabbit must be regarded as a welcome addition to their diet.

Flora.—Practically the whole of the country travelled through from Pearce's Sheep Camp to the Western Australian Border can be included in the vegetational divisions characterised by "Desert with spinifex and belts of low shrubs" and "Mulga bush." In some places the former type predominates and in others the latter, but a mixture of the two types would be a better classification.

In the sand-hill country north of the Musgrave Ranges, large areas of grey mulga scrub are to be seen, while over the border in Western Australia, mulga scrub is scarce, and spinifex, stunted mallee and desert oak are the predominant species.

Wide "buck-bush" and mulga flats are frequent on the northern flanks of the Musgrave and Petermann Ranges, and in the alluviated flats which extend for long distances into these ranges many varieties of herbaceous plants are to be found with grasses, ironwood trees, Bloodwood gums, white barked river gums, etc.

Extensive areas of "Park-lands" (open Mulga, Desert Oak, Kurrajong, Quandong and Mallee growth, with spinifex and sparsely distributed grasses and shrubs), are characteristic of much of the area.

All of the prominent dry water courses such as the Britten Jones, the Opparina, the Armstrong, the Irving, the Chirnside, the Hull and the Docker Rivers are thickly lined with white barked eucalypts, and not infrequently the river beds are also studded with the same gums.

At the Docker River there are numerous Bloodwood trees on the flats, and occasional trees of the same species occur further east in the Petermann Ranges.

The variety of spinifex commonly known as "Porcupine Spinifex" and which grows in strong rounded isolated clumps and is particularly obnoxious to travel through, does not occur west of Quartz Hill. The greater portion of the spinifex seen belongs to the "soft" variety which when burnt is edible by stock. In latitudes further north than those visited, the "Porcupine" spinifex predominates.

"Native Fig" trees are numerous on the low gneissic and granitic hills of the Musgrave and Petermann Ranges, and a species of "Fir Tree" is nearly always associated with them in these localities. A dark-green leaved shrub with a habit of growing in clumps on the more elevated portions of the low gneissic hills, and possessing numerous, fairly straight main stems coming up from the base is locally termed a "Spear tree." It has a pithy centre and has a light white wood. The stems of this shrub are straightened by fire and used by the natives as spear shafts.

Parakylia is plentiful on the sandy loam mulga flats between Pearce's Sheep Camp and the Musgrave Ranges. Myoporium (poison for camels), salt-bush, beefwood, prickly acacia, wind-grass, and a number of wildflowers of a leguminous species and daisies were also noted on the journey. The Sturt Pea was not observed to occur in this part of the interior, though further south, in the north of South Australia, it is fairly common.

WATER SUPPLIES.

From Pearce's Sheep Camp onwards it will be noticed from the Table of Distances appearing in an earlier part of this report, that only three waters were used by the expedition. The information able to be offered about this all-important subject is therefore very limited, since, with the exception of a soak dug at the eastern side of the bed of the Docker River at 2.3 miles north-west of Livingstone Pass, the writer saw no other waters.

Indultna Soak (Indulka on South Australian maps) at 74 miles out along the track from Pearce's Sheep Camp can be regarded as a permanent water. It is called a "soakage" but is in reality a gravity spring. The water issues from sheared and crushed gneiss on the eastern side of some low gneiss hills, which latter are sufficiently jointed and broken to absorb rain water falling on them. Mitchell's Knob lies about 4 miles due south of it and is an unmistakable landmark in this locality. The water is excellent when the old water lying in the excavation at the spring has been baled out and a fresh supply allowed to make.

Piltardie Rock-Hole, 205 miles along the track from Indultna Soak, was the next water used. This is a well-known and well-used series of rockholes in a gorge in a quartzite ridge in the Petermann Ranges. A cairn has been erected on the ridge on the eastern shoulder of the gap close to the water, and cannot very well be missed by a traveller. These rockholes can be relied on at all times as they are deep and well shaded, and hold a large quantity of water. The water is of excellent quality.

Warrapzuza Water-hole, 83 miles further out along the track from Piltardie Rock-hole, and about 2 miles south-west of the Ruined Ramparts, was the next water used, and though containing plenty of good water at the time of our visit cannot be relied on as a permanent water.

About 2 miles north-west of Livingstone Pass there is a very good soakage in the bed of the Docker River on the eastern side. The water is good, and a fair supply could be relied on even in the driest of seasons.

There are undoubtedly many permanent waters in the Petermann Ranges, but they are difficult to find without the help of local natives. The natives are not always willing to supply information about their water supplies, and it is sometimes necessary to use methods other than those based on vocal and sign principles to obtain the desired information.

In the 3¾ mile to the inch map accompanying this report, a number of waters located and used by Messrs. Talbot and Blatchford during a camel journey into the Petermann and Rawlinson Ranges in 1931 are shown. For information concerning water supplies in the Musgrave, Petermann and Rawlinson

Ranges, reference may be made to the following published reports (with plans):—

Reports on Prospecting Operations in the Musgrave, Mann and Tomkinson Ranges (with plans), by L. A. Wells and F. R. George. South Australian Parliamentary Paper No. 54, 1904.

Journal (with plans) of the Government Prospecting Expedition to the South-Western Portions of the Northern Territory, by F. R. George, South Australian Parliamentary Paper No. 50, 1907, Vol. III.

Extracts from Journals of Explorations, Fowler's Bay to Rawlinson Ranges (with plans), by R. T. Maurice. South Australian Parliamentary Paper No. 43, 1904.

These Parliamentary Papers are available at the Perth Public Library.

The geological formation of the Musgrave, Petermann and Rawlinson Ranges is particularly favourable to the formation of rock-holes in the dry water-courses cut in the steep sided hills. A number of sandy creek beds on the flat country immediately adjacent to the hills also afford likely spots for creek-bed soakages.

Many ideal well sites were seen on the fringe of the ranges, and it would be possible to provide artificial waters at very frequent intervals from Erandarrina Bluff in the Musgrave Ranges right out to the Western Australian Border.

A few remarks about the transporting of water supplies, etc., when using motor transport, may be of value to those not already experienced in this matter.

Mostly all natural surface waters suffer from pollution by organic matter, both animal and vegetable, and will not stand being closely confined in full drums or containers for periods of over three days. It is a good practice to only three parts fill the containers and to remove the plugs every night. This permits a free access of air with the necessary oxygen to prevent destruction of bacteria and their subsequent putrefaction. It is possible on long inland journeys to drink only boiled water; a little extra organisation is necessary to insure this, but the added safety from sickness is well worth the trouble.

Half inch rubber hose in lengths of 8 or 10 feet is useful for siphoning water from large containers, and a filling funnel of large size with a gauze diaphragm is indispensable when filling from limited supplies or in a strong wind. Water has frequently to be carried from rockholes, access to which is very difficult, and provision should be made in the equipment for closed containers of 4-gallon capacity only, with which to do this work. Forty pounds is about as much as a fairly strong man will carry with safety out of many of the places where rockhole water is usually found.

NATIVES.

The south-western corner of the Northern Territory has always been a stronghold of the inland aborigines, the good pastoral country and permanent waters of the mountainous area affording excellent feeding grounds for native game. During recent years a rectangular area of some 28,300 square miles of country embracing the Petermann Ranges, the Olla Chain, and portion of the Musgrave Range, has

been set aside in the extreme south-western corner of the Northern Territory by the Commonwealth Government as an Aboriginal Reserve. A Western Australian Aboriginal Reserve joins this reserve on the west. Permission must be obtained from the respective Governments concerned to enter these reserves for any purpose.

On the outward journey no natives were met with, though their tracks and the smoke from the hunting fires were frequently seen. On the return journey about 200 of both sexes including men, women and children were encountered in three individual parties. Two small parties encountered at Piltardie Rock-hole and near Gordon Hill were quite friendly disposed towards the party though they knew no word of English. These natives were entirely nude and were in reasonably good physical condition.

A larger party of some 100 in number were camped at Indultna Soak, and some of these were partially clothed and were, on the whole, rather poor physical specimens. This particular assemblage of natives was gathered at Indultna Soak in order to trade dingoes with European dingo-trappers ("Doggers") who operate in the Musgrave Range to the south.

The only weapons seen in the possession of the males were mulga-tipped spears and womeras—the boomerang and shield do not appear to constitute part of this tribe's weapons. Of possible anthropological interest may be the observance of two long-bearded female aborigines amongst a party seen at Piltardie Rock-hole in the Petermann Ranges. Another interesting feature about this tribe of natives is the extraordinary size of the "coolimans" used by the females as containers of water and carried on a hollow circular pad of human hair on their heads. Several of these "coolimans" seen would be about 4 feet long, 18 inches wide and 1 foot deep in the deepest part.

The expedition was not molested in any way by the natives, and it has been the writer's experience in many other parts of the Northern Territory as well as on this trip, that providing a few simple laws are obeyed by the party, little trouble need be anticipated from the natives. It is very advisable not to camp close to the water supply; bush natives come into water much the same as do wild animals, and the presence of a camp on the water may disturb them. Natives should never be permitted to come into the camp on any pretext, and likewise their camps should not be disturbed by the white man.

PHYSIOGRAPHY.

The two most prominent features of the physiography of this portion of Central Australia are the isolated hills and continuous ranges of hills, and the wide level areas of flat to undulating sandy country surrounding them.

The country travelled through from Alice Springs to west of the Western Australian border forms portion of the great inland plateau which extends well up into the Northern Territory, eastwards into Queensland, southwards into South Australia, and westwards to near the north-western coast of Western Australia. Near Alice Springs the general elevation of the plain country is about 1,900 feet above sea-level, whilst further to the south, a little to the north of the Musgrave Ranges, it is in the vicinity

of from 1,500 to 1,600 feet above sea-level. The heights of the hills and ranges rising out of this plateau vary from 50 to 2,000 feet.

The Musgrave Ranges are composed of high rough hills and spurs of gneissic and granitic rocks rising to a height of about 2,000 feet above the level of the surrounding country. They present a bold scalloped front to the north, and the differences in composition of the vast mass of mainly gneissic material composing them are very prominently displayed in the remarkable strike lines of the various beds seen to be folded along axes having mostly an east-west trend. Rugged massiveness is suggested by the topography of these ranges, and there is no individual outstanding formation which controls their topographic expression.

Numerous ravines are cut into the slopes of these ranges, and every here and there a wide alluviated valley extends through them from north to south. The drainage from the ranges is carried out a few miles only, in sandy creek and river beds, dry for the greater part of the year, to be absorbed into the sandy spinifex and mulga country to the north and south.

Further west the topographic forms change, and the massive forms of the Musgraves give place to the picturesque dip-slopes and erosion escarpments of the cuestas in the south-eastern end of the Orlia chain. In this section of the country several thick quartzite bands occur in the gneissic series, and it is these bands which dominate the topographic forms in the Orlia Chain, the Petermann Ranges and the Rawlinson Ranges. Flanked on both sides, as they frequently are, by less resistant weathering material in the nature of basic and acidic gneisses, and being folded into steeply dipping beds, the hogback type of ridge becomes prevalent, and the Petermann Ranges are largely composed of quartzite dip-slopes, erosion-escarpments, residual cappings, and hogbacks. The gneissic and granitic rocks form a gently rounded type of hill and are confined to low rises and hills in the flat sandy country immediately flanking the ranges.

The Rawlinson Ranges were not visited, but many miles of broken ranges extending westwards from Livingstone Pass near the Western Australian border have the same topographic expression, and from information contained in the chapter in this report dealing with the geology, it will be seen that these hills are continuous with the Rawlinson Ranges and that the latter are composed of the same rocks as the Petermann Ranges.

Blood's Range and South's Range, north of the Petermann Range and visible from it, appear to trend more nearly east and west than the Petermann Range, which has a north-west by west trend. The sky-line of these ranges suggests gentle dipping sedimentary beds only, and other observers report that Blood's Range is entirely quartzite and South's Range is composed of sandstone.

Hogbacks of quartzite occur as far north as the Docker Gap, and then to the north-west by west of this point the Walter James Range is seen as a long, high, flat-topped mass suggestive again of quartzite, which is dipping only fairly gently, and surrounded by flat sandy desert country with numerous sand-hills. South from the Walter James Range and separated from it by sand-hills and sandy spinifex country, the northern front of Mural Crescent

forms a striking feature running east and west. This structure has a similar topographic expression to that of the western end of the Petermann Ranges, and is probably composed of quartzite and gneiss apparently dipping steeply to the north.

A little north of west from the Walter James Range and separated from it by a comparatively short stretch of desert country (12 to 14 miles) lies the Robert Range, and it appears to be formed largely of red sandstone dipping to the south at a high angle. From the outline of this range there is a suggestion of quartzite being interbedded with the sandstone.

At a distance of 8 to 9 miles north of the Robert Range, a series of low broken sandstone ridges runs north and south and has a fairly even sky-line with well-defined bluffs at its northern end and at intervals along it. This formation was visited and, as was expected from its topographic expression, proved to be sandstone dipping gently in various directions.

The hills of the Petermann Ranges do not rise as high above the general level of the surrounding country as do those of the Musgrave Ranges, 1,500 feet being possibly the maximum height attained. Even so this brings the general level of the crests of the Petermann and Rawlinson Ranges somewhere near 3,400 feet above sea level. A 1934 map of the Northern Territory shows the Petermann Ranges at 4,000-3,500 feet above sea level, but this is probably excessive. There is no trigonometrical survey of this part of Central Australia and the figures quoted above are estimates only. An altimeter on one of the aeroplanes attached to the expedition showed the height of Mt. Bowley landing ground in the Petermann Ranges as 2,000 feet above sea level.

The outstanding feature of the topography of the Petermann Ranges and that portion of the Rawlinson Ranges extending westwards from the Western Australian border, is the dominating influence exercised on it by the quartzite beds which appear to cap the gneisses. These quartzite beds are up to 300 feet thick in places, and are particularly noticeable at "The Ruined Ramparts" near Livingstone Pass in the Petermann Ranges.

The sand-hill country encountered between Pearce's Sheep Camp and Erandirrina Bluff in the Musgrave Ranges and north-west of the Docker Gap in Western Australia, calls for some comment. In both instances the sand ridges bear no direct relation to the direction of the prevailing winds and are, for the most part, covered with mulga or spinifex growths.

The binding action of the roots of this vegetation and the protection afforded the sand by the top growth, prevents the extensive formation of new sand ridges or the migration of those already existing, under present climatic conditions. It would appear then, that these sand ridges had been formed under more arid conditions than those prevailing to-day. There are some sand ridges in these localities completely devoid of vegetation, and others on which the lower slopes only are covered, but speaking generally, the presence of thick growths of vegetation on the sand-hill country gives rise to the thought that existing flora and

climatic conditions could not very well have prevailed at the time of the formation of the sand-ridges.

The drainage of the whole area is, of course, of the inland type, and although many dry water-courses are to be seen extending northwards from the northern flank of the Petermann Ranges, none of them goes very far before dying out in the sandy desert.

That portion of Western Australia visible to the north and west from the low sandstone hills north of the Robert Range, presents a low even horizon, and as far as the eye can see, consists of spinifex covered sand-ridges and flats, with occasional patches of mulga and sparsely distributed desert oak (*Casuarina decaisnéana*). To the south and south-west the view is limited by the bold broken skyline of the Rawlinson Ranges, running in a general east and west direction for some 60 miles.

GEOLOGY.

In a recent paper by Dr. C. Chewings¹ on Central Australian Geology, the most recent conceptions of the stratigraphical sequence compiled from the writings of H. Y. L. Brown, Professor R. Tate, J. A. Watt, Dr. L. K. Ward, Professor W. Howchin, Sir Edgeworth David, Sir Douglas Mawson and Dr. C. T. Madigan are set out in Table No. 1.

The conception of the existence of a great sunland between two shields of Archaean rocks is brought forward and amply justified by detailed structural and palaeontological evidence.

The observations made by the writer of this report during recent journeys in portions of the area discussed by Dr. Chewings were, for reasons mentioned in the introductory chapter to this report, of a very cursory nature. They do not produce any conclusive evidence in rebuttal of Dr. Chewings' findings, although it will be found necessary to make some remarks which do not strengthen his conception with respect to the Pre-Pertatataka rocks.

A westerly continuation of the Ordovician beds, which are a feature of the Amadeus Sunland, into Western Australia, which Chewings states² may possibly be the case, was found to be a reasonable assumption, and quartzites and sandstones which probably belong to the Ordovician series were found as far west as 50 miles inside the Western Australian border.

The chief point on which the writer differs with Dr. Chewings and most other observers of the Pre-Pertatataka Series (the Pre-Nullagines of Western Australian nomenclature) in Central Australia is in the breaking up of this series into the Pertaknurra (Older Proterozoic) and Arunta (Azoic-Archaeic) Series on structural grounds.

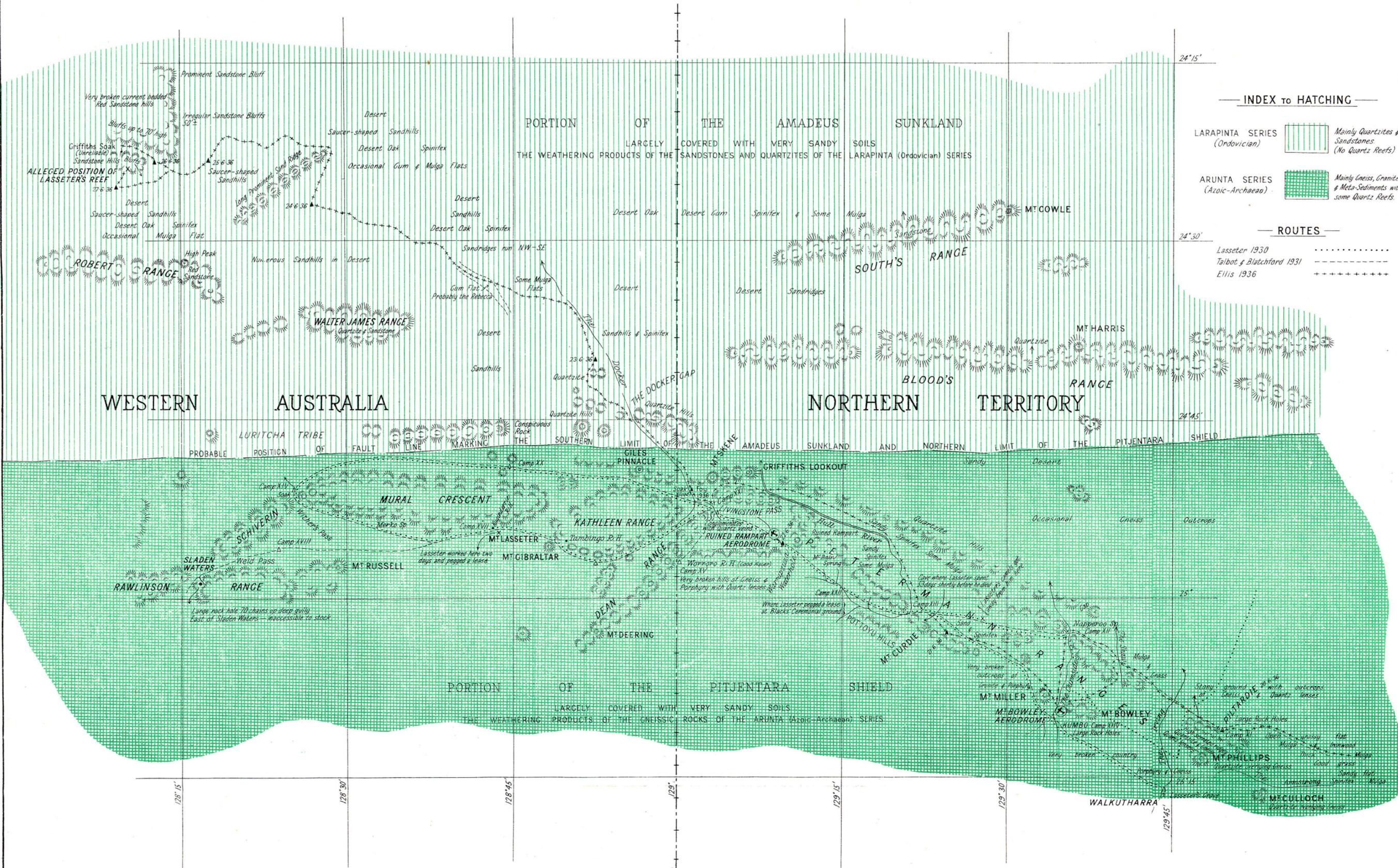
The type locality of the Pertaknurra Series is the southern flank of the Heavitree Gap Range in the Macdonnell Ranges, two miles south of Alice Springs. Most observers have regarded the erosion escarpment of a highly jointed, southerly dipping quartzite bed in this locality as being the base of the Pertaknurra Series, and although several ages have been

¹The Pertatataka Series in Central Australia, With Notes on The Amadeus Sunland: Trans. Roy. Soc. South Aust., Vol. LIX., 1935.

²Op. Cit., p. 151, para. 1.

GEOLOGICAL SKETCH MAP OF COUNTRY IN VICINITY OF THE PETERMANN AND RAWLINSON RANGES CENTRAL AUSTRALIA

To accompany report by H.A. Ellis; G.S.W.A. Annual Report, 1936



INDEX TO HATCHING

LARAPINTA SERIES (Ordovician) Mainly Quartzites & Sandstones (No Quartz Reefs)

ARUNTA SERIES (Azoi-Archaeon) Mainly Gneiss, Granite & Meta-Sediments with some Quartz Reefs

ROUTES

Lasseter 1930

Talbot & Blatchford 1931

Ellis 1936

assigned to these beds by different observers, their unconformable junction with the underlying gneissic rocks has generally been accepted. Ward² and Chewings⁴ have both concluded that this quartzite bed is a basal bed on an unconformable surface of rocks of Achaean age.

The Arunta complex as exposed in the Maedonnell Ranges consists of ortho- and para-gneisses, very many varieties of basic schists, garnetiferous and quartz-mica schists, slates, quartzites, dense silicified metamorphosed argillaceous sediments with garnets, graphitic schists, granite, pegmatite and basic dykes. Metamorphosed lavas and pyroclastics also occur to a minor extent.

It is in this complex of basal rocks in which gold, wolfram, tin and mica deposits occur in Central Australia. No mineralisation is known to have taken place in any of the rocks of younger age, and in this respect the series conforms to the Pre-Nullagine metalliferous rocks of Western Australia.

Considering now the relation of this supposed quartzite bed (Chewings' No. 1 quartzite) to the underlying rocks. The rough hilly stretch of country surrounding the town of Alice Springs is composed mainly of gneiss, some it very finely banded and the rest of it coarsely banded. Judged by the even thickness and considerable length, 2 to 3 miles in places, of certain finer banded portions of it, the conclusion that these stretches are paragneisses is reasonable. Some bouldery hills when viewed closely do not present a gneissic appearance, but when seen from a distance in the correct lighting give a very distinct indication of a weathered, coarsely gneissic mass. These are the gneissic granites of the series. Other bouldery granitic hills do not present any suggestion of gneissification, and these, in the writer's opinion, are the weathered surfaces of an intrusive granite which has not been subjected to folding, and which may probably be the granite from which the mineralising solutions have been derived.

Observations on the strike and dip of the planes of gneissosity in all the gneissic material, whether that immediately underlying the quartzite bed or further away from it in the gneissic granite to the north, show that the strike and dip of this quartzite band conforms with that of the planes of gneissosity in the beds below.

Careful investigations were made in the finer grained basic gneisses immediately below the quartzite band in the Heavitree Gap Range, with the object of ascertaining whether the planes of gneissosity or schistosity could be seen to be cutting across bedding planes, but with a negative result.

The coincidence in strike and dip of the bedding planes in the quartzite and underlying gneisses and schists must therefore be recognised.

Viewing this striking erosion escarpment from the north, the even nature of the junction line between the quartzite and the beds below is very marked, and were the underlying beds portion of an unmetamorphosed sedimentary series an uncon-

formity would not even be thought of. The contact must be regarded as a conformable one on the topographic evidence available here.

There are thick quartzite beds in the recognised Arunta complex, notably at Winneeke, and in Western Australia at Chittering, a short distance north of Perth, and south of Southern Cross in the Yilgarn Goldfield, and the evidence quoted above points to the Heavitree Gap quartzite being a bed in a conformable series.

The break in succession in the Pertaknurra Series must lie much lower down in the succession than is generally conceived, and if the margins of the coarsely gneissic granite could be mapped, possibly an unconformity could be shown to exist there.

Shifting the scene of the discussion now to the Petermann Ranges, where, on evidence gathered from other observers, Dr. Chewings premises the existence of the Pertaknurra quartzite, it will be shown that the writer was unable to recognise the unconformity between the Pertaknurra quartzite and the Arunta complex forming the southern or Pitjantara Shield.

The rocks of the Pitjantara (southern) Shield are essentially the same in nature and origin as those of the Arunta (northern) Shield, i.e., they are crystalline rocks of a granitic, gneissic, or schistose habit, and are rightly regarded as being of the same age, namely, Azoic-Archæan.

A similarity in the geology of the two shields is apparent, and in the Petermann and east Rawlinson Ranges the striking topographical features of the Maedonnell Ranges are reproduced, only on a smaller scale. The quartzite bed so prominent at the Heavitree Gap Range near Alice Springs, dominates the structure in the Petermann and Rawlinson Ranges, and it is here seen folded and warped, forming hogback ridges, cuestas, and domes. It is invaded by frequent quartz reefs and agrees in all manners with Dr. Chewings' No. 1 quartzite or basal bed of the Pertaknurra Series.

As in the vicinity of Alice Springs, the strike and dip of this quartzite bed was found to be the same as the strike and dip of the planes of gneissosity or schistosity in the underlying gneisses and schists, and the junction of the two types was seen to be conformable.

In the nest of hills of which Gordon Hill is the most prominent, at the south-eastern end of the Olla Chain, several horizons of quartzite in the gneissic series are plainly visible, and the strike and dip of the bedding planes in the quartzite and of the planes of gneissosity are concordant. The hogback in which is situated Piltardie Rockhole is composed of one main band of steeply dipping quartzite with one minor parallel band separated by coarse basic gneissic material. These quartzites are unmistakably part of a conformable series, and in every instance where their contact with the underlying beds could be observed in the western section of the Petermann Ranges, it was found that the junction was even, and that the strikes and dips of the two rock types were concordant.

Great difficulty has been experienced in Western Australia when seeking to find an unconformity in the Pre-Nullagine rocks. They have been classified into series, viz., Yilgarn, Kalgoorlie, Mt. Barren-

² Ward, L. K., Notes on The Geological Structure of Central Australia: Trans. Roy. Soc. South Aust., Vol. XLIX., p. 62 (bottom of page).

⁴ Op. Cit., p. 143.

Stirling Range Series, etc., purely on lithological or geographical grounds, but no conclusive evidence of the existence of a major unconformity in the Pre-Nullagine rocks has yet been established. The writer prefers to regard the Pertaknurra Series of the Macdonnell Ranges and the Petermann and Eastern Rawlinson Ranges as consisting predominantly of quartzite, forming an horizon in a great series of metamorphosed unfossiliferous rocks. The foundation rocks are included in this series, and it is thought that a close examination of the boundaries of the more coarsely crystalline gneissic portions of it might reveal an unconformity.

The route followed on the expedition did not permit of an examination of Ayer's Rock or Mt. Olga, the nearest point of approach being some 30 miles to the south. Dr. Chewings considers² that these two very prominent topographic features are remnants of the Pertatataka (Nullagine) Series resting on the basement rocks of the southern or Pitjentara Shield, and that the southern fault line of the Amadeus Sunkland lies to the north of them.

An opportunity will be availed of here to quote a description of the rocks composing the Mt. Olga line of residues made by Mr. T. Blatchford, sometime Western Australian Government Geologist, as a result of his inspection of them in 1931, and kindly made available to the writer in a personal communication. They are, he states, "composed entirely of rounded boulders, cemented together in a silicified matrix of grit. Viewed from the west, the western end presents three high rock knobs, separated by two narrow chasms which are wide enough to be passable by man. From the eastern aspect there are quite a number of smaller knobs, but none approaching in height those of the western end. The boulders comprise a most varied assortment of granites, porphyries, pegmatites and quartz. Quartzite boulders are rare. Amongst the more basic varieties, the most common are porphyrites, basalts, vesicular basalts, dolerites and gabbros. The size of the boulders varies enormously; some of the largest would probably weigh one or two tons but such are exceptional, the greater proportion being of the weight of a few ounces up to say fifty pounds."

"Many of the boulders have flattened sides, which, coupled with the extraordinary collection of different rock types, suggest that the deposit is the result of glacial action. Unfortunately we were unable to obtain samples which were definitely faceted or deeply grooved, but there were so many polished faces that I consider there is little doubt that the deposit has been transported and dumped by a glacier. We found no other occurrence of a conglomerate with the same characteristics."

Assuming Dr. Chewings' classification of the Mount Olga residues to be correct, namely, that they are of the Pertatataka (Nullagine) Series, then Blatchford's observations indicate a glacial period in the Nullagine (Pertatataka) sequence. This possibility does not seem to have been noticed in any of the many exposures of Nullagine rocks in Western Australia. The Mt. Olga beds have been described by other observers as boulder conglomerates, and the suggestion of a glacial origin does not seem to have been made before. The occurrence of a glacial period in Newer Proterozoic (Nullagine or Pertatataka) times is inferred from the presence of tillites in the Adelaide Series (Newer Proterozoic) [Pertata-

taka (Central Australia) or Nullagine (Western Australia)] in South Australia. In discussing the Pertatataka (Nullagine) Series, Dr. C. T. Madigan⁶ comments as follows:—

"The Pertatataka (Nullagine) seas were very extensive. They stretched from the Macdonnell Ranges southward to cover most of South Australia, and eastward to an unknown distance. No evidence of a glacial period, to correspond with the Sturtian tillites of the Adelaide Series, has been found, though this was specially sought in the western Macdonnells. The basal beds of the Nullagine, in lower latitudes, are doubtfully placed as fluvio-glacial, but the highlands shedding the ice responsible for the Sturtian tillite appears to have lain to the far south-south-west of the Macdonnells in the neighbourhood of the present Gawler Ranges in South Australia."

The presence of such rocks as vesicular basalts and dolerites in the Mt. Olga assemblage is noteworthy, since igneous rocks are not known to occur in the known Nullagine (Pertatataka) formation in Central Australia.

The Nullagine formation so extensively developed in the north of Western Australia has a considerable intrusive and extrusive igneous facies, and in North Australia the basalts of the upper Victoria River, which are so strongly developed in the vicinity of Catfish Yard, in all probability belong to the Nullagine (Pertatataka) formation.

In the same personal communication as mentioned above, Mr. Blatchford states that between Mt. Olga and Piltardie Rock-hole in a distance of about 60 miles on a west by north course, two low sandstone and quartzite ridges were crossed. The presence of this sandstone may have some structural significance, but as the details of its occurrence are not known to the writer, nothing of value can be gained by discussing it further.

From the description of the country passed over by F. George, from the Musgrave Ranges to the north of Mt. Olga⁷, it would seem that the Pitjentara (southern) Shield extended north of Mt. Olga, and that the southern margin of the sunkland lay therefore somewhere to the north. The Larapinta Series (Ordovician) occupies the country north of a line drawn to pass roughly through Goyder's Springs, north of Mt. Connor, Ayer's Rock and Mt. Olga, and its probable westerly continuation will now be considered.

Dr. Chewings⁸ describes the Larapinta succession in Central Australia as follows:—

1. Marena red sandstone and quartzite beds 400 to 900 feet thick, form the upper portion of the Larapinta Series. These rest upon
2. Marena Valley shales and mudstone, 400 to 700 feet thick with calcareous fossiliferous bands at the base, where the quartzite starts.
3. Stairway quartzite and sandstone, over 1,000 feet thick. These beds weather into serrated forms that suggest the name.
4. Stairway Valley beds are fossiliferous at the top, immediately under the quartzite, in thin calcareous bands, below which are 400 feet of shale and slate.

⁶ Madigan, C. T., *The Geology of The Eastern Macdonnell Ranges, Central Australia*: Trans. Roy. Soc. South Aust., Vol. LVI., p. 107.

⁷ George, F. R., *Prospecting Operations in The Musgrave, Mann and Tomkinson Ranges*, by L. A. Wells and F. R. George (with plans): South Aust. Parl. Paper No. 54, pp. 6-8, 1904.

⁸ Op. cit., p. 143.

² Op. cit., p. 150 (bottom of page).

5. No. 4 quartzite, the basal beds, at Ellery's Creek over 3,000 feet thick with a narrow flagstone band in one place.

Note:—Larapinta beds are the special feature of the sunkland and owe their preservation to having been faulted down *en masse*. Subsequently the beds were folded, and erosion has exposed many fossil localities."

He premises the probable extension of this sunkland into Western Australia,⁹ that is, that the Larapinta (Ordovician) Series extends westwards across the border. That this is a reasonable deduction will be seen from the paragraphs which follow.

On following the Docker River north-west from Livingstone Pass, a number of bold hills and short ranges composed of highly folded quartzite and gneiss are to be seen on either side for a distance of about 7 miles northerly from the pass. At the Docker Gap itself, situated some 13 miles north-west of Livingstone Pass, the gneiss has disappeared, and the low ranges in this vicinity through which the Docker River has cut its way, are composed entirely of a dense, highly jointed quartzite, dipping mostly to the north but showing signs of folding in the varying strikes of the outcrops. East-west strikes predominate here. For 3 or 4 miles north-west of the Docker Gap, short, strong quartzite ridges with a general east-west trend may be observed, and at a distance of about 6 to 7 miles north-east of the same point the western end of Blood's Range comes into view.

This range runs nearly east and west for a total length of about 55 miles, and when viewed from the south and south-west presents the topographic expression characteristic of the quartzite formations in the known Larapinta Series elsewhere in Central Australia.

George,¹⁰ Tietkens,¹¹ and Basedow¹² describe the rocks of Blood's Range as northerly dipping quartzites, and George states that the highest point of the range is about 800 feet above the general level of the surrounding country. At a distance of about 12 miles south of Mt. Harris, which is situated in Blood's Range, George¹³ reports a quartz blow in quartzite, and it therefore seems probable that this locality is somewhere near the northern limit of the southern or Pitjantara Shield in this vicinity.

At an average distance of about 12 miles north of Blood's Range, and running nearly parallel with it for its length of about 24 miles, is South's Range, and this is described by George as being composed of northerly dipping red, white and yellow sandstone. It would appear then that we have here in South's and Blood's Ranges some sedimentary beds whose lithological characteristics, stratigraphical succession and structural position would suggest that they were the upturned edges of the Larapinta Series corresponding to similar beds much further to the north and which dip in the opposite direction. Dr. Chewings¹⁴ summarises the position as follows:—

"Blood's Range, according to George, Tietkens and Basedow, appears to be the southern limit of the great sandstone and quartzite area of Larapinta rocks

that extends westwards from Gardiner's Range, Glen Edith, and Laurie's Creek, apparently without a break to the Western Australian border. Along its southern edge the Blood's Range and South's Range beds are upturned in the same way that the Larapinta Series are seen to overlook the Glen Helen Valley, on the opposite (north) side of the sunkland, only in the opposite direction, for Blood's Range and South's Range dip north."

At the Western Australian border this sunkland must be at least 50 miles broad in a north and south direction, and its probable extent into Western Australia will now be considered.

Proceeding in a general north-west by west direction from the Docker Gap, with the exception of the few quartzite hills and short ridges previously mentioned, no outcrops are encountered until an air-line distance of about 52 miles has been travelled. The Walter James Range, situated in approximately the same latitude as Blood's Range, is passed on the northern side and it appears to be composed of quartzite. It has a flat sky-line for the most part, but presents a broken appearance at its southern end. A prospector reported to the writer that there was no quartz, mica, sandstone or shale in it, that it was composed of quartzite, and that the main bulk of the range was oriented north and south. Circumstances did not permit of a visit to this range, but observations through field glasses conveyed the impression that there were some steeply dipping quartzite beds on its eastern side.

The first outcrop encountered in the desert country on a north-west by west course from the Docker Gap is about 50 miles out, where a low mass of broken sandstone hills with a general north-south trend rises to a height of about 100 feet above the general level of the surrounding sandhills and flat sandy spinifex country. The southern end of these hills lies some 8 miles north of the Robert Range, and their eastern flank extends for about 8 or 9 miles northwards and is marked by conspicuous bluffs and gaps. The sandstone weathers brick red, is current-bedded, cavernous, and contains occasional small water-worn pebbles of quartzite distributed through it, the pebbles not being confined to any particular horizon. The strike and dip varies, two prominent directions being N. 40° W. and east and west with dips of from 20° to 45° southwards. It is folded into gentle anticlines and synclines with horizontal east-west axes where seen in the southern exposures.

This nest of hills is separated from the Robert Range to the south by flat sand-ridge country, and although this range was not visited it can be stated with a fair degree of certainty, as the result of field-glass inspection in a remarkably clear atmosphere from a distance of about 9 miles, that it is composed largely of the same red sandstone. The Robert Range has a general east-west extension of about 10 miles, and the sandstone beds appear to strike east and west and to dip flatly to the south.

George¹⁵ reports occasional sandstone outcrops in the desert country north of South's Range; Warman Rocks, situated about 64 miles north-north-east from the Docker Gap, being composed of this rock.

On lithological and structural grounds it seems to be a reasonable suggestion that the lower quartzite beds of the Larapinta (Ordovician) Series are repre-

⁹ Op. cit., p. 151.

¹⁰ Op. cit., p. 8.

¹¹ Tietkens, W. H., 1889 Journal of The Central Australian Exploring Expedition, with map and section: C. E. Bristow, Govt. Printer, Adelaide, 1891.

¹² Basedow, H., 1926, Geological Report on The Petermann Ranges, Central Australia: Geographical Journal, 1929, pp. 259-265.

¹³ Op. cit., p. 8.

¹⁴ Op. cit., p. 151 (top of page).

¹⁵ Op. cit., p. 12.

sented in Blood's Range and the Walter James Range, and that South's Range and the Robert Range with the sandstone hills situated about 9 miles north of it, belong to the sandstone facies of the same series.

The northern edge of the Pitjantara (Southern) Shield would appear to lie along a line drawn approximately in an east-west direction a little south of the Docker Gap, extending westwards to at least as far as the Robert Range in Western Australia, and passing eastwards to the north of Mount Currie in the Northern Territory as postulated by Dr. Chewings.¹⁶ The extent of these probable Larapinta (Ordovician) rocks in Western Australia westerly and to the north of the Robert Range is not known, and cannot be surmised in the present state of our geological knowledge of this part of the State. Dr. Chewings¹⁷ suggests that the western limit of the sunkland in which the Larapinta (Ordovician) beds are the special feature, may be somewhere in the vicinity of the western side of Lake Hopkins in Western Australia, on account of the presence there of a ring of ranges and the exposure of limestone beds.

Reverting now to the geology of that portion of the Musgrave Ranges passed through on the journey, it is regretted that circumstances permitted of observations of such a nature only as make possible the remarks contained in the paragraphs below.

The Musgraves were reached from the north in the vicinity of Erandirrinna Bluff, just inside the Northern Territory border, in approximate longitude 132° 15' E. after passing over a wide stretch of red sandy loam flats with some sand-hills. About 15 miles north of this bluff there is an exposure of a very coarse grained porphyritic granite of a very fresh appearance, in which the ferromagnesian minerals are present to a very minor extent only. There are a few thin quartz veins in this granite, and in one of the major joints a "gnamma-hole" has been developed. The granite is level with the sandy ground surface and is exposed for only about two square chains. It does not show any trace of a gneissic structure and no other exposures of a similar type were seen anywhere on the journey.

By far the greater portion of the outcrops passed over in a westerly course along the northern flank of the Musgrave Ranges consisted of granite and gneiss. The granite weathers to low rounded hills which are sometimes bouldery and sometimes smooth, and does not possess any gneissic structure. The gneiss seen appears to be mainly orthogneiss derived from a granitic magma, and many degrees of gneissosity, ranging from a wide and barely perceptible banding right down to a nearly schistose structure, are to be seen. In these gneisses there is a lack of sharpness in contact between the acidic and more basic portions and sometimes, as at Mitchell's Knob, the banding has a fine flow-like structure and even closes in almost circular forms. Some gneisses were seen north of Mitchell's Knob, which, on account of the sharp contact between the acidic and more basic portions, the relatively narrow width of the type (mostly basic), its continuity of outcrop, the presence of pitching drag-folds, and in one instance the distinct recognition of diminishing grain-size towards the top of the bed, can be surely classified as paragneisses.

¹⁶ Op. cit., Map p. 155.

¹⁷ Op. cit., p. 150.

A hint of the existence of extensive beds of paragneisses is obtained when the mass of the Musgrave Ranges lying to the south of a long and wide re-entrant between Erandirrinna Bluff and Mitchell's Knob is viewed from Mitchell's Knob in the late afternoon of a bright day. Long, continuous, curving and wavy narrow bands of rocks of contrasting colours can then be seen to stretch for miles in a general east and west direction, conveying the impression of a vast sedimentary series highly folded and steeply dipping.

Near Indultna (Indulka on South Australian maps) Soak, about 4 miles north of Mitchell's Knob, the gneisses are invaded by pegmatite, and short narrow quartz lenses with tourmaline are of frequent occurrence. Tourmaline and quartz were not seen in association in any other locality.

In many of the dry creek beds which run north from the Musgraves near their western extremity, numerous slabs and sub-rectangular pieces of quartzite occur, and in the ranges to the south there is a distinct suggestion of narrow steeply dipping beds which are probably composed of quartzite.

Generally speaking, the axes of the folds in this obviously highly folded complex strike east and west, but there are many deviations from this direction, particularly in that portion of the Musgrave Ranges which runs northwards from Mounts Morris and Woodward, where strikes approximating to west-north-west are persistent for many miles.

Some fragments of a fresh, medium grained basic rock with the macroscopic characteristics of a dolerite were seen near Indultna Soak. This rock is probably present in the complex here as intrusive dykes, since numerous occurrences of fresh basic dykes are known in the Musgrave Ranges further to the south, and are also reported to exist in parts of the Petermann and Rawlinson Ranges.

On the northern flank of the Musgrave Ranges there are no rocks of a younger age than the Pre-Pertatataka Series (Pre-Nullagine)—on the southern flank there are some sedimentary beds which, according to Jack¹⁸, are of Cretaceous, Ordovician and Cambrian ages. It would seem that Chewings¹⁹ regards Jack's Cambrian as Pertatataka (Nullagine). Ayer's Rock and Mt. Connor, though almost certainly belonging to the Pertatataka Series, cannot be regarded as flanking the Musgrave Ranges to the north, separated as they are from the latter by a very wide stretch of sandy desert country.

The predominant rock types noted in the Musgrave Ranges were acid and basic paragneisses, orthogneisses of a granitic origin, quartzites, gneissic granite and massive granite. Similar rocks were noted in the Petermann and eastern portion of the Rawlinson Ranges, with the notable difference that in the latter areas quartzite predominates and the proportion of gneisses of a slightly more basic nature increases.

Nowhere in this semi-mountainous area of Pre-Nullagine rocks is there any development of a volcanic or intrusive igneous phase comparable with the greenstone areas associated with rocks of a similar age in the goldfields of Western Australia, nor is there any marked parallel between these Musgrave, Petermann and Rawlinson Ranges rocks, and the

¹⁸ Jack, R. L., 1915, The Geology and Prospects of the Region to the South of the Musgrave Ranges, . . . Geol. Surv. S.A. Bull. No. 5, p. 19 et seq.

¹⁹ Op. cit., p. 162.

other lithological divisions of the Western Australian Pre-Nullagine Series. They do not contain nearly as many distinct rock-types as occur in say the Arltunga or Winnecke areas in Central Australia, and they clearly lack the noticeable variety of metamorphic, sedimentary, volcanic and intrusive igneous rocks of the mineral fields of North Australia and the other Central Australian gold localities such as Tanami and The Granites.

Throughout the Petermann, Rawlinson and Musgrave Ranges there is a moderate development of quartz as short lenses and stringers in the planes of gneissosity of the various gneisses, and occasionally in bedding planes and tension cracks in quartzite. In the vicinity of Indultna Soak in the Musgrave Ranges these quartz veins are associated with tourmaline, but in most of the other occurrences noted, the quartz was either entirely glassy or was sparsely impregnated with titaniferous haematite. Occasional pegmatite dykes of small extent occur in the gneiss, and these, like the quartz veins, follow the planes of foliation or gneissosity.

It is probable that the rounded outcrops of non-gneissic granite, the only unmetamorphosed rock (with the exception of basic dykes) occurring in the area under discussion, represents an intrusive granite from which the pegmatite dykes and quartz veins have been derived.

An outstanding feature of the outcropping rocks in the Musgrave, Petermann and Rawlinson Ranges is the remarkable freshness and hardness of all of the rocks. The bands of softer, more "kindly" looking, ironstained and fissile rocks frequently associated with Central Australian mineral fields are conspicuous by their absence here. There is not nearly as much detrital and reef quartz in this area either, when compared with other mineral-bearing localities in rocks of similar age in Central Australia. A fairly steady east and west strike varied by occasional stretches of country where a west-north-west strike prevails extends for a distance of nearly 270 miles, and the impression is gained from a study of structural features throughout this length that although crustal deformation has been severe, it has not been of the same magnitude as that associated with other mineral-bearing localities in rocks of the same age in other parts of Central, North and Western Australia.

For those who favour the necessity for the existence of north-south strikes, or strikes approaching thereto, before any hope can be held out for the existence of mineralised belts of country, there is little encouragement in this long length of possible mineral-bearing country. Strangely enough, belts of Pre-Nullagine rocks both in Western Australia and in North Australia which have a general east-west trend have been found to be barren of mineral contents, while on the other hand just such belts of country at Arltunga, Winnecke and Tennants Creek in Central Australia carry gold reefs.

It is not unreasonable to come to the conclusion, based solely on comparison with other gold-bearing areas in rocks of similar age in other parts of Central, North, and Western Australia, that the Musgrave, Petermann and Rawlinson Range areas are not promising metalliferous provinces. It may be urged against this statement that it is not backed by detailed investigation and that it is too sweeping. It is backed, however, by the statements of some widely experienced geologists who have visited the area before the writer, and what is perhaps more important,

by the experience of a great many very good prospectors—only good prospectors can operate in this part of Australia—who have spent a great deal of time with the pick, shovel, dish and dolly pot, and who have mostly failed to raise a colour of gold in this part of Australia which has come to be commonly known as "Lassefer's country."

PROSPECTING OPERATIONS IN THE MUSGRAVE, PETERMANN AND RAWLINSON RANGES.

On account of the relative inaccessibility of the country embracing these ranges, situated as they are in perhaps the most arid part of the Australian continent, it may be pardonable for the general public to have the impression that this area is but little known to prospectors. This is not correct, as will be shown by subsequent paragraphs.

The Musgrave Ranges, being situated closest to the main overland telegraph route, have perhaps received most attention from prospectors. In the years 1900 and 1901 the South Australian Government sent two expeditions under the leadership of Messrs. R. T. Maurice and W. R. Murray on journeys of exploration from Fowler's Bay to the Rawlinson Ranges, and from Fowler's Bay to Cambridge Gulf. Although these journeys were mainly in the nature of exploratory work, a considerable amount of prospecting was done on both trips where the route passed through the Musgrave, Mann and Rawlinson Ranges, and the leaders of these expeditions report²⁰ very disappointingly on the mineral possibilities of the range country.

In 1903 Messrs. L. A. Wells and F. R. George led a South Australian Government prospecting party into the Musgrave, Mann and Tomkinson Ranges, and in the subsequent report²¹ Mr. L. A. Wells could not hold out any bright prospects, from a mineral point of view, for the country traversed.

The Petermann Ranges were exhaustively prospected during another South Australian Government Prospecting Expedition sent out under the leadership of F. R. George in 1905. In the subsequent report²² on these operations compiled by W. R. Murray, it is observed that the only place in the Petermann Ranges where traces of gold could be found was at Foster's Cliff, and these traces were found in a "floater" of quartz and were certainly not indicative of payable gold.

The first recorded details of the topography and geography of the Petermann and Rawlinson Ranges resulted from the exploration by E. Giles in this part of Australia in 1874, and appears in a volume written by E. Giles.²³ Giles does not appear to have done any systematic or even intermittent prospecting, or if he did, no mention is made of the mineral possibilities of the country in his writings. It is probable that Giles was the first white man to visit the Petermann Ranges, and he certainly did not discover any free

²⁰ Maurice, R. T., Extracts from Journals of Explorations, Fowler's Bay to Rawlinson Ranges and Fowler's Bay to Cambridge Gulf (with plans): S.A. Parliamentary Paper No. 43, 1904.

²¹ Wells, L. A., and George, F. R., Reports on Prospecting Operations in the Musgrave, Mann and Tomkinson Ranges (with plans): S.A. Parliamentary Paper No. 54, 1904.

²² George, F. R., Journal (with plans) of the Government Prospecting Expedition to the South-Western Portions of the Northern Territory. S.A. Parliamentary Paper No. 50, 1907, vol. iii.

²³ Giles, E., Australia Twice Traversed: The Romance of Exploration, being a Narrative compiled from the Journals of Five Exploring Expeditions into and through Central South Australia, and Western Australia from 1872 to 1876. Vols. I. and II. Published by Sampson Low, Marston, Searle & Rivington, London, 1889.

gold there, otherwise he would have mentioned the fact in his writings.

The Horn Scientific Expedition to Central Australia in 1896 and a Central Australian Exploring Expedition in 1889 traversed portions of the area under discussion, and although the reports on these expeditions are not available to the writer, neither expedition could have found free gold in payable quantity since there are no records of any payable gold having been found in this part of Australia.

One of the last of the official expeditions, or at least those having persons among their number who possessed some geological training, is the journey made by the late Dr. H. Basedow in 1926.²⁴ This publication has not been seen by the writer, but no discovery of payable gold was made, otherwise the fact would be well known.

In the year 1931 Messrs. Blatchford and Talbot, two Western Australian geologists who spent many years in the service of the Geological Survey of Western Australia, and who possess a wide knowledge of the goldfields of this State, accompanied the second expedition equipped by the Central Australian Exploration Company, Ltd. (Sydney), which was despatched to the alleged locality of "Lasseter's Reef" in the Petermann Ranges. During this journey Messrs. Blatchford and Talbot traversed the Petermann and Rawlinson Ranges from Piltardie Rock-hole in the east to Sladen Waters, near the western extremity of the Rawlinsons in Western Australia. Prospecting operations were carried out, but without success, by this party, and the conclusion reached by Messrs. Blatchford and Talbot was that the Rawlinson and Petermann areas were not a mineral nor a gold province, and to further prospect them would be a waste of time and money.

In the year 1930, the well known overlander, Mr. M. Terry, took a party of prospectors into the Petermann and Rawlinson Ranges starting from the overland telegraph line. Included in this party were some very efficient Central Australian prospectors, but in a personal communication to the writer Mr. Terry stated that no payable gold was found, and that the entire area was most unpromising from the point of view of the possible occurrence of gold.

In the same year Mr. D. McKay conducted an Aerial Survey Expedition into Central Australia and used the Petermann Ranges extensively for his ground organisation, clearing landing grounds between Foster's Cliff and Butler's Dome, at Mt. Bowley, and at the Ruined Ramparts. Associated with the ground parties were some leading Central Australian bushmen, and although the objects of this expedition were mainly that of the aerial mapping of the country, it is reasonable to assume that the ground parties did some prospecting. Evidence to this effect was noted by the writer when in 1936 he visited the landing grounds at Mt. Bowley and the Ruined Ramparts, and saw there at the old camp sites of this party, numerous miscellaneous collections of quartz and rocks. No likely auriferous country or payable gold has been reported by Mr. McKay.

Another expedition on which prospecting was carried out by experienced prospectors was that financed by Mr. V. Poy, of Sydney, and led by Mr. R. Buck, which traversed the Petermann Ranges as far west

as the Western Australian border in 1936. This party sampled numerous quartz reefs and in no case was anything approaching payable gold found, although one of the prospectors on this trip reported to the writer that traces of gold were found in thin quartz veins in the vicinity of Livingstone Pass in the Petermann Ranges.

The paragraphs above deal with the operations of organised Government, scientific, or private expeditions known to the writer through the medium of published reports or personal knowledge. There may possibly have been other expeditions, and in this resumé the observations of the surveyors who carried out the major triangulation surveys of the northern part of South Australia in the latter half of the nineteenth century have not been taken into account. Messrs. E. C. Playford and T. J. Worgan, who were for many years prominently associated with the Mines Department and mining industry of the Northern Territory, and who were also surveyors who had been engaged on the major triangulation of the Musgrave Ranges, informed the writer some years ago that the Musgrave Ranges were unpromising from a mineral aspect.

Of the individual prospectors either in pairs or in small parties who have entered the Musgrave, Petermann and Rawlinson Ranges from the north, south, east, and west, there is no record. The name J. Tregurtha and the year 1896 appears cut in the quartzite at Piltardie Rock-hole in the Petermann Ranges, and no doubt there were prospectors there before that year. Tregurtha was a West Australian prospector and came in from the west.

In 1904, another well-known West Australian explorer, F. Hann, got as far east as the Rawlinson Ranges and prospected round their western extremity. Some of the Central Australian prospectors who have prospected in the Petermann and Rawlinson Ranges are R. Wilkinson, A. Cameron, R. Westgarth, P. Johns, N. Crowther and L. Bloomfield and several of these prospectors, now well advanced in years, personally assured the writer recently in Alice Springs that they had not seen more unlikely looking gold country anywhere in Central Australia than that embracing the Petermann and Rawlinson Ranges.

THE LASSETER MYTH.

Strangely enough, the only person who seems to have ever found gold in this part of Australia was one named Lasseter, and he, according to his own story, found what prospectors dream about—gold in large lumps sticking out of a quartz reef.

In brief, Lasseter's story of the discovery is as follows:—

Early in the twentieth century he lost his bearings in the Macdonnell Ranges to the west of Alice Springs whilst travelling in that country with horses. In his wanderings alone he found this fabulously rich gold reef, and was only saved from perishing by an Afghan who found him, to be ultimately restored to health by a surveyor named Harding. Several years later he set out with Harding and again found this reef, the surveyor taking its position with his instruments. It is stated that on returning to civilisation they found their watches to be an hour and a quarter slow, hence the calculated position of the reef was 100 miles out as a consequence. (See page 75.)

²⁴ Basedow, H., 1926, Geological Report on the Petermann Ranges, Central Australia: *Geographical Journal*, 1929, pp. 259-265.

In 1929 or 1930, as a result of personal representations made by Lasseter to residents of Sydney, the Central Australian Exploration Company, Ltd., despatched a well equipped party with Lasseter as guide to again locate this reef. The result of this expedition was that Lasseter again found the reef when by himself, but perished in the Petermann Ranges.

The story of Lasseter's lost gold reef has been given to the world in book form as an historical novel,²² and only those uninitiated in the psychology of gold prospecting will fail to see in it the utter lack of any evidence establishing the fact that Lasseter ever found any gold of any description.

Dealing with a few of the more important aspects of the case against the supposition that Lasseter ever found a gold reef, we must first of all enquire into the truth or otherwise of his statement that he was in that part of the country when he claims to have first discovered the reef. Prior to his departure from Alice Springs on the journey from which he did not return, and on which he claimed to have again found his reef, he was closely questioned by a number of old residents of Central Australia who knew the country to the west of Alice Springs. He was unable to answer questions relating to various names and places and could not fix positions familiar to his interrogators. He could not, in fact, give any correct information about any building, store or Government office in Alice Springs at that time, and the consensus of opinion was that he had never been in Central Australia before the time of his being questioned. The Government administrative officers who also questioned him firmly believed that Lasseter was suffering from delusions, and he certainly failed to convince anybody in Central Australia that he had ever been there before.

Dr. L. K. Ward, Government Geologist of South Australia, interviewed Lasseter in 1929 and comments as follows on the result of that interview* :—

"Lasseter was unable to give any satisfactory account of his alleged movements after leaving Arltunga, and it was impossible to arrive at any conclusions as to where he had been at the time of his claimed discovery. With tragic irony he stated that he was anxious that no one should perish from thirst on the track to the find, and wanted the Government to lay a pipe line from the Gascoyne River in Western Australia prior to the resumption of the search for the reef. Lasseter stated that he made his way back to settlement on foot, after losing his last horse at the western end of Lake Amadeus."

In a letter published in the Sydney "Bulletin" on July 15, 1936, a correspondent who knew Lasseter personally submits evidence distinctly in favour of the conception that Lasseter could easily be suffering from hallucinations when he claimed to have found this fabulously rich gold reef.

It is not unlikely that the germ of the hallucination responsible for Lasseter's claim to the discovery of a rich gold reef had its origin in a novel entitled "Blood Tracks of the Bush," by Simpson Newland, published by Gay and Hancock, Ltd., Lon-

don, 1919, where, in Chapter XV., pages 120-134, an account of the imaginary existence of rich gold deposits in this part of Australia is given. The circumstances associated with this fictitious gold occurrence bear a remarkable resemblance to Lasseter's story, and from information contained in the Sydney "Bulletin," previously mentioned, it is very probable that Lasseter had read this book.

The obvious trimming to Lasseter's story whereby the position of his reef located by Harding by astronomical methods was considered to be in error by 100 miles (no direction is stated) on account of a watch error of 1¼ hours will not stand investigation. Time is not required in the determination of latitude, but is essential for the working out of longitude. An error of 1¼ hours in time would mean not an error of 100 miles in longitude, but of about 1,100 miles, hence this story cannot be given any weight as a reason for the elusive nature of the locality of this lost gold-reef.

Another very strange aspect of the case is the fact that a period of some 30 years was allowed to lapse by Lasseter before he made any attempt to exploit his alleged find. This, of course, when viewed in the light of what genuine gold-seekers will do and suffer in pursuit of gold is sufficient evidence in itself to stamp the find as mythical. The whole of the area where this alleged reef exists is accessible to camel transport, given the right time of the year and a normal season, and it can be confidently asserted that there is hardly a square mile of this part of Australia that has not been seen by white men since the year 1900.

A feature of the story is the difficulty experienced by Lasseter in again locating this reef when with the last expedition which he accompanied as a guide. If he were able in the first place to get through this country with horses he must have been a really first-class bushman, and as this part of Australia is particularly prolific in distant landmarks and he had the sight of an El Dorado to spur a bushman's instincts in the matter of fixing the landmarks in his mind, then surely he should know within a few miles of where this reef was situated. There is no doubt that his lack of knowledge and experience of the country was the cause of his failure to survive its pitfalls, and ultimately led to his death.

In recent years several claims to the discovery of Lasseter's lost reef have been made; in each instance as in Lasseter's own case, the reef has been seen by only the alleged discoverer. Strangely enough too, when nearing the supposed locality of the reef, the finder generally either quarrels with his mate or for some other reason goes away by himself and returns with the statement that he has found the reef, but never yet has anyone produced any specimens which unquestionably came from the reef. Specimens have at times been produced which are alleged to be from this reef, but investigation has established the fact that they have actually been obtained from other sources.

To the writer's mind, one of the strongest arguments against the probable existence of a quartz reef studded with gold and outcropping for a considerable length in this part of Australia is the fact that not at any time have any of the natives who inhabit this country ever produced to the white men who go into it or those with whom some of them come in con-

²² Idriess, Ion L., *Lasseter's Last Ride*: Published by Messrs. Angus & Robertson, Sydney, 1931. (Many subsequent editions.)

* Personal communication.

fact at the Hermannsburg Mission, any specimens of either tin ore or gold. Most of the inland natives of Australia know what brings the white man into their country, as is evidenced by the manner in which even the most uncivilised of them approach a camp with quartz-crystals, haematite in quartz, any unusual development of mica, or, in fact, any what to them is an unusual rock occurrence. Prospectors with an intimate knowledge of the native tongue and native customs have combed this so-called "Lasseter's country" with the aid of natives who have been born in it and lived in it for years, and they have come out of it firmly convinced that Lasseter's Reef is a myth. It is wrong to think that because a large portion of "Lasseter's country" is desert nothing is known of it. The natives have been for centuries and still are, hunting over it, and over thousands of square miles of it the natives will tell you there is not even a pebble of white quartz.

A detailed analysis of all of the statements associated with the alleged finding of a fabulously rich gold-reef in Central Australia by one named Lasseter is not intended in this report, and only the most obvious flaws in the story have been dealt with above. In conjunction with the paragraphs under this heading of "The Lasseter Myth," it would be as well to include a summary of the geological information set out in previous chapters having a bearing on the subject under immediate review.

There is, to begin with, the outstanding consistency in the results and reports of the prospecting parties and individual prospectors who have operated in the only possible area where gold could occur in this part of Australia, namely, the Musgrave, Petermann and Rawlinson Ranges. These results have shown that the country, though possibly goldbearing, is of a most unpromising nature, and that the most that has ever been obtained in it is traces of gold.

The conclusion arrived at by Messrs. Blatchford and Talbot, Western Australian geologists with a very extensive knowledge of gold and its manner of occurrence, after an extensive journey through the Petermann and Rawlinson Ranges, was that these areas did not constitute a probable metalliferous province. The writer wishes to associate himself with this view, and would add that a detailed knowledge of practically all of the known gold-bearing areas in Central and North Australia (gained in his capacity as Commonwealth Government Geologist for the Northern Territory over a period of three years) as well as many in Western Australia, helps him to arrive at his conclusion.

There is a very great area of what has become to be known as "Lasseter's Country" in which there is no geological possibility of the occurrence of gold-reefs or any other minerals usually associated with the gold-bearing rocks of Central Australia. At the risk of aiding any future finders of Lasseter's Reef, and in the hope of providing some means whereby the *bona fides* of such finders may be gauged, this area of totally impossible gold country will be described. (See Plate IV.) It embodies all that portion of Central Australia situated westwards of the overland telegraph line and lying between two approximately east and west lines located as follows:—

The northern boundary line can be said to start immediately south of Heavitree Gap 2 miles south of the town of Alice Springs, and extends westwards along the southern flank of the Maconnell Ranges

to just south of Mt. Tate, then westwards to just north of Mt. Winter, then slightly south of west to the south of Mt. Rennie, and then in a general westerly direction for at least 50 miles into Western Australia.

The southern limit of this zone is marked by a line drawn through Mt. Daniel near the railway line, about halfway between Crown Point and Charlotte Waters, west-by-north to Goyder's Springs, then west-north-west to the south-eastern end of Lake Amadeus, then in a general westerly direction north of Mt. Currie, passing across the Western Australian border between the Docker Gap and Livingstone Pass immediately north of the Petermann Ranges, and continuing for at least 50 miles into Western Australia along the northern flank of the Rawlinson Ranges.

This area is what is termed by Dr. Chewings the Amadeus Sunkland, and is occupied mainly by beds of Ordovician age and their recent weathering products. This very large area of sandstone and quartzite belongs to a series of rocks of sedimentary origin laid down millions of years after the period of gold introduction into the older rocks on which they rest. The basement rocks, the only possible gold bearers, are buried thousands of feet deep over the major portion of this sunkland.

Outside of this area, particularly to the north and west, the older possible gold-bearing rocks are covered with thick deposits of almost horizontal sediments of yet another age, and only very infrequently are the older rocks exposed to view as the result of the removal of the cover rocks by weathering processes.

The object of compiling the section of this report dealing with the alleged discovery of a rich gold-bearing reef in Central Australia by a person named Lasseter is to present to those people interested in gold-mining a few of the more salient features of what may be termed "The Case against Lasseter's Reef." In the past, many glamorous newspaper and prospectus accounts have been given as a "Case for Lasseter's Reef," but it is hoped that the subject matter of this report will be found to be a more reliable guide to hopeful investors than some of the statements which have appeared in the past.

It cannot be too strongly urged that "Lasseter's Reef" is likely to be held out as a bait to mining investors for many years to come, and it is necessary to urge just as strongly the necessity for extreme caution when contemplating any investment in a mining venture, the basis of which is a fabulously rich gold reef in Central Australia, which more than likely, the prospective investor will be informed is probably "Lasseter's Reef."

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The works listed below comprise what is thought to be a fairly complete list of published matter dealing either wholly or in part with the Musgrave, Petermann and Rawlinson Range areas and the country to the immediate north thereof, commonly known as "Lasseter's Country."

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PROGRESS REPORT ON THE GEOLOGY AND
MINES OF THE YILGARN GOLDFIELD
(South of the Great Eastern Railway).

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

GENERAL GEOLOGY.

In a resumé of the general geology of this area made by the writer at the conclusion of the 1935 field-season and published in the Annual Progress Report of the Geological Survey for 1935, several tentative conceptions of the geological structure were set out, it being pointed out at the time that these ideas were subject to revision as progress in field-work was made.

Up to the close of field-work in 1935, no evidence sufficient to establish the intrusive nature of any of the greenstone had been discovered, but towards the end of the 1936 field season, examination of the hilly country immediately south of Southern Cross, where exposures are reasonably good, revealed the presence there of unshaped basic igneous rock transgressive into a highly sheared basic rock composed mainly of a variety of hornblende classified by Dr. Simpson, Government Mineralogist and Analyst, as anthophyllite.

Associated with this basic igneous intrusive rock is a liberal development of small patches of a basic pegmatite, occurring in the intrusive rock in much the same manner as does a normal pegmatite in granitic masses.

Examination of black mineral concentrates from very decomposed basic rocks from the vicinity of Marvel Loch reveals the presence of chromite, hence it is reasonable to assume a probable ultra-basic composition for these rocks, and also attribute to them a probable intrusive habit.

It can now be stated that some of the greenstones are intrusive, but this feature has in no way been found to affect or influence the occurrence of gold.

One result of the regional mapping has been to establish an order of succession for the various rock-types occurring in this portion of the Yilgarn Goldfield. This system of metamorphic rocks starts off with the greenstone series at the base and passes upwards, with the increasing development of the sedimentary phase, to the metamorphosed sediments of what has been known as the Yilgarn series.

It has been decided to refer to the whole of the metamorphic rocks of the Yilgarn Goldfield as the Yilgarn system, and to subdivide this system into two series, namely, the greenstone series and the whitestone series, of which the former is the lower in the stratigraphical succession and hence the older.

The greenstone series embraces the rocks of a basic or intermediate composition derived from a volcanic or intrusive igneous origin. The term includes the dark coloured sediments, tuffs, and all fragmental volcanic material associated with the flow and intrusive volcanic rocks.

The whitestone series embraces the recognised metamorphosed sediments of an acid composition, previously referred to as the Yilgarn system by Mr. Blatchford (G.S.W.A. Bulletin No. 63).

THE BROAD GEOLOGICAL STRUCTURE.

The ultimate key to the major geological structure of the gold-bearing belt of the Yilgarn Goldfield, south of the Great Eastern Railway, was found in the distribution of the ferruginous quartzites or jaspilites ("Jaspers" of the prospector), and when these failed, in the distribution of a recognisable band in the greenstone series characterised by being composed of anthophyllite with associated ironstone, and cellular and banded secondary silica formations.

The structure can be fairly completely indicated as far south as the Cheriton group at the southern end of Parker's Range, but the paucity of outcrops and the dense scrub from this point south to the southern boundary of the goldfield, has prevented the elucidation of the major structure in this portion of the area investigated. The only known auriferous locality south of Parker's Range in the Yilgarn Goldfield is Forrestonia, and from structural data obtainable from the South and Middle Ironcap, this occurrence would appear to be situated on or near the axis of an anticlinal crossfold trending north-east and south-west.

The structure of the Yilgarn system, and hence the distribution of the rock types, is controlled primarily by two sets of folding, the axes of which lie practically at right angles to each other. The first system took place along axes having a general north-north-west and south-south-east trend, and resulted in a series of generally parallel, tightly folded anticlines and synclines. These folds were not always symmetrical, and overturned asymmetrical anticlines and synclines form part of this folded system, the major folds of which are anticlinoria and synclinoria.

Superimposed upon this series of folds, either subsequent to or coincident with the folding period during which the first series was formed, is a series of crossfolds which has produced a buckling of the main N.N.E.-S.S.W. series, and has been re-

sponsible for the changes in strike of the beds, producing curved, divergent, and convergent outcrop lines.

The axes of these cross folds appear to strike a little north of east and a little south of west, and the degree of folding varies considerably. The axes of these cross folds are naturally not always horizontal and changes in pitch in both degree and direction can be expected. No information as to the effect this variation in pitch of the axes of the cross folds has on gold occurrence has yet been obtained.

The manner in which these two series of folds have determined the broad geological structure of the gold belt from Southern Cross south as far as the Cheriton Group is illustrated in Plate VI. With the exception of the short structure line drawn in a southerly direction through Greenmount from near Southern Cross, and the two lines concave to the east and west in the vicinity of Harris' Find and the Great Victoria respectively, the structure lines represent the general line of outcrop of a band or bands of ferruginous quartzite or jaspilite ("jasper" of the prospector) occurring in the Greenstone Series, probably somewhere towards the base of that series.

The structure line drawn from near Southern Cross southwards through Greenmount represents the line of outcrop of a basic igneous rock composed essentially of anthophyllite and is at a different horizon to the jaspilites. Similarly, the lines concave to the east and west previously mentioned represent the general trend of the outcrop lines of the Whitestone Series which constitutes the upper portion of the Yilgarn System.

The degree and direction of regional dips are indicated by arrow-heads attached to the structure lines, and where these are absent, the dips are vertical. The outstanding feature of Plate VI. is the two opposing structure curves convex to the south and north respectively in the vicinity of Nevoria and Parker's Range, and the two hyperbolic curves flanking them on either side. This distribution of beds represents the cross folding of an anticlinal structure by a cross syncline, and the steep northerly pitch of drag folds at the Great Victoria and the steep southerly pitch of similar structures at Nevoria indicate that the axis of this cross fold must lie somewhere between these two points.

The partially completed oval-shaped curve passing through Magowan's Find, Toomey's Hills, Parker's Range and then round through the Olga, Dulcie and Cheriton Groups, is shown by its regional dip and distribution to be an anticlinal structure folded by a cross anticlinal fold. Such a structure can only be formed by two bounding synclinal cross folds, hence there must be another synclinal cross fold immediately south of the Cheriton Group, and it is probably a very strong fold. Some evidence can be produced in support of the existence of this cross-fold. The westerly continuation of the cross-fold passing between Nevoria and the Great Victoria in a general east by north and west by south direction is indicated at Edward's Find, where steep northerly pitches occur. Still further west at Felstead's Find, steep southerly pitches are to be seen, and it is not unlikely that the influence of this strong cross fold has extended further west.

Between the Great Victoria and Edward's Find, and Edward's Find and Felstead's Find, are extensive areas of granite and/or gneiss, and at the latter

two localities the cross-fold passes through only very narrow greenstone belts. The occurrence of gold in these two isolated localities seems to have some connection with the structural influence brought about by the cross fold.

The canoe-shaped pattern resulting from the cross folding of an anticlinal structure, which the structure-line map on Plate VI. indicates is the case in the gold belt south of Southern Cross as far south as the Cheriton Group, gives us a base from which to attack the structures lateral to this major one, where such structures remain. A major synclinal axis is depicted extending south-south-east from just west of Southern Cross, and since the structure lines running through Kennyville and Mt. Rankin are on the same horizon, the regional dip indicates a synclinal structure between these two places. The position of the axis is fixed by the occurrence of part of the Whitestone Series (the upper portion of the Yilgarn System) as a narrow band flanked by rocks of the Greenstone Series on either side, along the line of the axis where mapped. Between Greenmount and Mt. Rankin and west of Blackbourne's, an anticlinal axis is shown, and this anticlinal structure is an antiline on the limb of a larger syncline.

The convergence of the structure lines south of Blackbourne's can only be due to cross folding, or in other words, change of pitch in the N.N.W., S.S.E. axes.

The major syncline is asymmetrical, and likewise the regional dips of the major anticlinal structure to the east indicate that it, too, is asymmetrical in the same direction. The general nature of this major asymmetrical anticlinal and synclinal folding is indicated in the section on Plate VI., and it is intended to convey the impression that the limbs of these major folds have subsidiary, but still fairly large, minor anticlinal and synclinal folds imposed upon them, and that the general nature of the folding along the N.N.W., S.S.E. axes has resulted in the formation of tight chevron types of folds.

The asymmetry of the folds suggests that the structures with which we are dealing form portion of a limb of an anticlinorium or synclinorium, the other limb of which may possibly be found in the Coolgardie Goldfield, or on the other hand, it may have been assimilated by the invading granite.

At Southern Cross there is a gradual increase in the pitch of the drag folds to the north in a northerly direction, and an anticlinal cross fold has been indicated here.

At Marvel Loch centre the convergence of strike lines and the changes of pitch of drag folds again indicate cross folding, while at Palmer's Find the detailed mapping done by Messrs. Hobson and Matheson indicates that the main mine there is situated in a minor synclinal cross fold on a larger anticlinal cross fold.

There is some suggestion of periodicity in the occurrence of the stronger cross-folds, but it would be unwise to arrive at any definite conception of the wave lengths of these folds at the present juncture.

THE BROAD RELATION BETWEEN STRUCTURE AND GOLD DEPOSITION.

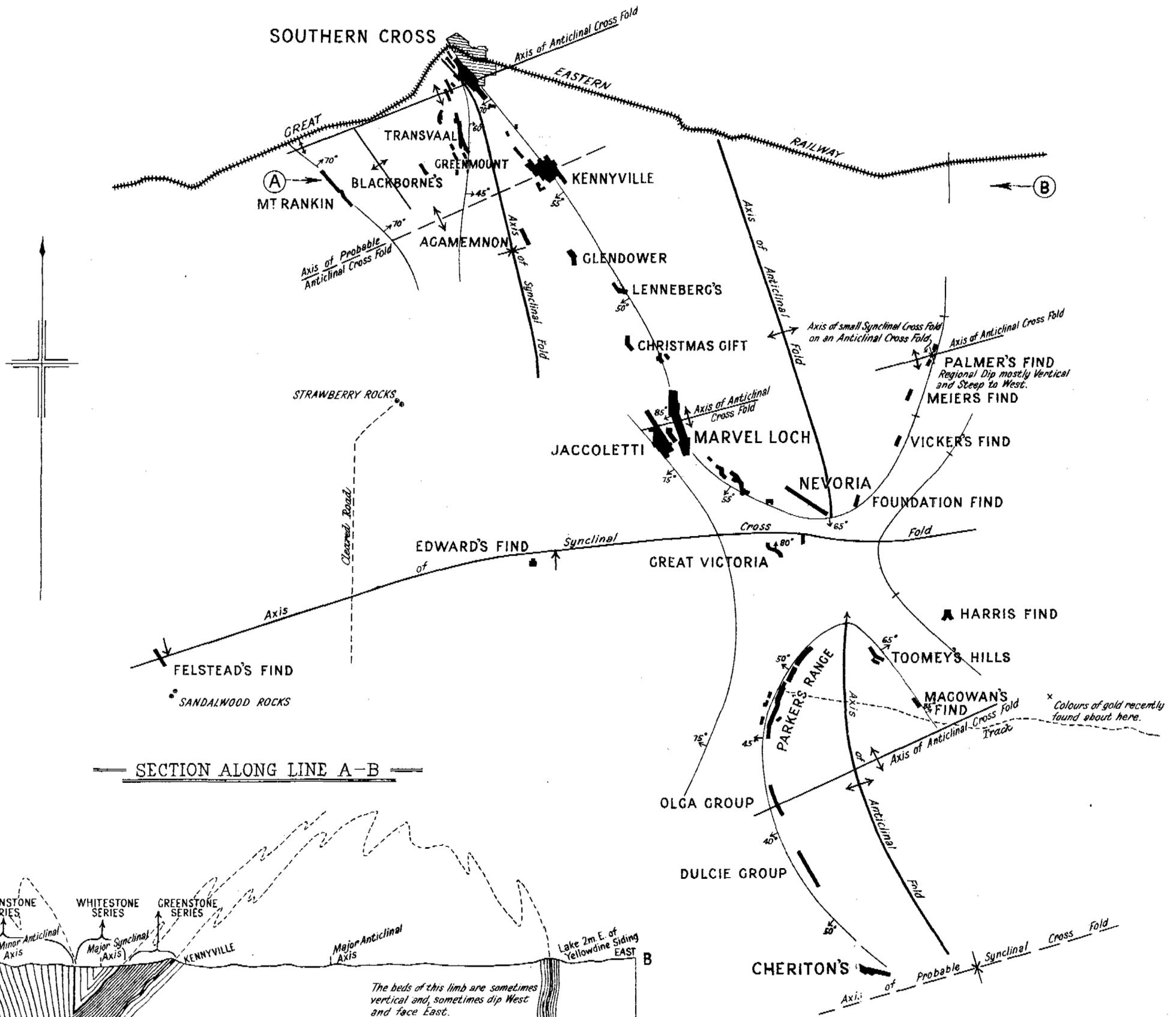
Of an area of about 5,500 square miles geologically surveyed during the course of the field work in 1935 and 1936, only about 5 per cent. of exposures exists, and geological observations in the rocks of the Green-

PLAN OF PORTION OF GOLD BELT SOUTH OF SOUTHERN CROSS

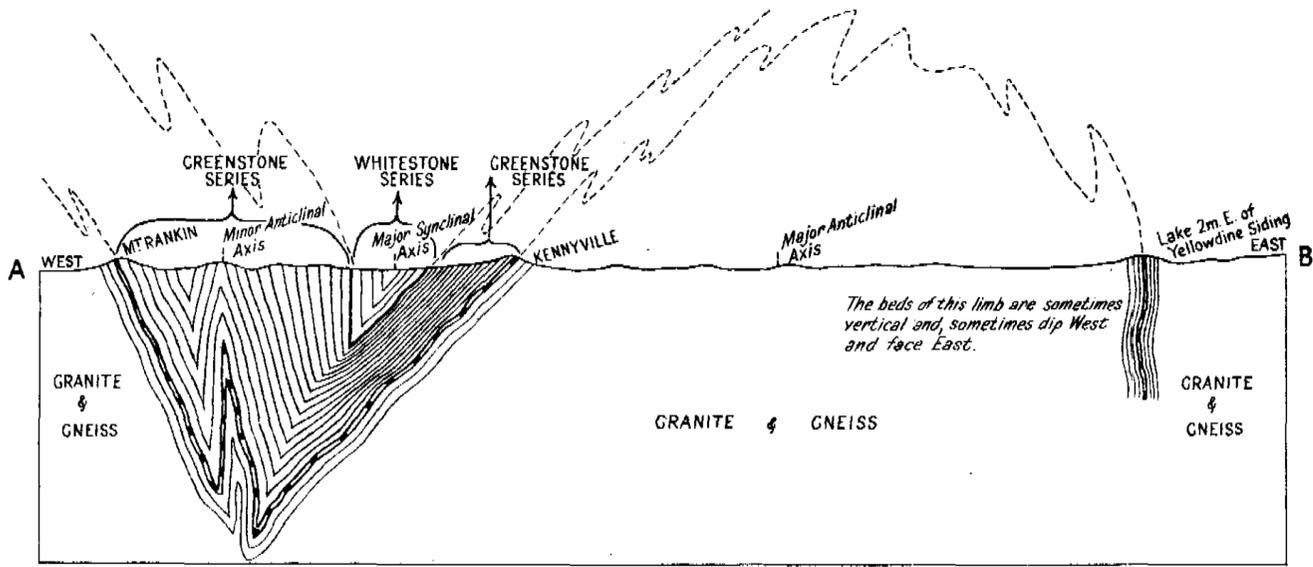
Showing Structure Lines and Mining Centres



YILGARN GOLDFIELD



SECTION ALONG LINE A-B



stone Series (the chief gold hosts) have had to be made under very unfavourable outcrop conditions. These facts prevent the making of statements more definite than those given below, when the subject under the above heading is being discussed.

The structure-line map on Plate VI. indicates in a definite manner the occurrence of most of the gold centres in a relatively narrow zone along the outcrop portions of limbs of anticlines and synclines. When it is realised that the rocks in which the gold occurs form part of a folded series, there is hardly anywhere else where they could form, hence this discovery in itself is not of any significance, except perhaps, in so far as a somewhat definite horizon, namely, that immediately above, below, and including the jaspilites, has been found to be a gold horizon in the area investigated.

Of the many aspects of the problem concerning the reasons for and causes of gold deposition, perhaps the main one is that embracing the structure of the rock masses in which the gold is found. The distribution of the gold localities in groups both along and across the strike of the host rocks surely has some significance, and the observations made during the course of this survey have indicated that this localisation of gold deposition has been associated with cross folding.

The concentration of gold localities in the syndinal cross fold between Great Victoria and Nevoria is significant, as is also the occurrence of gold at Edward's and Felstead's Finds on the supposed westerly extension of this fold.

The vast area over which gold occurs in Western Australia indicates no lack of suitable granitic magmas, and the general similarity of the rocks in which it occurs, namely the Greenstone Series, shows that the influence of rock type is not paramount. It would seem then that this problem of geological structure and associated gold deposition, evidence for the close connection between which has been found during the survey, is of vital importance.

Only a few of the facts relating to this problem have been elucidated so far in the area investigated, and the value of predictions based on these facts suffer accordingly. Useful results based on the interpretation of geological structure can only come after the broad structural details of several goldfields have been investigated.

PROSPECTING RECOMMENDATIONS.

The recommendation made in the progress report of this survey for 1935 concerning the advisability of lateral prospecting from underground workings in existing mines is again made with confidence. An additional guide to this method of prospecting lies in the fact that the influence which folding has had on the origin of the ore bodies causes them to be frequently arranged *en echelon* in a steeply dipping series of rocks. This indicates the advisability of continuing a drive some distance beyond the end of an ore body which "peters out," and then by either cross-cutting or diamond-drilling, testing the country laterally.

There is some evidence to support the belief that the pitch of the ore shoots is coincident with the pitch of minor folds which may be observed in the wall rocks in the initial stages of opening up a mine.

Recognition of this probable relation should greatly aid the setting out of a development programme on any new mine.

Surface prospecting operations on this field must be very largely confined to methods involving the extensive use of loaming, and in most of the localities suggested below, it will be found the only practicable means of testing. The following localities are suggested as being those most favourably situated for the possible occurrence of gold:—

(1) The country south-westwards from Lenneberg's Find between that locality and the old Southern Cross-Marvel Loch Road.

(2) The country for half-a-mile west of the 15½-mile position on the Yellowdine-Parker's Range Road. The most southerly turning point of the Nevoria jaspilite should be situated somewhere in this locality, but a thick mantle of soil covers the flat country here.

(3) The northern end of the belt of mica schists, etc., in which Harris' Find (Mundy Hills) is situated.

(4) The jaspilite band occurring at Parker's Range, Toomey's Hills and Magowan's Find, must curve round in an anticlinal nose somewhere about 1 to 2 miles east of the 20-mile peg on the Yellowdine-Parker's Range Road, and this flat soil covered area is worth prospecting in this locality.

(5) At about 1 mile south from the main Parker's Range Dam a track turns east from the main road, and after crossing some lake country a short distance in, follows a general easterly direction across heavily forested, flat, red sandy soil-covered country. At from 13 to 14 miles in along this track the south-easterly continuation of the Harris' Find country is encountered, and this belt is worthy of prospecting in this vicinity, and to the south-east.

(6) The country for 1 mile west and parallel to the Olga and Dulcie lines of leases, south of Parker's Range.

(7) About 9 miles west by south from Edward's Find and on the western side of a long cleared north-south road which comes into Strawberry Rocks is situated on Locations 460 and 462 (Lands Department Litho. 23/80). On soil and vegetation occurrence only, it appears that there are some rocks of the Greenstone Series here though none could be found outcropping.

(8) The narrow belt of greenstone running from Boddalin south-eastwards to Sandalwood Rock, a length of some 25 miles. This is a difficult belt to trace, and guides to its occurrence may be found in the following places:—

- (a) Near the S.W. corner of Location 492 (Lands Department Litho. 23/80).
- (b) Near the N.W. corner of Location 340 (Lands Department Litho 23/80).
- (c) Near the S.W. corner of Location 334 (Lands Department Litho. 23/80).
- (d) Near the S.E. corner of Location 498 (Lands Department Litho. 23/80).
- (e) Near the S.E. corner of Location 516 (Lands Department Litho. 23/80).

(9) Locations 473 and 474 on Lands Department Litho. 23/80 consist largely of greenstone, and as this is a newly mapped patch of possible gold-bearing country it should be worth investigating.

Several other patches of greenstone not previously mapped have been located, but as these are of small extent only, they have not been included in the above list.

In the course of working a small mine, difficulty is sometimes experienced in obtaining sufficient filling for stopes. Cross-cutting from suitable positions in the softer oxidised rocks of the upper levels would, in these cases, serve the double purpose of providing stope filling and lateral exploration.

NOTES ON SOME MINING GROUPS IN THE YILGARN GOLDFIELD.

(R. A. Hobson, B.Sc.(Hons.))

The following notes are a continuation of those already published in the Annual Progress Report of the Geological Survey for the year 1935, and represent a summary of the work done during the 1936 field season.

BURBIDGE GROUP.

The following G.M.L.'s, at the north end of the group, are to be considered:—G.M.L.'s Nos. 3731, 3732, 3733, 3734 and 3735.

At the time of inspection no work was being done on these leases. The only work, which had been done in the past, consisted of a few shallow holes, and an occasional costean in a greenstone belt crossing G.M.L.s. 3733 and 3734. As these leases lie to the north of the Great Victoria main workings, it was hoped that they might contain a continuation of the Great Victoria lode formation. Although it was not possible to trace this for more than a few chains beyond the western end of the open-cut, it is most probable that it continues in a north-westerly direction. This being so it would lie to the west of the leases under consideration. Outcrops, on the leases being discussed, are scarce, but it is likely that they are underlain to a great extent by a grey micaceous schist, which in the neighbourhood of the Great Victoria workings contains no values. There is a belt of biotite-hornblende gneiss, striking N. 35° W., and with an approximate width of 11 chains, in the central portion of the leases. There is no suggestion of the structural conditions in the neighbourhood of the Great Victoria workings existing anywhere on the leases under consideration.

BANKER GROUP.

Locality.—3¼ miles, E. 12° N. from Burbidge townsite.

There are three G.M.L.s. in this group, all three controlled by the Yilgarn Gold Mine, N.L. Because of labour troubles, and subsequent trouble with water and plant, it was not possible to inspect the main workings on Banker, G.M.L. 3404, during the past field season. It is hoped, however, that before the final report is written, it will be possible to make an examination of these workings. Work of a prospecting nature was being carried out in three other places at the time of inspection.

While the major portion of the area is underlain by greenstones, varying from fine to coarse-grained, there are, on the western side, conspicuous outcrops of a massive, fine-grained, jointed quartzite. The most conspicuous outcrop of these quartzites forms a ridge, rising in parts from 100 to 150 feet above the general level of the country, and extending for approximately half a mile in the north-west corner of

the area. At either end the ridge dies away and passes into soil covered flats. Strikes vary from N 10° W.-N. 70° W., and dips from 70° N.E. to vertical.

TOOMEY'S HILLS GROUP.

Locality.—4¼ miles north-eastward from Parker's Range Residence Areas.

There are no G.M.L.s. in existence in this group, and very little prospecting work was being done at the time of inspection. Old workings, now abandoned, were not inspected.

The area is almost entirely greenstone. There is, however, a band of quartzite, varying from 6-16 chains in width, towards the south-west corner. Strikes vary from N.50°W.-N.70°W., while the dip is consistently to the north-east at angles varying from medium to high. It is probable that many of the greenstones are metamorphosed lavas. Most of the work in the past has been done on three leases, G.M.L.s. 520, 289, 237. On G.M.L. 520 two parallel quartz reefs have apparently been worked, while on G.M.L.s. 289 and 237 it appears that there was only one reef. The strike and dip of these reefs are parallel to the strike and dip of the country.

Magowan's Find.—This find was made towards the end of 1936 by Mr. A. Magowan. Although it is not within the Toomey's Hills group area this will be a convenient place to discuss it. The find is located about 4 miles east-south-east from Blue Hill, old G.M.L. 520, at Toomey's Hill, and is approached by a track from the south-east corner of this group. At the time of inspection, although there were seven P.As. pegged, only one was being actively worked. The finder and his mate had done a certain amount of work on their P.A. Two grab samples collected by the writer for assay gave the following results:—

Y.523.—From a small heap of ore at the side of a shallow hole—gold, trace; silver, trace.

Y.524.—From the west face of the same shallow hole—gold, 10grs. per ton; silver, 13grs. per ton.

Both results are very low, but insufficient work has been done to judge the prospects in the immediate vicinity of the original find. Values were being obtained from a banded ferruginous quartzite, similar to those occurring in many places in the Yilgarn Goldfield. Outcrops are poor, laterite and soil covering most of the area. There appear to be at least six ferruginous quartzite bands in the neighbourhood of the original find, and possibly more. Scattered outcrops of ferruginous quartzite and fragments can be traced for just over a mile. Scattered fragments of greenstone were observed south of the present workings. The general strike is east-south-east, and the dip is probably steep, but this could not be observed with certainty.

It is believed that the ferruginous quartzites found at Magowan's Find are the continuation of those seen at Parker's Range, and the various groups south of there. Magowan's Find is therefore structurally similarly situated to the northern groups on the Parker's Range line (see report by H. A. Ellis, page 78). It is reasonable, therefore, to expect somewhat similar conditions with regard to gold deposition. Because of this the place seems a reasonable one in which to prospect, and the prospectors are advised:—

(1) To look for values in the banded quartzites. Values in these are likely to be generally low and erratic, but there may be richer patches.

(2) To look for quartz reefs in the greenstones in the immediate vicinity of the quartzites, and for a distance of 10-15 chains either side. Values in these quartz reefs will vary considerably, but may be quite good.

(3) To look for the continuation of the quartzites in a south-easterly direction. Unfortunately in this direction there is a large area of flat soil covered country, which may completely obscure any outcrops.

CENTENARY GROUP—PARKER'S RANGE.

Locality.—Immediately to the north of the Parker's Range Residence Areas.

There is only one G.M.L. being worked in this area, and very little prospecting work is being done. In the past quite a number of shafts have been sunk, generally a few chains east of a series of low hills, which mark the outcrop of a banded ferruginous quartzite. Three quartzite bands can be traced, more or less continuously, from the north-east corner of the area towards the south-west corner. The central of these forms the most conspicuous outcrops, and has a maximum width of 30 feet. It is flanked on the west side, at a distance of less than half a chain, by another quartzite band having a width not exceeding 15 feet. East of the main band, there is another at about 4 chains distant, and having a width not exceeding 30 feet. Except in the north-west corner, where the geology is completely obscured by soil, the remainder of the area is greenstone, varying from fine to medium grained. The strike is north-north-east, and the dip westerly at moderate angles. The main work in the past has been between the main and the eastern ferruginous quartzite bands.

Centenary, G.M.L. 3520.—At the time of inspection this G.M.L. was equipped with a 2-head battery, but subsequently a 10-head was erected. Mining was being carried on below water level (about 60 feet V.D.), and water was being pumped for use in the 2-head battery. It is evidently considered that sufficient water is available in the numerous shafts for the 10-head battery.

An underlay shaft close to the old battery shed was the only shaft accessible, and this had been taken to a depth of 131 feet. At 60 feet from the surface there were old levels going north and south, which, however, had been mullocked. The bottom level at 131 feet was accessible, but no ore body was exposed. The gold occurs in small lenticular quartz ore bodies, having a maximum width not greatly exceeding 30 inches anywhere in the mine. Values are high, and said to be better the larger the quartz lens. Unfortunately the quartz lenses are generally small, and a relatively large amount of country has to be mined.

From the bottom of the underlay shaft drives extend northwards for 56 feet, and southwards for 65 feet, the last 21 feet of the south drive being inaccessible. At 29 feet from the underlay shaft the south drive is joined by a vertical shaft, which bottoms 4 feet below the level of the drive.

The precise extent of the stoping is not known. Above the 60ft. level (now mullocked) the stoping is said to extend within 10 feet of the surface. South of the underlay shaft stoping is comparatively extensive, and apparently, in part, breaks through to the

old 60 ft. level. North of the underlay shaft stoping has been carried to a height of 12 feet. On the bottom level there is a stope length of 113 feet. It is to be remembered, however, that the ore body has not been continuous, but merely a series of lenses. The average stope width appears to have varied from 24-30 inches.

At the surface the underlay shaft is about 2 chains east of the main ferruginous band.

SPRING HILLS GROUP.

Locality.—2½ miles southwards from Parker's Range Residence Areas, and about the 13-mile peg on Parker's Range-Ravensthorpe Road.

The general geology of this group resembles that of the Centenary Group. The same three ferruginous quartzite bands are found, and the remainder of the area is greenstone. The general strike is N. 10°-15° E., and the dip westerly at moderate angles.

In the past the main production has been from the Spring Hills group of leases, and there are comparatively extensive opencuts on these leases. At the time of inspection no underground work was being done on these leases, and the workings were not examined. The opencuts extend over a length of 350 feet, and have an approximate width of 15 feet. Production ceased in 1928, apparently at about water level.

Towards the north end of the group good values were being obtained by prospector Harris (P.A. 4393, boundary approximately that of old G.M.L. 1547), and lower values by prospectors Baker and Ewing (P.A. 4490, boundary approximately that of old G.M.L. 1546).

P.A. 4393.—On this P.A. a shaft has been sunk to a vertical depth of 15 feet, and then on an underlay of 55° to a depth of 43 feet. Driving north had just been commenced at the time of inspection. Values were being obtained from a porous iron stained laminated quartzite, over a maximum width of 4 feet. The hanging wall is a much weathered greenstone, while the footwall is similar to the material containing the values. In the face there were fairly abundant stringers of quartz, having a maximum width of 1-1½ inches. A crushing of 28 tons from the upper portion of the shaft was said to have given 10.4 dwts. of gold per ton by amalgamation, and 8 dwts. gold per ton by cyanidation. As the quartzite containing the values has a high porosity, conditions must have been suitable for secondary enrichment.

P.A. 4490.—Two shafts were inspected on this P.A., both at the southern end and comparatively close to the shaft on P.A. 4393. The southern shaft had been taken to an underlay depth of 52 feet, while the northern one was 36 feet deep. A crushing of 52 tons from both shafts gave 5½ dwts. gold per ton by amalgamation, and 3¾ dwts. gold per ton by cyanidation. Values are being obtained from two laminated quartzite bands, the eastern one being 3-4 feet wide, and the western one 2 feet wide. They are separated by a band of greenstone. Only a small amount of driving has been done.

The southern shaft on this P.A. is approximately 60 feet from the shaft on P.A. 4393. It appears, therefore, that values are very erratic along the strike. The maximum width of any ore body so far disclosed is 4 feet. These facts, together with the probability of considerable secondary enrichment,

suggest that these workings, while being of value to prospectors, are not likely to develop into anything more important. No geological reason is apparent why values are better in some portions of the ferruginous quartzites than in others.

These ferruginous quartzites have been prospected in many places in the Yilgarn Goldfield, but values are generally low and erratic, and further development has occurred in only a few places.

DULCIE GROUP.

Locality.—About the 5-mile peg on the Parker's Range-Ravensthorpe Road.

At the time of inspection there was more activity at this group than at the other Parker's Range Groups. High values have been obtained from relatively small lenticular quartz reefs, occurring in the greenstone close to the main ferruginous quartzite band. The strike and dip of these reefs are parallel to the strike and dip of the country. Unfortunately the life of these mines seems to have nearly ended, and unless further development takes place, activity at this group will diminish. The same three ferruginous quartzite bands, found in the other groups, occur here, and can be traced more or less continuously through the group. The general strike is N. 25° W., and the dip to the west at low angles.

Constance Una, G.M.L. 3411.—A small lenticular quartz reef, striking approximately N. 25° W., and dipping 25° W., has been worked to an underlay depth of 222 feet. Values are high, up to 3½ ozs. gold per ton by amalgamation, and 10-12 dwts. gold by cyanidation. The average thickness of the quartz is said to be 12-18 inches, with a maximum of 48 inches. The greatest stope length is approximately 80 feet at the 116 ft. level. The reef pitches north at about 40°, and is bounded on the north side by a fault. Very little work has been done looking for the continuation of the reef north of the fault. The north drive at the 222 ft. level has been continued, and a search should be made for the continuation of the reef by crosscutting east, close to the fault and parallel to it. The north pitch means that the stope length has been getting shorter in the lower levels. Subsequent to the first inspection, the shaft was deepened by 50 feet and the reef was found to finish 10 feet below the level.

Dulcie Jean, G.M.L. 3401.—This G.M.L. adjoins the Constance Una, G.M.L. 3411, on the north side. At the time of inspection no work was being done, the ore body having been completely stoped to water level. The main underlay shaft and levels were accessible only with difficulty; the shaft was small, and most levels had been partly filled with mullock. Water level was at 312 feet. The ore body had been worked by three levels off the main shaft, and two off a shallower shaft some 115 feet north from the main underlay shaft. The strike of the ore body is approximately parallel to that of G.M.L. 3411, and the dip is 30° W. The greatest stope length is 80 feet at the 190 ft. level. The maximum width of quartz is said to be 22 inches, and the average 6-7 inches. In the upper levels the reef was said to have ended on a "slide" at the north end. The pitch appears to be to the south at a fairly high angle.

Below the water the quartz is said to have a maximum thickness of 6 inches, and an average thickness of 2 inches.

Pomeranian, G.M.L. 3452.—Adjoins the Dulcie Jean on the north side. A lenticular quartz reef has been worked to an underlay depth of 267 feet. The general strike is parallel to that of the reefs of G.M.Ls. 3401 and 3411. The dip is 40° westerly in the upper levels, but in the lower levels has flattened to 30°. The greatest stope length is 80 feet at the 219 ft. level, and the greatest width of quartz is 60 inches. Values are said to have averaged about 13 dwts. Water has not yet been reached, but the lowest level, 267 feet underlay depth, was just getting damp. At the 169 ft. and 219 ft. levels the quartz has ended at the north end of the drive against a pegmatite dyke. This dyke has been penetrated at the 169 ft. level, and found to be 27 feet thick. Unfortunately after going through 4 feet of country another pegmatite dyke was encountered, and work was stopped. As the ore body is pitching to the north it follows that unless it is located north of the pegmatite dyke, the end of the life of the mine is well within sight. It was not possible to decide whether there had been any faulting at the pegmatite, but it appears that there may have been. It is recommended, therefore, that the second pegmatite dyke should be penetrated, and crosscuts put both east and west to look for the reef north of the dyke.

Scots Greys, G.M.L. 2801 (2676 on the posts).—This lease is equipped with a 5-head battery. The main shaft has been sunk to a depth of 200 feet, and a certain amount of driving has been done from the bottom to increase the amount of water available for battery use. There are two levels, one at 45 feet and the other at 92 feet, and a smaller level off a winze from the 92 ft. level.

There is a suggestion that deposition has occurred in the central portion of a southerly pitching drag fold occurring on the east limb of an anticline. Insufficient systematic development has been done to enable a clear conception to be formed of the conditions.

The ore body is quartz, varying in width and probably pitching approximately south-south-west. Quartz is showing in most faces of the stopes, and evidently only the richer portions have been removed.

Fortuna, G.M.L. 3460.—Six shafts have been sunk on this lease and some of these were connected by driving. The general strike of the ore bodies is N. 20° W., and the dip to the west at moderate angles. Although there is plenty of quartz, very little stoping has been done. A maximum of 5 feet of quartz was noted. Generally, however, there are two parallel reefs, much narrower, and separated by varying amounts of country. Most probably values are low.

Janetta, G.M.L. 3779.—

Locality.—On the Parker's Range-Ravensthorpe Road, at the 4-mile peg, about one mile southwards from the main leases of the Dulcie group.

The ore bodies are two small quartz reefs, striking N. 70° W., and dipping 25°-30° S.S.W. The maximum stope length observed was 25-30 feet, and the greatest thickness of quartz is said to have been 24 inches. More work has been done on the lower reef, which is 11 feet below the upper. Access to the lower reef is gained through a shaft, which is vertical for 54 feet and then underlies for 117 feet. The lowest level was not accessible.

Snowdrop, G.M.L. 3384.—At the time of inspection no work was being done on this G.M.L. Most of the workings were very old and not accessible, or only

partially accessible. A series of quartz reefs striking and dipping parallel with the gneissosity of the greenstone country appear to have been completely stoped. Only stringers or very narrow veins of quartz remain below the stoping.

KENNYVILLE GROUP.

Locality.—6 miles east-south-east from Southern Cross.

At the time of inspection there were three existing G.M.Ls. in this group, two of which were being actively worked, and there was a small amount of prospecting activity. Most of the area is underlain by greenstones of varying types. A banded ferruginous quartzite can be traced, more or less continuously, from the southern boundary of the area mapped, to within half a mile of the north boundary where it is lost under alluvium. The general strike is about N. 45° W., and the dip varying from westerly at moderate angles to vertical. Values have been obtained mainly from lenticular quartz reefs in greenstones, and to a very much less extent, from the banded ferruginous quartzites. The chief producer of the group is the Leviathan Mine, which has been worked, intermittently, since 1903.

Leviathan, G.M.L. 3432, and Leviathan Extended, G.M.L. 3664.—

Both leases are held by Leviathan Amalgamated G.M. Co.

The main reef has been worked to a depth of approximately 297 feet, by three main levels off a vertical shaft. Recent work has been done between Nos. 2 and 3 levels. The ore body is a lens of quartz striking N. 70° W., dipping almost vertically and pitching north-westward at about 40°. The greatest stope length is 310 feet at No. 1 level; at No. 2 level the stope length has shortened to 220 feet. At the time of inspection stoping was still being continued between Nos. 2 and 3 levels. The average stope width between these levels is 4 to 6 feet.

Values between Nos. 2 and 3 levels are said to be 8 dwts. gold per ton by amalgamation, and 2½ dwts. gold per ton by cyanidation. Quartz is still showing in the floor of the bottom level, and values are said to be similar to those in the stope above.

When the mine was unwatered, water level was said to be at about No. 1 level. True water level is probably lower, and hard rock was said to have been first encountered about 30 feet above No. 2 level.

Generally, the mine is free from faulting, although one fault was observed at No. 1 level. The reef had been moved 10 feet southwards. Only one granitic dyke was observed and this was occupying a joint and not a fault plane. The dyke cuts the reef obliquely at No. 3 level, and dips 50° easterly. As the dyke has acted as a natural dam, larger flows of water occur east of the dyke.

There seems to be no reason why both the quartz and the values should not persist for some distance yet. The ore body has not been explored for more than a few feet below the bottom level, and active work underground was suspended towards the end of 1936.

At the north-west end of No. 3 level values were reported on either side of a fairly defined fissure, on the continuation of the reef, and in rock quite similar to the country elsewhere in the mine.

An appreciable amount of ore has been obtained from working off an underlay shaft 480 feet, bearing N. 17° W., from the main shaft of the main workings. The ore body has been worked by four levels off an underlay shaft to an underlay depth of 290 feet. At the time of inspection water level was 280 feet from the surface, and water was being pumped for battery use. The strike is variable, the ore body being convex to the west in plan, and the general dip is 35°-40° W. The greatest stope length is 135 feet at No. 3 level. Values are said to have extended beyond the quartz into the country, which is similar to the country in the main workings. Both quartz and the country in its immediate vicinity are much fractured and broken. No free gold was seen, but conditions seem favourable for secondary enrichment. Gold is said to occur, however, in the stone and not on fractured faces. The short stope length seems against deeper development.

There is a suggestion from the main underground workings that deposition has been controlled by a drag fold, showing only very slight folding. The shape of the ore body in the workings off the underlay shaft is suggestive of portion of a more sharply folded drag fold. The fact that the pitch of the ore body in the main workings is similar to the dip of the ore body in other workings supports this view. This being so, there may be a further ore body immediately to the south and on the same horizon as that in the workings off the underlay shaft. There are no surface exposures from which one can confirm these ideas.

Cornishman, G.M.L. 3506.—No work was being done on this lease at the time of inspection, but three levels were partially accessible. The ore body is a quartz reef, striking N. 25° W., dipping vertically, and pitching probably to the south. Insufficient workings were accessible to note the maximum stope length. Judging from the width of the drives, the reef in the parts of the mine examined must have been very narrow. It is said that below the present water level, which is at 139 feet from the surface, the reef has widened to 4 feet.

P.A. 4682.—A banded ferruginous quartzite has been worked by three levels to a maximum depth of 77 feet. Very little stoping has been done, and values are too low for the mine to be of value to prospectors. A crushing of 50 tons is reported to have yielded approximately 3 dwts. gold per ton by amalgamation, and the same amount by cyanidation. The ferruginous quartzite has a width of 9-10 feet at No. 1 level, but has narrowed to about 3 feet at the bottom level. The strike is N. 45°-50° W., and the dip 50°-55° S.W.

BATTLER GROUP.

Locality.—About 30 chains east-north-east from the 8-mile peg on the Southern Cross-Marvel Loch Road.

There are two G.M.Ls. in existence and also a certain amount of prospecting activity. The chief producer is the Battler, G.M.L. 3667, which was worked from 1910-1924 under various names. The ore bodies are lenticular quartz reefs with varying strikes and dips.

Battler, G.M.L. 3667.—The ore body is a lenticular quartz reef, striking N. 70° W., dipping from the surface to No. 1 level probably at 60° N.E., and

from No. 1 level to No. 2 level at 45° N.E., and pitching to the north-west at a moderate angle. The greatest stope length observed was 200 feet, and the maximum width above the north drive, No. 2 level, which was the only stope accessible, was 12-15 feet. The stope length of an individual lens above the same level was 75 feet. Values from here are said to be 5-6 dwts. gold per ton by amalgamation, and a similar amount by cyanidation. No. 1 level was almost completely inaccessible due to falls; No. 2 level, which was mostly heavily timbered, was quite wet.

Access to the workings was by means of a three compartment vertical shaft, sunk to a depth not greatly exceeding 210 feet, which was the bottom level.

The mine is equipped with a 5-head battery.

Patronis G.M.L. 3668.—Two shafts were accessible at the north end of this G.M.L., and only the southern of these two shafts contained any quartz. The ore body is a narrow quartz reef, striking N. 45° W., and dipping 65° E. The maximum width of quartz in each face was 6 inches. The ore body has been stoped over a length of 51 feet, and to a maximum height of 18 feet. The maximum width of stoping would not exceed 24 inches. The shaft is 36 feet deep.

As, at the time of inspection, no work was being done on this lease, no knowledge of values was obtained.

Adjoining P.As.—A 5-head battery was being erected on one of these by prospector Trinidad, and a certain amount of prospecting work was being done. The ore bodies are lenticular quartz veins, which have been worked to a maximum depth of 129 feet. The quartz is much fractured, and a maximum width of 6 feet was observed. A crushing of 107 tons from prospector Trinidad's workings was said to have yielded 7 dwts. gold per ton by amalgamation, and 15 dwts. gold per ton by cyanidation.

HOLLETON GROUP.

Locality.—3½ miles east of the 47-mile peg on the Rabbit Proof Fence, forming the west boundary of the Yilgarn Goldfield.

Four G.M.Ls. and two P.As. were examined at Holleton. In the past the main production has come from the Glenelg Queen, G.M.L. 3312, and North End Extended, G.M.L. 3377. At the time of inspection all of the workings on G.M.L. 3377 were accessible, but only one level on G.M.L. 3312. On this lease surface waters had found their way into the workings, mainly by means of the opencuts. The ore bodies are lenticular quartz reefs, having very variable strikes and dips. Exposures at the surface are poor, much of the area being covered with laterite.

North End Extended, G.M.L. 3377.—A lenticular quartz reef having a general strike of N. 18° W., and a general vertical dip, has been worked to a depth of 190 feet by three levels off a vertical shaft. It has a slight southerly pitch. The maximum stope length is 370 feet at No. 1 level, and the maximum width was said to be 15 feet in the stope above the same level. The average width was said to be 4-5 feet. Payable portions of the reef have been com-

pletely stoped from the 190ft. level, which is the bottom level, to the surface.

At the 190 ft. level the reef was seen to dip westward at about 45°, and when followed down in a winze it was seen to alternate between a vertical and a westerly dip. At the bottom of the winze it had thinned out, and dipped westward at a moderate angle. The reef has been followed down in three winzes below the 190 ft. level, but only one of these was accessible. Values were said to have been poor in all three winzes. In the winze inspected, quartz was still present at the bottom. There are three possibilities:—

(1) The reef has lensed out, and there is no continuation at depth.

(2) Faulting has occurred in pre-gold times, with resultant drag on the ore channel.

(3) There has been slight pre-gold folding.

Possibilities (2) and (3) seem to be worthy of consideration. In either event a continuation may be expected west of the present reef. Values might be expected when the reef resumes its normal dip. As a start the quartz could be followed down in one of the winzes, but subsequent procedure would depend upon the conditions observed as the work proceeded. More details could be supplied should it be decided to proceed with development. Diamond drilling from the surface would also be possible.

Glenelg Queen, G.M.L. 3312.—A lenticular quartz reef having a general strike of N. 30° E. and a general dip of 45° E. has been worked to a vertical depth of 150 feet. There is a main vertical shaft and three levels, the upper of which is not connected to the main vertical shaft. Only portion of this upper level was accessible. The stope length at this level was 270 feet. At the south end of this stope the reef is seen to end against a pegmatite dyke, striking N. 75° E., and dipping northerly at 45°. This same dyke apparently forms the southern boundary of the ore so far worked, at all levels. This information was gained from an old mine plan in the possession of the management. At No. 1 level the dyke appears to be occupying a fault plane. Movement on the south side of this fault has been to the east, and consequently the continuation of the reef should be looked for east of the main drive, and south of the pegmatite. Workings from two shafts, west of the opencuts, failed to reveal any trace of quartz. Unfortunately it was not possible to examine the lower levels for confirmation of this idea.

At the north end of the stoping at No. 1 level the ore body is seen to branch, one reef continuing along the drive, and one going into the east wall. There are no values beyond the end of the stoping. At lower levels the north end of the stoping approaches towards the main shaft. The result is a wedge shaped body of ore, with a probable stope length of about 100 feet at the 150 ft. level.

Delphi, G.M.L. 3461.—Two parallel quartz reefs with a general strike of N. 50° W., and a general vertical dip, have been worked to a maximum vertical depth of 100 feet. There is only a small amount of stoping, most of which is at the upper levels. The maximum width of quartz observed anywhere in the workings is 15 inches, but the average width is appreciably less. Much minor faulting and fracturing

is observed in the country in the proximity of the reef. Values appear to be low, and the reefs too narrow for it to be of any value.

Holleton, G.M.L. 3428.—Access to these workings is by means of a shaft which is vertical for 64 feet and then underlies north-east for 35 feet. A quartz reef, having a general strike of N. 40° W., and a dip of 30°-35° north-easterly, has been worked to a maximum depth of 70 feet. At this level it has a stope length of 120 feet, and has been stoped practically to the surface. The average stope width is said to be about 30 inches. At the 70 ft. level it is intersected, and faulted by a pegmatite dyke striking parallel to the reef and dipping at a flatter angle in the same direction. The thickness of the pegmatite is 2-3 feet. The pegmatite has been followed down in the shaft for a short distance and then a winze sunk. From the bottom of this winze a crosscut extends north-eastwards for 40 feet, at which distance there is a small drive. Only stringers of quartz are visible in this drive. Where the dyke intersects the reef at 70 ft. level the reef does not show any signs of thinning out, and the drag indicates that the reef below the pegmatite has moved to the north-east, in the direction in which the crosscut has been taken. It is possible that a further extension of this crosscut would reveal a continuation of the reef. The country is quite hard at this depth, and for convenient working of any extension so found, it would probably be necessary to sink a new vertical shaft. The strike and dip of the reef are parallel to the gneissosity of the country, which is a micaceous hornblende gneiss.

A certain amount of prospecting work is being done south-east of G.M.L. 3428 on P.A. 4579. A shaft has been sunk to 35 feet, and a small amount of driving and crosscutting done. A crushing of 94 tons for 3½ dwts. gold per ton was obtained from the drive and rise. In the crosscut values are said to extend over a width of at least 21 feet.

P.A. 4195 (portion of old Great Beacon G.M.L. 3330.)

A quartz reef has been worked to a maximum depth of 85 feet, but at the time of inspection only a portion of the workings was accessible. The reef strikes N. 75° W. and dips 55°-60° S. The bottom level at 85 feet was not accessible at the time of inspection, but it appears, from the description given, that the reef was intersected by a fault striking parallel to the reef at the bottom of an adjacent vertical shaft. Another fault was indicated, which, it was thought, might be a continuation of that probably occurring at the 85 ft. level. The strike and dip, however, were different. It was not possible to decide exactly what had happened. It was concluded that the best method of attack would be from the main workings. A winze from the 52 ft. level to the 85 ft. level should be cleaned out, and the contact of the reef and the supposed fault exposed. Subsequent procedure would depend upon the conditions observed. If the description given was correct, it seems likely that there is a fault at the 85 ft. level, and consequently there should be a continuation of the reef below the present workings.

SUNDRY LEASES.

Under this heading the following leases are considered:—

Golden Cube, G.M.L. 3683.

Golden Arrow, G.M.L. 3766.

Marjorie B, G.M.L. 3090. Now held as P.As.

Snake Hole, P.A. (old G.M.L. 1837). Now held as P.As.

Golden Cube, G.M.L. 3683.—

Locality.—Bearing 17°, distance 1 mile 50 chains from Burbidge business and residence areas.

A quartz reef, having a general strike of N. 85° E., and a dip of 55° S., has been worked to a vertical depth of 132 feet. The strike and dip of the reef are parallel to the schistosity of the greenstone forming the country. At the surface more or less continuous workings extend over a length of 280 feet. Access to one portion of the present workings is by means of a vertical shaft, said to be 200 feet deep, but which was inaccessible below 124 feet at the time of inspection. Another portion of the workings is accessible by an old underlay shaft, from the bottom of which a winze has been sunk. From the bottom of this winze access is gained to the 132 ft. level by way of a crosscut and an underlay winze, a somewhat complicated means of entry, and one quite unsuitable for hauling ore. These workings could be connected to those off the vertical shaft by continuing a drive from the vertical shaft for about 45 feet.

A winze from the underlay shaft has been sunk for a distance of 40 feet through a pegmatite dyke. The old workings west of the present workings are said to have bottomed on pegmatite. While this is certainly true at the east end of the workings, it seems doubtful at the western end, unless there is more than one pegmatite dyke. As already pointed out, the old workings at the western end were not accessible. Subsequent to inspection it was reported that the vertical shaft had been cleaned out, and pegmatite exposed in its walls. The reef has been located below the pegmatite in the underlay shaft, and 140 feet of driving, not entirely on quartz, has been done. The maximum quartz at this level (132 feet, V.D.) is 24 inches, with the reported value of 15 dwts. gold per ton.

Golden Arrow, G.M.L. 3766.—

Locality.—One mile south from Great Leviathan workings.

This lease is equipped with a 5-head battery. Water is obtained from a shaft said to be 110 feet deep. As far as can be judged from accessible workings a series of small lenticular quartz reefs, striking N. 35°-40° W., and dipping 65° easterly, have been worked to a maximum depth of 110 feet. Most of the stone crushed in the past seems to have come from the workings towards the south end of the lease, and off what is now the pump shaft. This shaft is vertical for 34 feet, and then underlies eastward at 65°. It is said to have a total depth of 110 feet, but at the time of inspection water level was at 97 feet. Very little of the workings were accessible. The reef followed down from the surface was seen on the wall of the shaft to lens out at about the present water level, and

another lens to have commenced just east of the first one. This second lens is said to have been driven on for 76 feet from the bottom of the shaft.

Marjorie B. (G.M.L. 3090), *Snake Hole* (old Kingfisher Proprietary, G.M.L. 1837).—These are now both held as P.As. A certain amount of prospecting work has been done on short, narrow, lenticular quartz reefs.

Southern Cross United Gold Mines.—Southern Cross United Gold Mines control a fairly extensive reserve in the neighbourhood of Southern Cross. Attention has been turned to the old workings of the Central, Fraser's and Fraser's South leases. Portions of these workings have been unwatered, cleaned out, and extended, and active development work is being continued. To the end of 1912 the total production from this group of leases was 174,131.7 ozs. of gold from 335,753.75 tons of ore, giving an average grade of just over 10 dwts. gold per ton. After 1912 major production ceased, and in subsequent years production has been small and intermittent, generally not exceeding a few hundred tons of ore for any one period.

Work was commenced from No. 1 shaft, which has been deepened to 391 feet. No. 2 level has been continued northward to within approximately 110 feet of the old Central shaft, and southwards to connect to an old level off the old No. 2 shaft. At No. 3 level driving both north and south has been done, and going south it has connected with some stoping above the old 366 ft. level.

Towards the end of 1936, No. 3 shaft was equipped with winding gear, and a commencement made with the unwatering and reconditioning of the workings off this shaft.

The ore bodies in the workings so far examined are a series of lenticular quartz reefs, often containing an appreciable proportion of country rock, striking N. 30°-35° W., dipping 50°-55° W., and pitching southwards at angles varying from 25°-45°. The strike and dip of the ore bodies are everywhere parallel to the strike and dip of the schistose greenstones forming the country. Deposition appears to have occurred by metasomatic replacement, along zones of shearing which are parallel to the schistosity. The strike of the country is variable, and has generally been followed in driving. Deposition has occurred at various horizons, in varying amounts and with varying gold content, across 500-600 feet at least of country. Generally the mine is free from faulting.

Unfortunately the geological examination of the workings has not so far yielded any controlling factor, and it is therefore not possible to predict the position of likely new ore bodies. The southerly pitch of the ore bodies at a comparatively flat angle is an important feature to consider when looking for the extension of known ore bodies at greater depth. It is also important when drilling from the surface. With lenticular ore bodies it is quite possible for an incorrectly placed drill hole to pass through the blank between the ore bodies. Due allowance should be made for the southerly pitch. The policy of the present management in putting out frequent drill holes at right angles to the drives seems very sound.

NOTES ON SOME MINING GROUPS IN THE YILGARN GOLDFIELD

(South of the Great Eastern Railway).

(R. S. Matheson, B.Sc.)

PALMER'S FIND.

Palmer's Find is situated on the western shore of a salt lake approximately 8¾ miles south-south-east of Yellowdine Siding, and approximately 2½ miles east of the 8-mile peg on the Yellowdine-Parker's Range road. Gold was first discovered here by a prospector early in September, 1934, and it has since proved to be one of the most important discoveries in recent years. The find was made in a belt of greenstone country half a mile wide, which has a general strike N. 15° E. and dip vertical. The greenstone belt is bounded on the west by what is thought to be a contact gneiss, on the east the outcrops cease at the lake shore. Pillow lavas, amygdaloidal lavas, and tuffs have been recognised in the greenstone series, interbedded with which are two beds of ferruginous quartzite. The pillow lavas occur in rather peculiar circumstances, resembling augen structure on a large scale. The pillows form the eyes and these are set in a matrix of tuffaceous or basic sedimentary material which appears to stream around them. A doubtful facing on the pillow lavas, indicating that the beds face east, was obtained 26 chains south-south-east of the main mine. The area is riddled by post-gold pegmatite dykes which are often garnetiferous and sometimes contain large flakes of mica.

Large quartz reefs are scattered abundantly throughout the area and there appear to be two different types. The auriferous quartz is sugary and vitreous, and the other quartz is milky white and probably associated with the pegmatite intrusions.

The Yellowdine Gold Development, Ltd., was the only company operating at the time of inspection, and there were a few men still working the alluvial patch. The alluvial* patch is an area of 5 acres situated between the Whinfield reef and the lake shore, and it is almost worked out.

A considerable amount of prospecting by costeaning, diamond drilling, etc., has been done throughout the group, but that which has been done outside the property of the Yellowdine Gold Development, Ltd., has apparently been fruitless.

YELLOWDINE GOLD DEVELOPMENT, LTD.

Whinfield Reef.—Due to folding, this reef outcrops at the surface as two parallel reefs, 40-50 feet apart, which join at the north end. The enclosing greenstone country has a general strike of N. 10° E. and dips steeply. The east reef is 340 feet long and the west reef 385 feet long. The width, however, cannot be measured with any degree of certainty as it shows considerable variation due to changes in elevation and the encroaching of the overburden. Open-cutting has been commenced at the north end and the broken ore is being dropped down passes to the 50 ft. level.

50 ft. Level.—On the 50 ft. level in the main east crosscut, the east reef appears to split into two reefs. The west leg joins the west reef 75 feet north and

* This is in accordance with the Mining Act, 1904, which states:—("Alluvial"—(1) When applied to gold: Any earth containing or supposed to contain gold, and not being a lode, dyke, reef or vein.)

Speaking in geological language, however, this gold is eluvial.

YELLOWDINE GOLD DEVELOPMENT LTD.

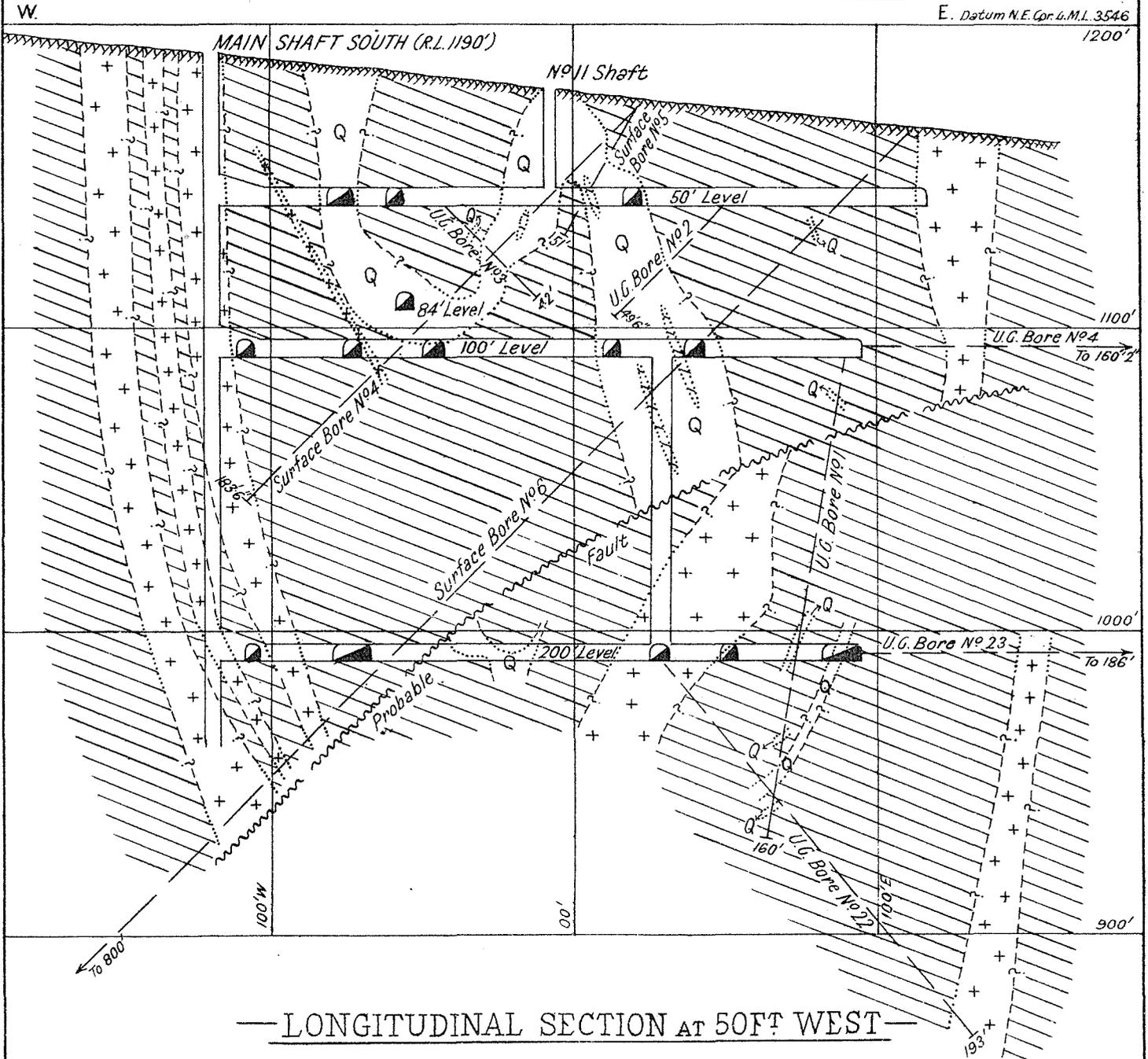
PLATE NO VII

PALMER'S FIND

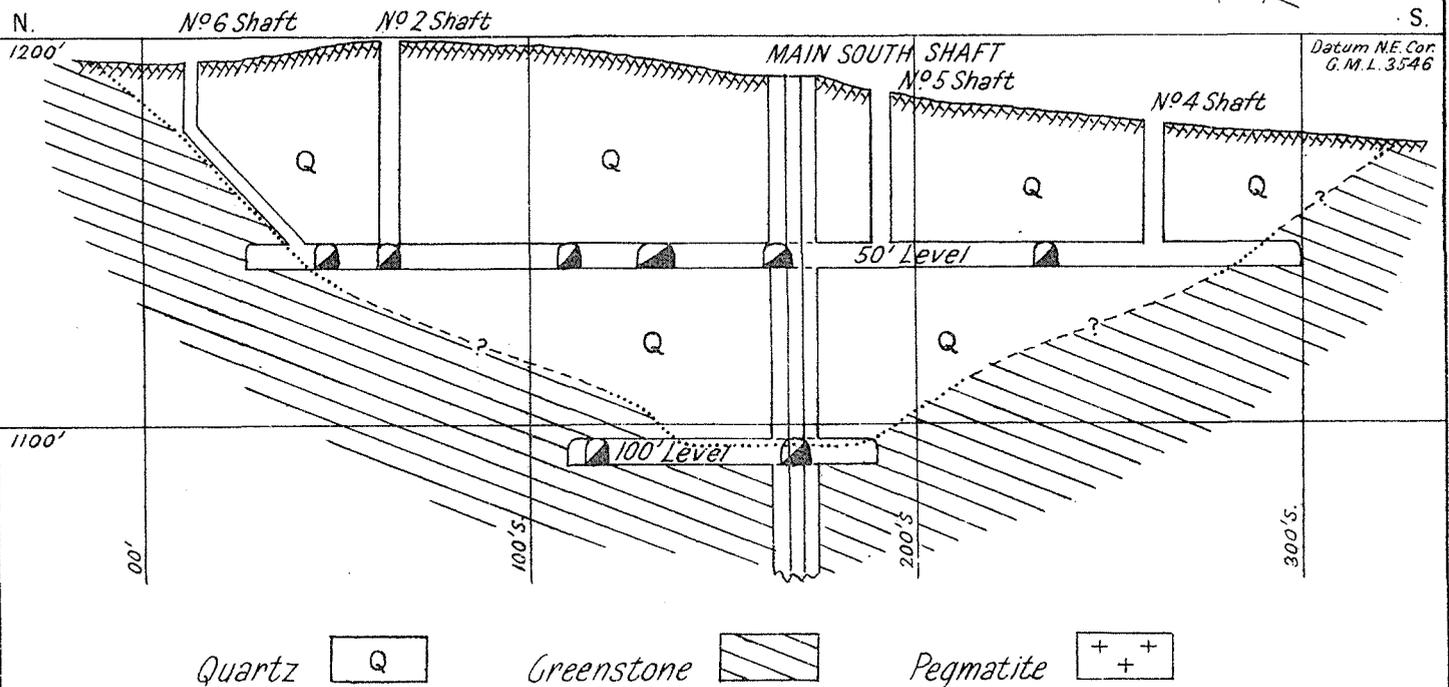
Scale 50 feet to an inch



TRANSVERSE SECTION AT 170 FT SOUTH



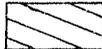
LONGITUDINAL SECTION AT 50 FT WEST



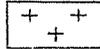
Quartz



Greenstone



Pegmatite



Bore information supplied by management.
Sections & Geology by R.S. Matheson, Oct., 1936.

83 feet south of the Main East crosscut, forming a closed body of quartz. At the south end of the quartz mass the pitch is 35° N. and at the north end the pitch is 40° S., and this is accounted for by folding on an east-west axis. A careful study of the dips at the quartz boundary proves the quartz to be in a closed syncline. On the 50 ft. level the average width of quartz in this synclinal mass is 20 feet.

The east leg is the east leg of an anticline, the crest of which outcropped at the surface, and it is 357 feet long and has an average width of 10 feet. It is cut off sharply by a pegmatite dyke 220 feet north of the Main East crosscut, and it narrows away to a stringer southwards.

100 ft. level.—The trough of the syncline is at the 100 ft. level where it is showing in the roof of a drive for a length of 60 feet. The true width of the quartz here is 23 feet, measuring vertically. Arsenical pyrites is showing in the quartz, and also in the quartz at the 84 ft. intermediate level. Stripping 45 feet wide, measured horizontally, is being carried out at the 84 ft. intermediate level, but this is not the true width of the quartz but across the trough of the syncline.

At the 100 ft. level, the east leg has an average width of 20 feet and is exposed for a length of 515 feet. It is cut off by a pegmatite dyke 340 feet north of the Main East crosscut, and narrows away to a stringer southwards. Stripping of the quartz in the north drive has commenced.

Approximately 45 feet below the 100 ft. level the east leg cuts off on a fault, striking approximately N. 55° W. and dipping 35° S.W., as seen in the main east crosscut at the 200 ft. level. The evidence that normal faulting has taken place is conclusive, but the actual position of the fault is doubtful. The footwall has been displaced approximately 70 feet west with respect to the hanging wall.

There is an irregular quartz reef exposed on the 100 ft. level, 80 feet south-south-west of the Main South Shaft, and it is probably portion of a structure parallel to that of the Whinfield Reef. The reef contains arsenopyrites, has an average width of 8 feet, and is driven on for 90 feet. The reef is assimilated in places by a pegmatite dyke and consequently the structure is not preserved. Exploratory work on the 50 ft. and 200 ft. levels has failed to disclose this reef.

200 ft. level.—On the 200 ft. level, 80 feet from the Main South Shaft in the Main East crosscut, an irregular body of quartz is exposed which is very likely the continuation of the east leg which underwent faulting between the 100 ft. and 200 ft. levels. Values are reported to be very low in this quartz and it is not being worked.

At the end of the Main East crosscut, 205 feet from the Main South Shaft, a quartz reef average width 3 feet has been driven on 125 feet north and 144 feet south. In this drive payable values are reported to extend 50 feet north and 50 feet south of the Main East crosscut. The reef dips 65° W. and is probably a portion of a structure parallel to that occupied by the Whinfield Reef. The extent

of the quartz above the level is not known, but underground bore No. 22 intersects the reef 40 feet V.D. below the 200 ft. level. Pegmatite is showing in the face of the north drive and the quartz has pinched to a stringer. Crosscutting is in progress from the end of the south drive to intersect good values which were located by surface bore No. 15 at approximately the same reduced level as this drive.

The reported estimate of the ore available in the Whinfield reef from the surface to the 100 ft. level is 100,000 to 135,000 tons of ore, with an average value of 15 dwts. to 1 oz. gold per ton.

Structure.—The two sections accompanying this report (Plate No. VII.) illustrate the structure of the Whinfield reef. In transverse section the reef has the appearance of a large dragfold, the axial plane of which has been seen from examination of smaller dragfolds to strike N. 5° E. and dip 55° W. The reef has no pitch on the line of section. The quartz occupies a dragfold in greenstone country and is on the east limb of a major anticline. The reef is the result of a metasomatic replacement of the country, and the presence of large isolated "horses of mullock" within the quartz supports this view.

The longitudinal section is drawn through the centre of the syncline, and it shows clearly the opposing pitches at the north and south ends. This is due to a synclinal crossfolding on an east-west axis and crossfolding has undoubtedly been an important factor in gold deposition.

EGAN'S REEF.

Egan's reef outcrops approximately 300 feet north of the Whinfield reef, and it appears to be an offshoot from a large body of quartz which contains only traces of gold. The reef has an average width of 10 feet, and is being opened from the surface over a length of 135 feet. The average value of the quartz is reported to be 12 dwts. gold per ton. The quartz is parallel to the enclosing greenstone country, and megascopically it is similar to the quartz composing the Whinfield reef.

50 ft. level.—The quartz is exposed at this level for a length of 152 feet, and the width changes from 16 feet at the south end to 1 foot at the north end. At the south end the quartz is in the roof and pitching 40° N., meeting the floor of the drive 23 feet from the south face. A pegmatite dyke encroaches on the east boundary of the quartz going north, and the quartz has been partly assimilated. Crossfolding has been associated with the occurrence of this shoot and, if the shoot is not entirely assimilated going north, the pitch will likely change to south, fixing the shoot in a synclinal crossfold. The opposing pitches at the north end of the Whinfield reef and the south end of the Egan reef suggest an anticlinal crossfold between the two reefs.

Production.—The following table shows the official production to the end of October, 1936. Ore from both the Whinfield and Egan reefs is included in the tonnages stated, but the majority has been from the Whinfield reef. So far only battery treatment of the ore has been carried out, and the tailings are being stacked for treatment in the cyanidation plant, which is expected to be in operation by January, 1937.

Month.	Tonnage. long tons.	Gold therefrom. fine ozs.
May	881	379.38
June	2,776	1,446.84
July	3,311	1,609.61
August	4,095	1,888.77
September	4,469	2,270.49
October	4,381	2,114.92
Totals	19,913	9,710.01

The average value of the tailings on hand is reported to be 8 dwts. gold per ton.

Conclusions:

1. The large "horse of mullock" occupying the syncline of the Whinfield reef is being mined along with the quartz, and this will increase the tonnage and lower the grade of the ore.

2. There is, at the most, three years' ore reserves in sight. Encouraging results have recently been obtained in surface bore No. 15, but whether or not this is a large ore body has yet to be investigated.

3. Structure is an important factor controlling gold deposition, the presence of a synclinal crossfold appearing to be an essential condition. Prospecting could be done to the best advantage in the known synclinal crossfolds. Other crossfolds are likely to occur, but it is impossible to infer their location. The ferruginous quartzite, due east of the Whinfield reef, should be investigated for the presence of lode material. The bed is in the lake floor at this point, but this should be no obstacle to diamond drilling.

The Whinfield reef is a type of "saddle reef," and this should be borne in mind when prospecting for other ore bodies. New ore bodies may be located in the same horizon in the greenstone series as the Whinfield reef, or stratigraphically above or below it. The best results will be obtained by prospecting within the synclinal crossfold.

Actual sites for boring and more information concerning recommendations for prospecting will be published at a later date.

NEVORIA GROUP.

This group is situated about 6 miles east-south-east of Marvel Loch in an area of interbedded ferruginous quartzite and greenstone, which is traversed by numerous flatly dipping pegmatite dykes. The general strike of the country is east-south-east, and the dip varies from 50° S.S.W. to vertical, but at the east end of the group there is a sudden change in strike and, west from the 15-mile peg on the Yellow-dine-Parker's Range road, the ferruginous quartzite is striking N. 15° E. Areal mapping* has shown that the Nevoria Group is located on the nose of a major anticline which pitches to the south-east at approximately 55°. The ferruginous quartzite is fractured and contorted into dragfolds, the noses of which are favourable structures for the deposition of gold. Ore shoots are found in both anticlinal and synclinal noses which shows that the major structure is overriding the minor structures. Quartz veins are everywhere associated with the lode material, and the primary gold is probably confined to them. The lode material is the result of secondary enrichment of the ferruginous quartzite by circulating waters, and the

* Refer to Plate No. VI.

values in it may be expected to decrease below ground water level, and probably become unpayable. It may not be the present ground water level which will limit the depth of the lode material, but the deepest level to which the ground water level has fallen in the past. For instance, if the ground water level in the past was 50 feet below the present ground water level, one may expect the enriched zone to extend 50 feet below the present ground water level. Whether the ore body will, or will not, live with depth depends on the quartz content.

There are, at least, four beds of ferruginous quartzite, and it is thought that these are the same bed repeated by folding. There is a lack of evidence for this view at Nevoria, but it is definitely the case at Mt. Rankin and Southern Cross, where the geology is less obscured. The composition of the ferruginous quartzite indicates that it must have been laid down under very peculiar conditions, and one finds it difficult to believe these peculiar conditions existed more than once. This supports the idea that there is only one horizon of ferruginous quartzite. The contortion of the ferruginous quartzite and the presence of numerous flatly dipping pegmatite dykes hamper mining operations.

Nevoria Gold Mining Company.—The company holds an almost continuous line of leases extending in an east-west direction for approximately 2½ miles; the only break in the line is the Kurrajong G.M.L. 3454. Included in the company's property are the old Never Never workings. The official production figures for the Nevoria Group to 1933 show that 44,069.5 tons yielded 10,620.15 fine ozs. of gold, and specimens totalled 14.90 fine ozs. of gold.

During the first examination of the property in February, 1936, work was being done on Just in Time G.M.L. 3390 (old Never Never) and Iron Channel G.M.L. 3394, the remainder of the leases being under exemption. Three main shafts were being sunk with the intention of investigating the lodes at three levels to a depth of 300 feet.

Isolated shoots of ferruginous quartzite lode have been worked in the past, and while there seems good evidence for the existence of four beds of ferruginous quartzite, only two beds have been worked to any extent. To facilitate the description these two beds will be designated the Main lode and the North lode.

A considerable tonnage of ore has been mined from the main open cut which has an average depth of 60 feet, average width 25 feet, and length 325 feet. Below the east end of the open cut the ore body has been stoped to ground water level at 153 feet, V.D., over a length of 110 feet and an average width of 20 feet. The 153 ft. level was inaccessible, but a winze is reported to have been sunk from this level to 205 feet, V.D., from the surface, and sulphides with good values were encountered in the winze.

The Main lode has also been worked from the Hamilton shaft. On the 50 ft. level the footwall of the ferruginous quartzite bed has been overhand stoped for 13 feet over an average width of 8 feet and a length of 180 feet. It is underhand-stopod over the same average width to 25 feet, V.D., the length of the stoping being unknown.

From the Whip shaft the main lode has been worked by open cutting and stoping to 68 feet, V.D., the average stope width being 4 feet 6 inches and stope length 50 feet. The North lode has also been

worked from the Whip shaft, and is stoped erratically from 24 feet, V.D., to 85 feet, V.D., for a maximum length of 85 feet, the stope width varying from 20 feet to 4 feet. The maximum stope width and stope length is at the 53 ft. level.

The workings on the Main lode on G.M.L. 3394 were inaccessible. Occasional shafts, shallow open cuts and potholes are scattered over the remainder of the company's holdings.

The ferruginous quartzite throughout is fractured and contorted, and there is a definite relationship between geological structure and position of ore shoots. The shoots are situated at the noses of the dragfolds, and pitch with them to the south-east. The lode is generally ferruginous at the surface but, at depth, it changes to a laminated rock with alternate bands of quartz and actinolite. Secondary enrichment has undoubtedly taken place, the evidence being the occurrence of good values in flat floors in the lode, the presence of paint gold, and the occurrence of values in some of the flat pegmatite dykes.

Numerous flat pegmatite dykes are encountered in the underground workings which have changing strikes and dips. Some of the dykes are garnetiferous.

Recommendations.

As explained previously, structure is a controlling factor in the gold deposition at Nevoria. There are other important factors whose influence will not be discussed at present, and still others whose influence is yet to be understood. Similar structures can be located, however, and provided the other essential conditions exist, these structures will contain shoots of ore. Only two beds of ferruginous quartzite have been mined to any extent, and these only disjointedly. Systematic prospecting should disclose further dragfolds, and with them shoots of ore.

The other ferruginous quartzite beds could be advantageously prospected north-west and south-east from the known ore shoots. Prospecting of the lodes underground is proving difficult because of the intense drag-folding and the resulting isolation of the ore shoots. It is essential, however, to ascertain the attitude of the lode on at least one level, and where the ore shoots lie. When this is known, taking into account the dip of the ferruginous quartzite and the pitch of the ore shoots (*i.e.*, the pitch of the dragfolds), the mining exploitation could be more systematic and less costly. It may be possible in time to arrive at a measurement of what might be called the wavelength of the dragfolds (*i.e.*, the distance from one anticlinal nose to the next), and if this distance is constant then prospecting could be reduced to a minimum.

The management expects the sulphide zone to be the mainstay of the mine, as values are improving where it has been encountered. It is well not to be too optimistic, because ground water level and the commencement of the sulphide zone almost coincide, and in a secondary enriched area such as Nevoria, an enrichment is likely to occur at ground water level.

At the extreme east end of the company's property, on the ground formerly occupied by G.M.L. 3108, there are some favourable structures outcropping which warrant prospecting.

In October, 1936, another examination of this property was made, and the following work had been carried out by the company.

Crosscuts had been extended from No. 1 Main shaft at the 150 ft. and 250 ft. levels. On the 150 ft. level the Main lode was encountered 83 feet south-west from the shaft and the North lode 11 feet north-east of the shaft. The crosscuts at the 250 ft. level (93 feet in all) are entirely in pegmatite. The strike of the pegmatite dyke, as near as can be ascertained, is east-north-east, and crosscutting has been done almost along the strike. To avoid the pegmatite dyke in order to investigate the lodes, it would be advisable to drive in a south-easterly direction from the end of the south-west crosscut.

There are crosscuts off the No. 2 main shaft at 250 feet, V.D., and the shaft at this level is in the North lode. The lode is contorted, and contains sulphides of which pyrrhotite appears to be the most abundant. A west drive has just been commenced on this lode. Values are proving to be best at the noses of the dragfolds. The south-west crosscut is in progress to intersect the Main lode at this level.

At the 132 ft. level off No. 3 main shaft, three lodes have been disclosed; the North lode, the Main lode and a South lode. If the north-east crosscut is continued a fourth lode should be found.

A ferruginous quartzite lode is being examined by the company at the 50ft. level off No. 4 main shaft on the Newry G.M.L. 3456. As the workings are still in the oxidised zone the geology is obscure.

Kurrajong, G.M.L. 3454.—Lode material in ferruginous quartzite has been mined on this lease from the surface to 45 feet, V.D., over a maximum width of 8 feet and a maximum length 40 feet. The ore body is in the nose of a dragfold pitching to the south-east, and what has been said concerning the Nevoria Gold Mining Company is applicable here. In February, 1936, a small parcel of ore was crushed yielding 6 dwts. of bullion per ton by amalgamation, and 9 dwts. of bullion per ton by cyanidation.

P.A. 4392.—This prospecting area is situated approximately a quarter of a mile west of the 15-mile peg on the Yellowdine-Parker's Range road. A prominent ridge of ferruginous quartzite, which is highly contorted, having a general strike of N. 15° E., runs through this holding. Numerous quartz stringers can be seen filling fractures in the ferruginous quartzite. Prospecting is being carried out and good values are being obtained in noses of the dragfolds. The dragfolds here are small and do not approach the dimensions of the dragfolds in the ferruginous quartzite where the strike is east-west, and consequently no appreciable ore shoots are likely to be found.

FOUNDATION FIND.

This find is situated on the Yellowdine-Parker's Range road 45 chains north of the 15-mile peg. The place was abandoned at the time of inspection and there were no accessible workings. The workings, which are not extensive, are prospecting efforts on ferruginous quartzite lode.

HARRIS' FIND.

Harris' Find is situated approximately 5 miles north-east of Toomey Hills. There is a paucity of outcrops, but the geology that can be seen indicates that the country is highly contorted. The strike of the country varies from N. 70° E. to N. 60° W. and the dip varies from 70° W. to vertical. The best outcrops are in the vicinity of the leases, and whitestones, mainly grey garnetiferous and chiasolite schists, predominate. Interbedded with the whitestones are greenstones which are thought to be mainly of tuffaceous origin, but some flow rocks also occur. Most of the greenstone outcrops are in an advanced stage of weathering, and it is only by applying knowledge obtained elsewhere in the district that these outcrops can be recognised as greenstones.

Only two leases were being worked at the time of inspection; viz., New Hope, G.M.L. 3702, and Mundy Hills 1, G.M.L. 3671, where quartz reefs and lode material associated with quartz stringers constitute the ore bodies. Because of the lack of evidence one is unable to form any reliable opinion concerning the relationship of ore bodies to the geological structure.

A quartz reef with graphite outcrops approximately 11 chains north-east of the north peg of Mundy Hills 4, G.M.L. 3674.

Approximately 35 chains north of the north peg of Mundy Hills 1, G.M.L. 3671, is a shaft which has recently been worked, and arsenical pyrites is showing in the quartz on the dump.

A quartz reef, reported to assay 3 dwts. gold per ton, has been prospecting from this shaft.

New Hope, G.M.L. 3702.—The ore body has been exploited between Shafts B and C which are adjacent to the south-east boundary of the lease. The underground workings were accessible from Shaft B, the north-western of these two shafts. Lode material with quartz veins, striking N. 45° W. and dipping 80° S.W. with the enclosing whistone country, has been stoped from 92 feet V.D. from ground level, to the surface. The average stope length is 23 feet and the average stope width is 2 feet. No idea of the pitch of the shoot could be obtained. The ore body is along a line of weakness near the centre of a grey schist bed which is 38 feet wide, measured in the crosscuts at the 129 ft. level. The grey schist bed is bounded by greenstone.

Quartz stringers are showing in the faces of all the drives except at the 129 ft. level, where one foot of quartz is showing in the face of the south-east drive. There is no quartz in the face of the north-west drive at the 129 ft. level, and there is a sporadic distribution of quartz along the roof of the drive. No stoping has yet been done on this level, but the lessees report that the payable shoot is still in the roof of the drive. It is reported that in the course of driving here, a parcel of 160 tons of ore was crushed at Howlett's battery for a return of 6 dwts. gold per ton by amalgamation. In the south-east drive at the 129 ft. level, 17 feet from Shaft B, is a winze 14 feet V.D., and ground water level has just been encountered.

Values are said to be improving in the winze and this is probably due to secondary enrichment by circulating waters. The depths of the levels have been measured from the top of the dump so that the depth to groundwater level from ground level is 134 feet.

Shaft A, 160 feet north-west of Shaft B, is being sunk with the intention of connecting with the north-west drive from Shaft B, at the 129 ft. level. This connection will surmount the ventilation problem, which has been hampering mining operations.

Mundy Hills 1, G.M.L. 3671.—This lease adjoins the New Hope lease on the south-east boundary.

Adjacent to the north-west boundary of G.M.L. 3671 a quartz reef has been stoped for an average length of 73 feet, and average width of 2 feet, from the 32 ft. level to the 59 ft. level. The stoping has been carried out between the shafts D and E, and 20 feet north-west of shaft D. Shaft D, the north-western of these two shafts, is 79 feet, V.D., from the top of the dump, but it was inaccessible below the 59 ft. level. On the 32 ft. level the quartz attains a width of 3 feet between the two shafts, but quartz is absent in the face of the north-west drive. A quartz stringer is showing in the face of the north-west drive at the 59 ft. level, and one foot of quartz is showing in the south-east wall of shaft E between the 32 ft. and 59 ft. levels. There is no quartz in the face of the 24 feet south-east drive off shaft E at the 54 ft. level.

The ore shoot is parallel to the enclosing whistone country, and is in the same line of weakness as the ore body in the New Hope lease.

Another ore body, composed of lode material and quartz, is being mined from shafts F and G, situated near the south-east boundary of the lease. The two shafts are connected at the 50 ft. level where the majority of the work has been carried out. The ore body has been prospected at the 100 ft. and 135 ft. levels off shaft F, the southern of these two shafts, but these workings were inaccessible.

At the 50 ft. level the greenstone country is in a highly oxidised condition, and there is an erratic distribution of quartz and of values in the lode material. The quartz is reported to carry values throughout, but there is only one defined reef which is situated 15 feet east of shaft F. This reef, which is parallel to the enclosing country, has a curving strike, but the general strike is N. 30° E., and the dip 70° N.W. The average width of the reef is 3 feet and it can be traced over a distance of 65 feet. Overhand stoping, 20 feet high and 20 feet south-west of the rise in the east crosscut off shaft F, has been done. A small amount of lode material, resulting from secondary enrichment, has been stoped in two places. The values in the lode material are erratic, and the limits ill-defined. The strike of the country varies from N. 20° W. near shaft F, to N. 35° E. near shaft G, and the dip is 70° W. A relationship between quartz deposition and geological structure is suspected, but, owing to a lack of evidence, the structural control could not be established.

A mining company recently held an option over this property, but it was not exercised.

The following production figures have been supplied by the lessees:—

CRUSHINGS AT HOWLETT'S BATTERY.

—	Tonnage (long tons)	Gold therefrom (bullion)—		Month.
		by amal- gamation.	by cyan- idation.	
From the Northern Workings.	24½	dwts. grs. 7 0	dwts. grs. 2 15	Mar. 1934
	70	6 0	2 10	Aug. 1934
	49	5 0	1 18	Oct. 1934
From the Southern Workings.	60	5 0	2 21	Feb. 1935
	194	5 0	3 18	Oct. 1935
	42	6 0	2 21	Jan. 1936
60 tons at grass expected to yield 8 dwts gold per ton by amalgamation.				

PARKER'S RANGE GROUP.

This group embraces all mining tenements situated in a strip of country extending one mile west and 1½ miles south of the Parker's Range townsite. The group lies in an area of greenstone interbedded with some thin whitestone beds. The general strike of the country is north-north-east, and the dip varies from 35°-65° W. Three beds of ferruginous quartzite have been mapped along the eastern margin of the group and they are remarkably free from dragfolds. It is thought that these three beds are one bed repeated by folding on a north-south axis, but the supporting evidence is lacking.

A fault striking N. 73° E., which has displaced the southern portion a distance of one chain to the east, cuts through the group, crossing the main road about 6 chains south of the 15-mile peg. Numerous milky white quartz reefs are scattered along the line of the fault.

There are three distinct lines of workings on this group.

Shallow potholes and occasional shafts are scattered along the ferruginous quartzites, and these constitute the east line. Although prospecting is dormant on this line at present, the work done indicates that it must have been active in the past.

There are two existing prospecting areas on the central line. One occupies the ground formerly held by the Etl Ess Dee lease.

There is also a western line on which the most important shows were the late Searchlight, the late Piemonte, and the late McIntosh Deeps.

P.A. 3509 (late L.S.D. lease).—There are two lines of workings on this prospecting area. In the eastern line of workings, a granitic quartz reef of lenticular habit, striking and dipping with the enclosing greenstone country, has been mined. These workings were inaccessible at the time of examination.

Activity is confined to the workings accessible from Shaft B, on the western line, where mica schist lode with quartz stringers constitutes the ore body. The country strikes N. 15° E. and dips 50° W.

In Shaft B, 108 feet V.D., ground water was encountered at 50 feet V.D., and the installation of a pump was found necessary to cope with the water. At 104 feet V.D. there is a southerly drive along the hanging wall contact of the mica schist with the greenstone, for a distance of 53 feet from the shaft. At 28 feet in this drive, a crosscut 24 feet in length connects to Shaft A at this level. The face of the drive is in mica schist with quartz stringers. The owners report that the best values are at the contact of the mica schist with the greenstone. From Shaft B to the face, over a width of 10 feet, the mica schist is said to average 10 dwts. gold per ton. The extent of the values overhead and underfoot is unknown.

A trial crushing of 6 tons, in March 1936, is reported to have yielded 5 dwts. gold per ton by amalgamation and 4 dwts. gold per ton by cyanidation.

A two-head battery is being erected on the property.

Conclusions.—The lode is undoubtedly secondary because the mica schist is barren above ground water level. The 104 ft. level is in an enriched zone and there is little hope of the values living in the mica schist lode to any great depth. Primary gold exists, however, in the quartz stringers accompanying the lode material, and the owners have in their possession some very rich specimens, but unfortunately these are scarce. The chances of this show becoming a large producer depends on whether or not the stringers form a workable body of quartz at depth.

P.A. 4352.—A 1½ inch quartz stringer with a few inches of lode material, in greenstone country, has been worked in scattered potholes to a maximum depth of 30 feet. The present holders are obtaining some good prospects, showing coarse gold, from this seam and are cleaning out the old workings with the hope that the seam may be worth following down.

A quartz reef with tourmaline, striking with the country, outcrops 2 chains south of the workings and good prospects are reported to have been obtained.

P.A. 4397 (late Piemonte lease).—This is situated in a greenstone area having a general north-north-east strike and dipping 50° W. At the time of examination, work was being carried out in two shafts. Shaft A, the southern of these two shafts, has been sunk to 45 feet V.D. where a quartz reef, striking N. 25° E. and dipping 55° W. with the enclosing greenstone country, was intersected. At the 45 ft. level a mixture of quartz veins and reported lode material, 3 feet wide and said to be payable can be seen in the north wall of the shaft. There is a south drive at this level for 31 feet and the quartz gradually increases in width going south from the shaft, attaining a width of 3 feet in the face. The owners were preparing to stope this reef, in which the values are reported to be best on the hanging wall. A fault striking north-north-east and dipping 30° W. cuts through the face of the south drive. There has only been a small displacement of the footwall to the west, and no difficulties to the mining of the reef should result from the faulting. Shaft B underlies 50° W. On the

No. 1 level, at 42 feet linear depth, there is a south drive for 29 feet, showing 5 feet 6 inches of quartz, with interstitial lode material in the face. The quartz is stoped above the level 12 feet high and 5 feet 6 inches wide, over the length of the drive, and is reported to have averaged $4\frac{1}{2}$ dwts. gold per ton by amalgamation, and $2\frac{1}{2}$ dwts. gold per ton by cyanidation.

The quartz pinches out to stringers in the north drive at this level, 17 feet from the shaft. The drive continues and connects Shaft C and then Shaft D and the drive finishes at 120 feet from Shaft B. Quartz stringers are showing in the face. A short east crosscut off the north drive at 50 feet from Shaft B exposes a parallel quartz reef, 5 feet wide, in which the values have apparently been unpayable. This reef can also be seen on the footwall of Shaft D where it is 6 feet wide. Off the bottom of Shaft B, 65 feet linear depth, there is a short east crosscut which discloses a few quartz stringers.

WHITE HORSESHOE, G.M.L. 3540.

This lease is situated on the main road $3\frac{3}{4}$ miles south of the Parker's Range townsite. The workings are in greenstone between two ferruginous quartzite beds. The country has a general north-north-west strike and the dip varies from 35° - 50° W. Near the south boundary of the lease where the geology is obscured by a thick overburden of red sandy soil, the ferruginous quartzite beds have been displaced east by faulting or folding. A line of small lenticular quartz reefs has been mined here in the past.

Shaft A, the working shaft, is 51 feet V.D.; there is a 10 feet east crosscut from the bottom, off which there is a drive for 20 feet on a bearing of N. 10° W. At the south end of the drive, 3 feet of quartz with "horses of mullock" is showing in the roof. The quartz has been overhand stoped to one foot from the north face, where the quartz has pinched to a few stringers, and back on the pitch to the surface. The stoping pitches approximately 55° S. and is reported to have averaged 9 dwts. bullion per ton. The quartz is lenticular and strikes N. 10° W. and dips 35° W. with the country. The lessees are about to underhand stope this reef from the 51 ft. level drive.

Shaft B, the old main shaft, was inaccessible, but the ground water level was approximately 50 feet V.D. from the surface.

OLGA GROUP.

This group is situated in an area of greenstone with some interbedded whitestone on the main road to Ravensthorpe, approximately 6 miles south of Parker's Range townsite. Four beds of ferruginous quartzite traverse the centre of this group. The strike of the country changes from N. 10° E. at the north end of the group, to N. 30° W. at the south end, and the dip varies from 35° - 65° W. The ferruginous quartzite beds are gently folded and are apparently non-auriferous in this area. Between the ferruginous quartzite beds, small quartz lenses with high values and parallel to the enclosing greenstone country, are being mined. In the Parker's Range and Spring Hills groups there is more than one "gold line," and other "gold lines"

should be discovered in the same relative positions at the Olga and Dulcie groups. This group warrants prospecting approximately for 50 chains to the west, but the thick overburden may present difficulties. Future discoveries are expected to be of similar size and tenor to the existing shows in this vicinity.

Approximately 4 chains north of the north boundary of the Manita, G.M.L. 3717, a quartz diorite dyke cuts across the strike of the country.

Black Cat G.M.L. 3716.—The main shaft underlies 45° - 52° S.S.W. to ground water level at 144 feet vertical depth (i.e., 200 feet linear depth). Two ore shoots which pitch steeply to the south-east are being mined, and the main shaft is sunk between them.

The south-eastern ore body has been stoped intermittently from the surface to water level. The average stope length is 17 feet, measured in the drives, and the average stope width 2 feet. Quartz, 1 foot 6 inches wide and reported to assay $12\frac{1}{2}$ dwts. gold per ton, is showing in the face of the drive at the 52 ft. V.D. level and 2 feet of quartz with payable values is showing in the face of the drive at the 78 ft. V.D. level. On the 140 ft. V.D. level a quartz stringer is showing in the face of the south-east drive, and the quartz is reported 10 feet long in the floor.

On the north-west side of the shaft a lenticular quartz reef has been stoped out between the 140 ft. V.D. and 119 ft. V.D. levels, and the 119 ft. V.D. level is overhand stoped for approximately 20 feet. The average stope length is 23 feet and the average stope width is one foot. Quartz, 10 inches wide, is showing in the face of the north-west drive at the 119 ft. V.D. level, and at the 140 ft. V.D. level there is a quartz stringer in the face of the north-west drive. In the floor of the north-west drive at the 140 ft. V.D. level are two quartz lenses, 5 feet long and 8 inches wide, which are reported to assay 5 ozs. gold per ton.

Along the roof of the north-west drive, at the 92 ft. V.D. level, the average width of quartz is approximately one foot, and there is 2 feet of quartz showing in the face. The quartz on this level is reported to average 3 ozs. gold per ton. Some specimens containing coarse gold were seen on this level and paint gold is said to occur.

The main shaft underlies at 45° to 93 feet linear depth, where the dip steepens to 52° and this dip is retained to 143 feet linear depth when the shaft resumes its initial dip. This local steepening in dip has influenced the quartz deposition and probably the values. The greatest width of quartz is attained in this section and the values begin to improve, but being in a secondary enriched zone, nothing definite concerning the influence of the steepening in dip on the values could be ascertained.

Gradual changes in strike resulting from gentle folding were observed in the underground workings. The folds pitch steeply to the south-east, ore shoots occupying the synclines and only stringers of quartz are present on the anticlines. Briefly, the quartz ore bodies appear to be associated with favourable strikes and dips which are a reflection of the major structure. The shoots have pinched on their strike because anticlines are being approached.

A continuation of the drives north-west and south-east is recommended, as new shoots will probably be disclosed. The driving could be done to the best advantage off the section of the main shaft dipping at 52°.

Changes of dip have resulted from folding on a horizontal N.W.-S.E. axis. The quartz is pinching and shortening with depth, and a gentle anticline belonging to this set of folding is being approached. When the anticline is passed the dip will steepen once more, and the shoots will probably regain their width and length. Bearing in mind the pitch of the shoots, prospecting should be done in this direction. The installation of a pump will be necessary, however, to cope with the water.

There is a pronounced fold in the ferruginous quartzites on this lease, and the nose should be investigated.

Manita G.M.L. 3717.—The main shaft on this lease underlies at 40° S.W. to 46 feet, V.D., and then the dip steepens to 45° to ground water level at 118 feet, V.D., from the surface. On the south-east side of the main shaft a lenticular quartz reef, pitching steeply to the south-east, has been stoped sporadically from 37 feet linear depth to water level. A block of ore which is reported to have averaged 30 dwts. gold per ton, has been stoped out between the 117 ft. V.D., and 84 ft. V.D., levels over an average length of 14 feet and an average width of 3 feet. Overhand stoping has been carried out on the 84 ft. V.D. level to 32 feet from the shaft over a width of 4 feet and 8 feet high. The average value for this block is reported to be 27 dwts. gold per ton. The 48 ft. V.D. level is overhand stoped to 18 feet from the shaft over a width of 3 feet and height 38 feet, and underhand stoped 23 feet over the same average width to 8 feet from the shaft.

Quartz stringers are showing in the faces of the drives.

Prospecting should be carried out on the same lines as recommended for the Black Cat G.M.L. 3716.

A new shaft is being sunk half a chain to the west of the north-east lease peg on two 4-inch quartz stringers, which are reported to contain good values.

Miner's Dream G.M.L. 3757.—Mining operations had just ceased on this lease when the examination was made.

The main shaft underlies at 35° S.W. to 100 feet linear depth, and then steepens to 45° to ground water level at 193 feet, V.D. The ore body, which is reported to have been a mass of quartz kidneys pitching as a whole steeply to the south-east, has been stoped out to water level. It is reported that the maximum width of quartz stoped was 2 feet, and the average width of the quartz was one foot. There is a gradual diminishing in stope length with depth. On the 56 ft. V.D. level the stope length is 66 feet, and on the 195 ft. V.D. level the stope length is reported to be 15 feet.

Immediately below the stoping on the 195 ft. V.D. level, a winze 44 feet linear depth is reported by the lessees, and at the bottom of the winze the ore shoot is 12 feet long and 2 inches wide; the values are unpayable. Prospecting should be carried out on the same lines as recommended for the Black Cat G.M.L. 3716.

P.A. (late King of the Range lease).—A prospecting area embracing the main workings of the late King of the Range and Range Queen leases has recently been pegged.

The workings off the old main shaft on the late King of the Range lease were accessible to ground water level at 104 feet V.D. A quartz reef of lenticular habit, striking N. 15° W. and dipping 40° W., has been stoped out from 23 feet V.D. to ground water level. The stoping pitches steeply to the south-east, and the average width of the quartz stoped is reported to be one foot. On the 81 ft. V.D. level the stope length is 82 feet, and on the 106 ft. V.D. level the stope length is 50 feet, showing a shortening in length of the shoot with depth. The shoot is reported to be underhand stoped to 20 feet below the 106 ft. V.D. level. Quartz stringers are showing in the faces of the drives.

The holders say they have reliable information that the shoot is worth working below water level, and they are about to unwater the shaft. It seems unlikely that work would have ceased here with ore in sight, and judging from the occurrence of other ore bodies in this vicinity the shoot should soon diminish to a stringer. Prospecting on the same lines as recommended for the Black Cat G.M.L. 3716, however, may disclose new shoots of ore.

There is a new shaft, shaft B, approximately 2 chains north-west of the old main shaft, being sunk on a 4-inch quartz stringer which is reported to assay 2 oz. 13 dwts. gold per ton. The shaft is vertical for 10 feet, and then underlies 45° W. for 30 feet.

CHERITON'S FIND.

Cheriton's Find is situated on the main road to Ravensthorpe, approximately 9 miles south from the Olga Group.

The place was abandoned, and there were no accessible workings. The geology is obscured by ferruginous laterite and red soil, the only outcrops being greenstones in an area of about 40 acres to the south of late G.M.L. 3032. Amygdaloidal lavas and tuffs striking N. 50° W. and dipping 50° S.W., constitute the major portion of the greenstones. Lenticular quartz-reefs, parallel with the enclosing greenstone country, have been mined here, but no extensive work has been done. The strike of the country is becoming more westerly, and one gains the impression that another major anticlinal nose is being approached, though no evidence can be produced to establish the idea. The paucity of outcrops makes it impossible to elucidate the geological structure. All efforts to locate the ferruginous quartzite beds in this vicinity have failed.

SOUTHERN CROSS.

Three Boys G.M.L. 3444.—The company holds two leases, viz., Three Boys G.M.L. 3444 and the Messina G.M.L. 3526, but the latter was under exemption and not being worked. There is a 10-head battery operating and a cyanidation plant is under construction. On the Three Boys lease, lode material in ferruginous quartzite beds constitutes the ore bodies. The ferruginous quartzites are interbedded with greenstones which strike N. 35° W. and dip 55°-70° S.W.

The main shaft has been sunk to ground water level at 96 feet V.D. and the main north-east crosscut at this level intersects three lodes; the West lode, the Central lode, and the East lode.

West Lode.—This lode, which has an average width of 2 feet 6 inches, was intersected in the main north-east crosscut, 28 feet from the main shaft, where it has been driven on for 67 feet. The values are reported to be unpayable, averaging only 2 dwts. gold per ton.

Central Lode.—This lode was encountered 122 feet from the Main Shaft and it is the main ore body. Driving has been carried out 143 feet north-west and 185 feet south-east of the main north-east crosscut, and the average width of the lode material is 9 feet. Stopping has been done in the north-west drive north-west from the main north-east crosscut, over a length of 70 feet. From the crosscut to 43 feet in the drive the stopping extends overhead to 50 feet V.D. from the surface, and from 43 feet to 70 feet the overhand stopping is 16 feet 6 inches high. There is a gradual increase in stope length upwards from the 96 ft. level, and at the 64 ft. level the stope length is 81 feet.

It is reported that a parcel of 817 tons stoped from here averaged 11 dwts. 9 grs. of bullion per ton, of which 5 dwts. 13 grs. are still in the sands.

The width of the lode is variable, and this is due to the presence of dragfolds which pitch flatly to the north-west.

East Lode.—The main north-east crosscut intersects this lode at 150 feet from the main shaft. The ore body is 18 feet wide and is exposed for a length of 66 feet. The lode material is in the nose of a tightly compressed anticline pitching 40° N.W., and this accounts for the values pitching into the floor at the north-west end of the drive. The average value of the ore is reported to be 6 dwts. gold per ton.

At the 75 ft. level off Shaft No. 6, which is situated 290 feet from the main shaft on a bearing of 125°, a ferruginous quartzite lode, said to average 6 dwts. gold per ton, is being opened up. The width is 22 feet and the exposed length is 50 feet.

Conclusions.

1. The different beds of ferruginous quartzite are repetitions of the one bed by folding. Dragfolds occur on the limbs of these folds and it is in these structures that the best values are likely to be obtained. The appearance of new lines of lode or the disappearance of some of the present ones is likely, and it is expected since the dragfolds have a flat northerly pitch. For example, if we are on the limb of a north pitching anticline and proceed southwards, dragfolds well down on the limb will gradually emerge at the surface.

Quartz stringers are present in the ore shoots, and this is the case in all mines working ferruginous quartzite lode material.

2. The recommendations for prospecting of the Nevoria Group are applicable here, but it should be noted that in the vicinity of the Three Boys lease the pitch of the dragfolds is along the strike and not across it.

3. A considerable amount of secondary enrichment has occurred and there will probably be a decrease in values below ground water level.

NEW ZEALAND GULLY GROUP.

This group is situated near the source of New Zealand Gully 1½ miles south-west of Southern Cross. The country is mainly greenstone but a grey schist

bed, 6 chains wide, has been recognised along the east margin of the group. There are discontinuous outcrops of anthophyllite rock (an aluminous amphibole) to the east of the grey schist bed. The general strike of the country is N. 30° W. and the dip varies from 70° N.E. to 70° S.W. Quartz reefs, and lode material with quartz stringers, parallel to the enclosing country, have been mined in this group. The ore bodies appear to be arranged *en echelon*; stepping to the east going north.

Queen Ann, G.M.L. 3473.—There is a 5-head battery on this lease but an insufficient water supply impedes its operation. Two "gold lines" are present on the lease.

West Line.—Lode material associated with quartz stringers in greenstone country is being mined at the 22ft. level over a width of 6 feet and a length of 100 feet. There is an insufficient amount of work done to establish the pitch of the shoot. The primary gold is probably confined to the quartz stringers and the lode material is the result of secondary enrichment. The average value of the ore is reported to be 3 to 4 dwts. gold per ton by amalgamation, and 3 dwts. gold per ton by cyanidation.

East Line.—A quartz reef of lenticular habit, situated at the western contact of the grey schist with the greenstone, is being mined. Several shafts have been sunk on this reef but the only accessible shaft was that adjacent to the battery. The quartz varies in width from a stringer to 8 feet, and the values are reported to vary from 4 dwts. gold per ton to 14½ dwts. gold per ton. Stopping has been carried out sporadically from the surface to 70 feet V.D. over a length of 110 feet. Ground water, which is reported to be encountered in this shaft at 90 feet V.D., is being used in the battery. The quartz is underfoot on the 70ft. level, and sulphides are reported in the quartz at depth.

Prospecting is recommended along the whitestone-greenstone contact, and also at the eastern contact of the grey schist.

Taroola North, G.M.L. 3637.—The greenstone country on this lease strikes N. 25° W. and dips 70° S.W. The working shaft was inaccessible at the time of inspection and the following information is reported.

The shaft is 45 feet V.D., and from the bottom there is 35 feet of driving on lode material with quartz stringers. Stopping has been carried out 25 feet overhead, and the average width is 4 feet. The values throughout have been low, and the lode material is unpayable in both faces of the 45ft. level drive.

Taroola, G.M.L. 3802.—The greenstone country on this lease strikes N. 40° W. and the dip varies from 70° S.W. to 70° N.E. There are three working shafts on this lease, and lode material with quartz stringers constitutes the ore bodies.

Main Shaft.—This shaft is situated near the north boundary of the lease and is vertical to 43 feet, where it underlies at 70° N.E. to 120 feet V.D. from the surface. Quartz and lode material have been stoped between 32 feet V.D. and ground water level at 110 feet V.D., over an average length of 40 feet and an average width of 4 feet. The average value of the ore stoped is reported to be 8 dwts. gold per

ton. The quartz attains a width of 1 foot in places, and sulphides were seen in some of the quartz on the dump.

Shaft A.—Shaft A is situated approximately 145 feet south-east of the Main Shaft. Opencutting, of lode material with quartz stringers, has been carried out 36 feet north-west and 38 feet south-east of the shaft, over a width of 3 feet 6 inches and to a depth of 6 feet. The shaft is 30 feet V.D. and the lessees are preparing to drive on the ore body. It is reported that a crushing of 15 tons of ore taken from the open cut on the south-east side of the shaft yielded 8 dwts. gold per ton by amalgamation and 8 dwts. gold per ton by cyanidation.

Shaft B.—Shaft B is situated 250 feet from Shaft A on a bearing of 120°. The shaft is 47 feet V.D. and there is a north-east crosscut for 34 feet, in which 4 feet of reported payable lode material was encountered.

As mentioned previously, the ore bodies in this group are arranged *en echelon* and this should be borne in mind when prospecting for new shoots. When driving north-west from known ore shoots offset to the east, and when driving south-east offset to the west.

Also, lateral prospecting may be done to advantage, north-east and south-west from the known ore shoots.

BLACKBOURNE'S FIND.

This find is situated in greenstone country approximately 5 miles south-south-west of Southern Cross. There are three "gold lines," and vuggy, ironstained quartz reefs with lenticular habit have been mined. The reefs are parallel to the enclosing greenstone country, which has a general north-south strike and dips 65° E. The ore shoots pitch 60° S., and are arranged *en echelon*; the shoots stepping to the east going north. There is a dryblown patch here from which a small amount of eluvial gold has been won.

The official production figures for this find to 1933 show that 1,467.90 tons of ore were crushed yielding 383.53 fine ozs. of gold.

One prospecting area, embracing the ground formerly occupied by G.M.L. 887, was in existence at the time of inspection. At the north end of the property some old workings were being cleaned out with a hope that, owing to the enhanced price of gold, further stoping of the shoot could be carried out. The ore shoot occurs within a quartz reef, and the reef as a whole is not payable. The shoot has been stoped out from the surface to 140 feet V.D. over an average width of 4 feet and an average length of 95 feet. Ground water was encountered at 188 feet V.D. from the surface.

Conclusions.—It is unlikely that any appreciable quantity of ore will be mined from the old workings, and the prospectors should apply their efforts to

prospecting for entirely new ore shoots. Lateral prospecting eastwards may disclose other "gold lines." Also, new shoots may be found by prospecting to the north of the old workings, remembering that they will be *en echelon* with the old shoots. At the north end of the driving at the 95 ft. V.D. level the reef is swinging eastwards, and if it resumes the favourable strike further north another ore shoot should exist.

MT. RANKIN.

No Trumps G.M.L. 3555.—Two beds of ferruginous quartzite striking N. 55° W. and with a general dip 70° E. form a prominent ridge traversing the centre of this lease. At least two other ferruginous quartzite beds exist, but their outcrops are discontinuous. Greenstones are interbedded with the ferruginous quartzites and the country is contorted. Areal mapping* has shown that Mt. Rankin is situated on the west limb of a syncline pitching 50° S.E. It is believed that there is only one horizon of ferruginous quartzite, and the existence of other beds may be explained by drag-folding.

Mining operations have been confined to the western of the two prominent ferruginous quartzite beds. Four isolated shoots of ferruginous quartzite lode material with quartz stringers, situated in the noses of dragfolds and pitching with them 50° S.E., have been worked in the past.

The official production figures for this lease from 1909-1910 show that 244 tons of ore were crushed, yielding 52.67 fine ozs. of gold.

The lessees are mining patches of ore from the old workings, and a crushing of 16 tons taken from the open cut near Shaft No. 1 (the northern shaft) is reported to have yielded 13 dwts. bullion per ton by amalgamation, and 4 dwts. bullion per ton by cyanidation. Secondary enrichment by circulating waters has undoubtedly played an important role in the formation of the ore shoots, and values may be expected to decrease below ground water level. The best values are obtained in the white coarser-grained patches in the ferruginous quartzite, provided these patches are in a favourable structure. There are more pore spaces available for the deposition of secondary gold in the coarser-grained patches, and this accounts for the improvement in values.

It is reported that Shaft No. 2 is 230 feet V.D., and ground water level has not yet been encountered.

Prospecting is recommended in the noses of dragfolds, which occur along the strike of the main ferruginous quartzite bed. Also, shoots of ore are likely to be found in the other ferruginous quartzite beds, and these should be prospected. The greenstones warrant exploratory work north-east and south-west from the Mt. Rankin line because auriferous quartz reefs may exist.

* See Plate No. VI.

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DIVISION V.

Annual Report of the Schools of Mines of W.A.

The Under Secretary for Mines.

I have the honour to submit, for the information of the Hon. the Minister, my report for the year 1936.

KALGOORLIE SCHOOL OF MINES.

Enrolments.

The individual enrolments reached a maximum of 629 as compared with 476 during 1935, this constituting the highest enrolment in the history of the school. Statistics are furnished herewith, showing the individual and class enrolments for each term.

Revenue.

The revenue for the school year, including fees received in connection with the self-supporting class in Internal Combustion Engines amounting to £211, has been £1,140.

In addition, fees received for investigations conducted in the metallurgical laboratory amounted to £342, all of which has been paid into the Metallurgical Laboratory Trust Fund established by arrangement with the Commonwealth Council for Scientific and Industrial Research to meet maintenance costs in connection with the laboratory.

Staff.

At the commencement of the year Mr. E. N. Johns, A.W.A.S.M., was appointed Assistant Lecturer in Engineering and in consequence of the absence on long service leave of Mr. E. H. Illidge, Lecturer in Mathematics and Physics, Mr. N. B. Hall was appointed a temporary Assistant in Chemistry and Mathematics.

To assist in the conduct of practical work, Demonstrators were appointed in Physics, Mathematics, Chemistry, Geology, Mechanical Drawing and Surveying and, in consequence, students have received more personal instruction than could have been given by the lecturers alone.

Mr. P. E. Clarke, B.M.E., was appointed Instructor in Mining I. and carried out the duties efficiently.

A messenger was appointed to assist the office staff and he has been of very great assistance.

I regret to have to record the death of Mr. J. B. McNeil, Instructor in Engine-driving, who had conducted the classes in the two grades of that subject for the past ten years.

Unfortunately, the School is losing the services of Mr. A. R. E. Bosustow, Instructor in Internal Combustion Engines, who has conducted this class since 1916, and I am pleased to be able to pay tribute to the excellent work performed by this officer.

The permanent members of the teaching staff have had a very strenuous year and all have given of their best to the work of the School and the advancement of the students.

Public Assay Department.

The assistance offered to prospectors by this branch of the School's activities has again been freely availed of, although to a somewhat less extent than during the preceding three years. The number of free assays and mineral determinations carried out during the year has been as follows:—

Assays for Gold	1,128
Assays for Other Metals	9
Mineral Determinations	111
Total	1,248

Metallurgical Laboratory.

The demand for the assistance to the industry rendered by the metallurgical laboratory has shown no sign of diminishing and, during the year, 45 investigations into the treatment of ores and metallurgical products have been completed and reports have been issued to the persons and companies seeking this advice. In connection with this work, 1,766 assays for gold have been carried out, 158 grading analyses and 283 chemical analyses, not including routine tests of cyanide solutions. The total revenue received from the laboratory has been £342, which has been paid into the special Metallurgical Laboratory Trust Fund.

Equipment.

In consequence of the very large increase in enrolment during the last few years the resources of the School have been severely taxed and it is necessary that serious consideration be given to the possibility of increasing the equipment in all departments.

The equipment for the Internal Combustion Engines Class is now being increased by the purchase of a horizontal Diesel engine and a new engine room is being built to accommodate the engine and boiler.

Buildings.

The accommodation at the School during recent years has been found inadequate and many of the large classes have been carried on under serious difficulties. If the numbers continue to increase, consideration must soon be given to the extension of existing buildings, particularly to the completion of the original design of the Geological Department.

Correspondence Classes.

Correspondence classes in Mining I., Metallurgy I., and Assaying I. were inaugurated during the year and the enrolments were as follow:—

Mining I.	..	..	..	57
Metallurgy I.	..	..	..	32
Assaying I.	..	..	..	24

These classes have thrown additional duties on certain members of the staff, who have carried out their additional duties conscientiously.

WILUNA SCHOOL OF MINES CLASSES.

A branch of the W.A. School of Mines was established in Wiluna in August, 1936, and a strong local committee was formed to advise the Department in connection therewith. The members of the committee are as follow:—Messrs. J. H. Terrell (Chairman), K. Moylan, W. Wainwright, J. O'Shanghnessy and Rev. Collard.

Classes.

The classes were commenced under local instructors drawn mainly from the technical staffs of the Wiluna and the Moonlight Mines, and these classes were satisfactorily conducted. Classwork was carried on in Mathematics, Mechanical Drawing, Electrical Work, Assaying, Mining, Metallurgy, Surveying and Internal Combustion Engines. Towards the end of the year a class in Chemistry was commenced and the class in Metallurgy was discontinued to allow the students to obtain a better knowledge of chemistry.

Enrolments.

These were as follow:—

Mathematics	..	..	..	64
Mechanical Drawing	..	..	..	24
Electrical Work	..	..	..	30
Assaying I.	..	..	..	13
Mining I.	..	..	..	52
Metallurgy I.	..	..	..	13
Surveying I.	..	..	..	14
Internal Combustion Engines				31
Total	..	..	..	<u>241</u>

The number of individual students was 165.

These numbers were very gratifying but it is not anticipated that they will be maintained in 1937.

Equipment.

The classes commenced with no equipment, but the General Manager of the Wiluna Mine was good enough to place the mine laboratory and equipment and the equipment of the workshops at the disposal of the Department. This enabled successful work to be carried on for the time being. It will be necessary, however, to build a laboratory to carry on the higher grade of chemistry and physics as early as possible.

Classrooms.

Lecture work was carried on in the Church of England and the Salvation Army halls respectively, and in the public school adjacent to the mines. It is probable that better facilities will be available at the town school for future classwork.

The necessary tables, blackboards, text books and other movable equipment were procured as required during the year.

General.

The extension of the classwork to Wiluna has been greatly appreciated as it enables the young men so far removed from the city to take up studies which will improve them in every way and make them more serviceable to the industry.

The Wiluna students work to the ordinary School of Mines syllabuses and take the School of Mines examinations. They are thus able to qualify for certificates and diplomas in the same way as the Kalgoorlie students.

I have to thank you, Sir, and the Department for your ready assistance during the year.

J. F. LYNCH,
Director School of Mines.

DIVISION VI.

Annual Report of the Inspection of Machinery Branch of the Mines Department for the Year 1936.

Operations under "The Inspection of Machinery Act, 1921." Annual Report of the Chief Inspector of Machinery and Chairman of the Board of Examiners for Engine-drivers, for the year ended 31st December, 1936, with statistics.

The Under Secretary for Mines.

For the information of the Hon. Minister, 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, 1936.

The work of this branch of the Mines Department is still increasing, and during 1936 the increase in the number of boilers and groups of machinery inspected was more rapid than in any previous year. The total number of Engine-drivers' Certificates issued was less than in 1935, but was well above the average of all years since 1922, when the Inspection of Machinery Act, 1921, came into force. The number of accidents to persons caused by machinery decreased by 4, but unfortunately 5 persons died from their injuries. Of these, three deaths were due to accidents on mines and have been dealt with in my report on the Mining Industry.

The financial position is again very good, a credit balance of £1,382 19s. 9d. being shown.

RICHARD C. WILSON,
Chief Inspector of Machinery.

To the Chief Inspector of Machinery.

Sir,

I have the honour to submit for the information of the Hon. Minister for Mines the following report on the operations of "The Inspection of Machinery Act, 1921," in the districts proclaimed thereunder, together with statistical tables for the year ended 31st December, 1936.

For the convenience of reference the report is divided as follows:—

1. Inspection of Boilers, New Construction, Maintenance.
2. Explosions, Interesting Defects, Tests, etc.
3. Inspection of Machinery.
4. Prosecutions under the Act.
5. Accidents to Persons due to Machinery or Boilers.
6. Engine-drivers' Examinations and kindred matters.
7. General, Staff, Mileage.
8. Revenue and Expenditure.

SECTION I.

Inspection of Boilers.

The total number of registered boilers, including various types of unfired pressure vessels, such as steam jacketed pans, digesters, vulcanisers, air and gas receivers, etc., which were fit for use according to records, was 4,121 on 31st December, 1936, compared with 3,969 on 31st December, 1935, making a net increase of 152.

There was a total of 160 boilers added to the register during 1936, including 7 second-hand boilers imported from other Australian States, 7 of which were transferred from the jurisdiction of other authorities in this State, and 146 new registrations, of which 44 were imported from the United Kingdom, 31 from other Australian States, 15 the origin of which has not been traced, and 56 which were built in Western Australia. The number of boilers built in W.A. was approximately 38 per cent. of the total of new registrations, compared with 41 per cent. in 1935, 33 per cent. in 1934, and 14 per cent. in 1933. The types built in W.A. were:—2 vertical stationary, 23 return multi-tubular stationary underfired, 3 locomotive portable rectangular firebox, 1 locomotive boiler, 26 air receivers, 1 steam cooker.

There were 8 boilers removed from the register during 1936. Of these one was converted to other uses, 6 were condemned as unfit for further use, and one transferred to another department not under the jurisdiction of the Act.

Thorough inspections numbered 1,981, being an increase of 166 over the figures for 1935 and 268 more than the figures for 1934.

Working inspections, that is, inspections made of boilers under working conditions, amounted to 111, compared with 44 in 1935. These working inspections are frequently of great value, and should, whenever possible, be made at least once during the currency of each certificate, but to do this more inspectors would be required.

The number of boiler certificates issued during 1936 was 1,982, compared with 1,827 in 1935, making an increase of 155 for the whole State. The increase for the districts worked from Perth office was 24, and from Kalgoorlie office 131. The large increase in the latter is accounted for by the fact

Maintenance.

Generally the maintenance has been good. The Kalgoolie Electric Light and Power Corporation increased their boiler plant by adding four second-hand Babcock & Wilcox double-drum boilers. They have also installed a water-softening plant, and replaced the cast-iron fittings on the saturated steam boilers and lines by cast-steel fittings, preparatory to fitting superheaters to all their boilers.

There have also been some changes in the boiler nests on the mines. In one case a nest of Lancashire boilers working at 120 lbs. was replaced by second-hand Babcock & Wilcox boilers at 160 lbs., and in another case additional boilers were added to the nest on account of the larger tonnage which was being handled by the winding engine.

In two widely-separated districts trouble has been experienced, due to feed water supplies deteriorating to a marked extent and causing very rapid corrosion.

On the Murchison Goldfield the trouble is probably due entirely to a succession of dry years, but in the South-Western corner of the State the water supplies appear to be gradually deteriorating, due to the clearing of the land, and this has been accentuated by two exceptionally dry years. If owners would take the trouble to erect batteries of condenser tanks to condense as much of the exhaust steam as possible, and pass the make-up water through a suitable softening plant, damage to their boilers could be reduced to a negligible amount. Owing to the scarcity of water it is not possible to use either jet or surface condensers, but if the condenser tanks have a sufficient area exposed to the air and are erected in an exposed situation, a large percentage of the exhaust steam will be condensed, and may be returned to the boilers. This method of condensing exhaust steam from non-condensing engines has been the custom on the Goldfields from the earliest days, but has not been utilised elsewhere to the same extent. Unfortunately on many gold mines a large percentage of the condensed water collected is used for domestic purposes as a fresh water supply for the staff and other employees to the detriment of the boilers. The only other suitable water supply available in many cases is the rain water collected from the roofs.

An outstanding example of the changes which can take place in the quality of feed water in a short time occurred in the case of a sawmill in the South-West of this State. A second-hand Babcock & Wilcox boiler almost as good as new was installed at this mill when 17 years old, and worked for six years without any noticeable deterioration to the drum, although the tubes and nipples were considerably thinned, and several had to be renewed. The next year corrosion in the drum was recorded as 1/16in. deep; the following year 1/8in. deep; the following year very active corrosion was noted particularly at the front end of the drum, and a certificate for only three months issued at a reduced working pressure. The owner was advised to have the feed water analysed with a view to the installation of a suitable softening plant. When the boiler was next inspected after three months use, the general corrosion of all parts was so great that the whole boiler had to be scrapped, and a new boiler purchased. This expense

could have been avoided by installing a suitable treatment plant to counteract the acidity of the feed water.

A considerable amount of damage can be done to a boiler when it is not in use, unless proper precautions are taken. If a boiler is likely to be lying idle for more than a few weeks, it should be thoroughly cleaned and left dry, or else completely filled with water which has been made definitely alkaline, and to which a suitable reducing reagent has been added to chemically fix the oxygen, in order to prevent corrosion from taking place.

In one case it was found necessary to replace about 50% of the tubes in a water tube boiler which was only required for use intermittently and for about 2 months total time in each year, owing to suitable precautions not having been taken when the boiler was laid off.

SECTION II.

Explosions, Interesting Defects, etc.

In the case of boilers as defined in the Inspection of Machinery Act, 1921, no explosion occurred, but a liquid receiver, size 7ft. x 10in. x 7/32in., which was attached to an ammonia refrigerating plant of ten ton capacity, burst and caused the deaths of two men. As this vessel was less than 5 cubic feet capacity it was not subject to inspection and test. Neither the country of origin nor maker's name of the receiver were known. It was constructed of wrought iron with the longitudinal seam lap welded. The plate was thinner at the weld than elsewhere; the portion of weld which failed appeared to have been defective; the material of the shell when tested subsequent to the accident was found to be cold short, due to excess phosphorus and sulphur without the presence of adequate manganese; also the grain of the iron was lengthwise of the vessel. From the evidence given at the inquest, it appears that the plant had been running unsatisfactorily for some days prior to the accident, and the pressure on both the suction and delivery side was too high. On the day of the accident the delivery gauge pointer was up against the stop pin, which is so placed that the quadrant is then at the end of its travel as it is prevented from further movement by the supporting bracket. The pressure required to bring the pointer to this position would be not less than 340 lbs. and any pressure above this would only strain the Bourdon tube, because further movement of the quadrant and pointer would be impossible. There is therefore nothing to show what the actual pressure was at the time that the liquid receiver burst.

When the receiver burst, both men were standing close to it. They were saturated with liquid ammonia which caused their deaths, and they may also have received extensive burns from a fire which occurred, caused, probably, by the ignition of oil vapour from the accumulated oil in the liquid receiver.

It is proposed to amend the Inspection of Machinery Act, 1921, to provide better control of refrigerating plants, and for the granting of refrigeration certificates. It is also proposed to make it compulsory for the person in charge of refrigerating machinery over 5 ton capacity to hold a refrigeration certificate.

Two locomotive portable rectangular firebox boilers with engines attached which were built in England in 1911 by a well known maker, were found to have developed cracks in the seams which necessitated repairs. In one case the longitudinal seam of the barrel ring at the smoke box end gave trouble through leaking rivets some few years ago. These rivets were near the centre of the seam and directly over the turn table bracket to which the front axle was originally attached. The leaking rivets were cut out and replaced by countersunk patch studs. The longitudinal seam was a double riveted lap joint and the rivets which leaked were in the inner row of the outer lap. When repairs were in progress fine hair cracks were noticed in some of the rivet holes. These appeared to be radial cracks. Later the seam leaked again and the bottom of the barrel was cut out. It was then found that the outside lap of the longitudinal seam was cracked just below the rivet holes for nearly the full width of the plate, and the supposed radial cracks were where the crack had run into the rivet holes at about 45° angle. This crack started on the inside of the plate and was not visible on the outer skin except at the rivet holes, but had practically reached the outer skin for nearly the full length when the seam was cut out. Portions of the seam and the surrounding plate were sent to the University Engineering Laboratory for analysis and test. It was found that the cracking was definitely not due to caustic embrittlement, and as the similar seam in the other course of the same barrel and both seams in the sister boiler were not affected, it is thought that the excessive vibration to which this boiler was subjected some years ago may have caused the crack to develop.

The other similar boiler developed a leak in the mudwell to barrel seam. When the mudwell was removed it was found that it had not been bedded to the barrel before riveting, and was definitely a very bad fit. Also the rivets at each side had apparently been closed first and as the radius of the flange was smaller than that of the outside of the barrel the flange did not lie close to the bottom of the shell. The result was that the shell plate developed several longitudinal cracks on the extreme bottom, both front and back of the mudwell opening, and the mudwell was cracked right through at the shoulder of the flange both front and back.

SECTION III.

Inspection of Machinery.

The total number of groups of useful machinery registered on 31st December, 1936, was 12,925 compared with 11,435 at 31st December, 1935, being an increase of 1,490 or more than twice the increase for the year 1935.

The total number of groups of machinery inspected during 1936 was 10,250 compared with 8,615 in 1935, an increase of 1,635. This also is more than double the increase for the year 1935.

There were 398 notices issued to owners during 1936 dealing with the guarding or repair of machinery. This was 67 more than the number issued in 1935.

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 31st December, 1936.

Classification.	Districts worked from Perth.	Districts worked from Kalgoorlie.	Totals	
			1936.	1935.
No. of groups driven by steam engines ...	560	524	1,084	1,081
No. of groups driven by oil engines ...	1,628	585	2,213	1,995
No. of groups driven by gas engines ...	71	174	245	248
No. of groups driven by compressed air ...	2	52	54	47
No. of groups driven by electric motors ...	7,201	2,123	9,324	8,060
No. of groups driven by hydraulic pressure ...	5	...	5	4
	9,467	3,458	12,925	11,435

Return No. 5—Showing Operations in Proclaimed Districts during Year ended 31st December, 1936.

(MACHINERY ONLY.)

	Districts worked from Perth.	Districts worked from Kalgoorlie.	Totals.	
			1936.	1935.
Total registrations, useful machinery ...	9,467	3,458	12,925	11,435
Total inspections made	7,780	2,470	10,250	8,615
Certificates (bearing fees)	3,312	642	3,954	3,603
Certificates (steam, without fees) ...	165	21	186	263
No. of extension certificates issued under Section 42 of Act ...	...	...	...	...
Notices issued (machinery dangerous) ...	370	28	398	331

The number of passenger lifts has increased by 5, but from Return No. 6 it would appear as if there were 5 goods lifts less than in 1935. Actually 1 goods lift was dismantled when a building was pulled down preparatory to rebuilding, and four lifts previously classified as goods lifts are now registered as service lifts, owing to the lift regulations being amended.

Of the five new lifts installed, two were erected in a new 12-storey office building. One is a car control lift to carry 16 persons and designed for a maximum speed of 600 feet per minute, the enclosure doors being power operated. The other is a collective dual control to carry 16 persons, maximum speed 450 feet per minute. Both these lifts are in many respects an advance on anything previously erected in this State.

The only passenger lift at present working outside the Metropolitan District was erected in a department store at Albany during the year.

A number of existing lifts were thoroughly overhauled and as far as practicable, modernised. Some of these lifts have been in use for more than thirty years.

Permits were granted for the erection of 5 new passenger lifts, for the reconstruction of one existing passenger lift and for the erection of 1 new goods and two service lifts.

Return No. 6—Showing Classification of Lifts on 31st December, 1936.

Type.	How Driven.	Totals.	
		1936.	1935.
Passenger ...	Electrically driven ...	150	145
	Hydraulically driven	1	1
Goods ...	Electrically driven ...	105	109
	Hydraulically driven	3	3
	Belt driven ...	4	5
		263	263

SECTION IV.

Prosecutions under the Act.

There were no prosecutions during the year 1936. It was intended to prosecute certain persons under Section 66 (1) and 67 of the Act, but it was found after making inquiries and consulting the Crown Law Department, that sufficient evidence could not be obtained to make a conviction reasonably certain. The alleged offence in one case was trying to obtain a certificate by means of fraud by submitting false testimonials, and in the other of giving a false testimonial.

SECTION V.

Accidents to Persons.

Return No. 7 below only includes fatal accidents and those which caused the injured person to be unable to follow his or her ordinary occupation for a period of two weeks or more. (Section 50 of the Inspection of Machinery Act, 1921.)

The number of persons injured by accidents due to machinery, boilers as defined, or power plants was 29 in 1936 compared with 33 in 1935, and of these the number of persons who died from their injuries was 5, including three caused by surface accidents on mines, which are also included in the report of the State Mining Engineer on the mining industry. Machinery accidents in timber mills are not included in this return, as the machinery on timber mills is not subject to the provisions of the Inspection of Machinery Act, 1921, but comes under the Timber Industry Regulation Act, 1926. Of the 5 circular saw accidents only one could have been prevented by a guard. In this case the accident was caused by the belt fastener catching the end of the board which was being sawed across. The operator's hand was jammed against the table by the board. This accident could have been avoided by exercising more care, but to prevent a recurrence, a guard was placed over the horizontal belt drive and round the pulley. Of the other four, one was due to stupidity on the part of the operator and the rest to pure misadventure.

Two of the three buzzer accidents were due to the guard not being kept in proper adjustment. The other was due to trying to plane two pieces of tongued and grooved matchboard or flooring at the same time. When the cutter struck a knot in one board, the board was forced back and the operator's left index finger was fractured through being caught in the gap by the knives. This was a square head machine.

The remainder of the non-fatal accidents present no special features and the majority could have been avoided by a little more care and forethought on the part of the injured persons.

Two of the fatal accidents were due to the bursting of an ammonia liquid receiver and were commented on in Division II.; the other three were mining accidents and have been commented on by the State Mining Engineer in his report on the mining industry.

Return No. 7—Showing Persons Killed or Injured by Boiler and Machinery Accidents in Proclaimed Districts during Year ended 31st December, 1936.

Numbers within brackets denote fatal accidents.

Class of Machinery.	Districts worked from Perth.	Districts worked from Kalgoorlie.	Total.
Metal Working—			
Wire Drawing Machine ...	1	...	1
Sawmilling and Woodworking—			
Circular Saw ...	5	...	5
Vertical and Spindle Moulder	...	1	1
Buzzer ...	2	1	3
General—			
Belting ...	1	3 (1)	4 (1)
Cutting Machine ...	1	...	1
Lead Roller ...	1	...	1
Dough Breaker ...	1	...	1
Hoist ...	2	...	2
Pumps ...	...	1	1
Gear Wheels ...	1	...	1
Printing Machine ...	1	...	1
Jib Crane ...	1	...	1
Shafting ...	...	2 (1)	2 (1)
Suction Gas Producer ...	...	1 (1)	1 (1)
Teasing Machine ...	...	1	1
Liquid Ammonia Receiver ...	2 (2)	...	2 (2)
	19 (2)	10 (3)	29 (5)

SECTION VI.

Engine-drivers' Examinations and Kindred Matters.

The total number of certificates granted in 1936 was 591, compared with 646 in 1935. This decrease of 55 in the total is of no great moment, because there was only a shortage of winding engine-drivers, which has now been overcome. There were 71 winding certificates granted in 1936, 42 in 1935, 19 in 1934 and 5 in 1933, making a total of 137 in four years.

The greatest decrease was in the number of boiler attendants' certificates granted. This is due to a large number of candidates having sufficient experience to make them eligible to sit for the examination for third class certificate without having previously obtained a boiler attendant's certificate.

Examinations were held as follows:—Perth 4, Kalgoorlie 4, Leonora 2, Cue 2, Meekatharra 3, Bunbury 2, Geraldton 1. Examinations were held at all the centres advertised.

The Board of Examiners met on 51 days in Perth, dealing with candidates' applications for certificates and other matters in connection with engine-drivers,

also to correct and mark examination papers. The travelling Board spent 26 days conducting exams. and a further 38 in travelling, etc.

The number of applications which were received and considered by the Board was 686, which was 62 less than in 1935, but 281 more than in 1934.

Complaints and Inquiries, etc.

Several complaints were made regarding the employment of uncertificated persons, contrary to Section 53 of the Act. All of these complaints were investigated, and steps were taken to see that only duly certificated persons were employed where required by the Act.

The personnel of the Board of Examiners remained unchanged.

Return No. 8—Showing Total Number of Engine-drivers and Boiler Attendants' Certificates (all classes) Granted in 1936, compared with 1935.

	Number Granted.	
	1936.	1935.
Winding Competency, including Certificates issued under Regulation 40 and Section 60 of Act	71	42
First Class Competency, including Certificates issued under Regulations 40 and 45 and Sections 60 and 63 of Act	15	26
Second Class Competency, including Certificates issued under Regulation 40 and Section 60 of Act	87	64
Third Class Competency, including Certificates issued under Regulations 40 and 45 and Sections 60 and 63 of the Act	121	135
Locomotive Competency	17	10
Traction Competency	2	5
Internal Combustion Competency	122	121
Crane and Hoist Competency	21	14
Boiler Attendant Competency	122	207
Interim	1	5
Copies	9	6
Transfer	3	11
Totals	591	646

SECTION VII.

General.

An electric winding engine on the Oroya south shaft of the Gold Mines of Kalgoorlie was fitted with a new type of speed and overwind controller, which was supplied by the Security Electric & Manufacturing Co., Ltd., of Sydney. The sensitiveness of this controller is independent of the speed, because instead of the usual centrifugal governor, which is insensitive at low speeds, the control equipment is operated by an electric generator which regulates the speed through relays on the control panel.

By means of cams on control discs, one of which is operated by each drum, the maximum speed of winding at any part of the wind can be predetermined and cannot be exceeded by the driver. The maximum rate of acceleration or retardation can also be controlled.

There are two instruments on the driver's platform, one of which shows the actual speed of the cage or skip in feet per second, and the other shows

the safe winding speed. The dial of the latter instrument is divided into two sectors coloured white and red respectively and clearly marked "safe" and "danger." While the pointer is in the white sector the driver knows that the safe speed for that portion of the wind is not being exceeded, but if the pointer is allowed to reach the red sector, then the winder will be brought to rest by the speed controller.

If desired, the speed controller can be automatically adjusted by means of the bell signals to lower maximum speeds when men are in the cage.

Overwinding and starting in the wrong direction are guarded against. Neither clutch can be released unless the brake for that drum has been fully applied, and the brake cannot be lifted unless the clutch on that drum is engaged. A trip switch is fitted to each brake, which prevents the winder being operated unless the brake is in proper adjustment as regards clearance between the piston and the bottom of the cylinder of the brake donkey.

The Sons of Gwalia, Ltd., have installed an improved overwind-overspeed device, and also have made improvements to the electrical device which notifies the driver by audible and visual signals should any of the centre supports of the main underlay shaft timbering become displaced. These alterations have been made with a view to preventing skip derailments, which have caused extensive damage in the past, involving costly stoppages and extensive repairs.

Two new electric winding engines which are operated on the Ward Leonard System were installed at Wiluna; they are the first of this type to be installed in this State.

The W.A. sub-committee of the Standards Association of Australia Boiler Sectional Committee held two meetings during the year of 1936.

Neither the Inspection of Machinery Act, 1921, nor the Regulations were amended during 1936.

Inspectorial Staff.

There were no changes either in numbers or in positions during the year. The services of one inspector stationed at Kalgoorlie have been utilised to report on electrical installations on mines, more especially where current above medium pressure is to be employed underground.

Clerical Staff.

The clerical staff was increased by one junior clerk.

Mileage.

The total number of miles travelled by inspectors during the year 1936 was 69,863. This was 12,427 miles more than the total for 1935. The large increase in the miles travelled by water was due to the biennial trip to Wyndham falling due in 1936; but in spite of this, the average number of miles travelled per inspection was only .09 higher than for 1935.

Return No. 9.—Showing Distances Travelled, Number of Inspections Made and Average Miles Travelled per Inspection for Year ended 31st December, 1936.

	Rail Miles.			Road Miles.			Water Miles.			Total Miles.			Total Number Inspections.			Average Miles per Inspection.		
	1936.	As compared with 1935.		1936.	As compared with 1935.		1936.	As compared with 1935.		1936.	As compared with 1935.		1936.	As compared with 1935.		1936.	As compared with 1935.	
		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.			
Districts worked from Perth ...	1,108	...	220	42,709	1,825	...	4,457	4,395	...	48,274	6,000	...	9,333	622	...	5·17	·32	...
Districts worked from Kalgoorlie	276	...	885	21,313	7,312	...	...	...	...	21,589	6,427	...	3,009	1,246	...	7·17	...	1·43
Totals ...	1,384	...	1,105	64,022	9,137	...	4,457	4,395	...	69,863	12,427	...	12,342	1,868	...	5·57	= Average all Districts, 1936.	
Increases or Decreases ...	...	Decrease 1,105		...	Increase 9,137		...	Increase 4,395		...	Increase 12,427		...	Increase 1,868		...	Average all Districts, 1935.	
																5·48	Average Increase ·09 mile per inspection.	

SECTION VIII.

Revenue and Expenditure.

The total revenue for 1936 was £811 0s. 7d. more than the total for 1935, but the expenditure for 1936 exceeded that for 1935 by £1,498 5s. 10d. There was a credit balance of £1,382 19s. 9d.

Return No. 10.—Showing Revenue and Expenditure for Year ended 31st December, 1936.

REVENUE.

	1936.		1935.	
	£	s. d.	£	s. d.
Fees for Boiler Inspections ...	2,921	5 2	2,739	14 5
Fees for Machinery Inspections ...	4,746	2 8	4,166	3 1
Engine-drivers' Fees ...	863	1 0	847	18 0
Incidentals ...	103	18 5	70	11 2
Increase—£810 0s. 7d. ...	8,634	7 3	7,824	6 8

EXPENDITURE.

	1936.		1935.	
	£	s. d.	£	s. d.
Salaries ...	5,330	9 4	4,256	0 0
Incidentals ...	1,735	1 3	1,281	8 9
Engine-drivers ...	185	16 11	215	12 11
Increase—£1,498 5s. 10d. ...	7,251	7 6	5,753	1 8

Profit—£1,382 19s. 9d.

I desire to thank all those who helped in achieving the satisfactory results of the year's work. Valuable assistance has been given by officers in other Government Departments in this State and also officers of Government Departments of other States and the Commonwealth.

In particular I wish to thank all the officers of this Branch and the Mines Department for their hearty co-operation.

G. MOORE,
Deputy Chief Inspector of Machinery.

DIVISION VII.

Annual Report of the Chemical Branch, Mines Department, for the Year 1936.

The Under Secretary for Mines.

I have the honour to present, for the information of the Hon. Minister for Mines, my annual report for the year 1936.

Staff.—Several changes in the staff took place during the year. Serious ill-health compelled Mr. D. G. Murray, A.A.C.I., a senior Mineralogist and Chemist, to resign in March and three months later he died. The Department thereby lost the services of a very able scientist whose special study for many years had been the chemistry of the rare metals and their natural compounds. Miss H. T. Cole, B.Sc., A.A.C.I., for private reasons resigned her position as chemist in the Agricultural Section where her most important work had been the study of the factors influencing the growth of exotic pines.

The demands on the staff are growing rapidly and the expansion of the Branch in the near future is inevitable. Additional staff is urgently required and with it further accommodation, equipment and funds.

Equipment.—Our assay equipment has been considerably improved by the substitution late in the year of oil-fired for coke and charcoal-fired furnaces.

A grant of £80 from the Trustees of the Commonwealth Metalliferous Fund has enabled us to considerably supplement our spectrographic equipment so that it is now possible to investigate many problems involving traces of unusual elements with a reasonable prospect of success.

Another modern implement of investigation, an ultra-violet lamp, is badly needed to supplement the means already at our command.

The condition of the library is still deplorable, owing to the complete lack of sympathy of the Treasury with our needs in this direction: It seems impossible to convince the lay mind that a small isolated band of scientists cannot be expected without external aid to give the soundest advice to the Government and people on scientific and industrial problems. A steady stream of new books and current journals cancels the evil effect of physical isolation, and places the brains and experience of the whole scientific world at the disposal of the people of Western Australia in a way that can never otherwise be achieved.

Inefficient ventilation in the Government Laboratory still causes us serious misgivings. It is only in recent years that one has come to realise the serious effects upon human beings of such common laboratory conditions as an atmosphere charged with silica dust from crushing machinery, lead fumes from assay furnaces, or vapour from frequently used toxic reagents, such as hydrogen fluoride, hydrogen sulphide, benzene, halogen compounds of organic radicles, etc.

Nature of Work Done.—The total number of samples registered for investigation during the year was 6,618. The number of individual determinations greatly exceeds the number of samples, each of which usually requires a search for more than one constituent. The samples received are classified in the following table:—

TABLE SHOWING SOURCE AND ALLOCATION OF SAMPLES.

Source, Department, etc.	Section 1. Foods, Drugs and Toxicology	Section 2. Mineralogy and Geo- chemistry.	Section 3. Agriculture and Water Supply.
Mines—State Batteries ...	2	1,220	...
State Mining Engineer ...	...	78	...
Geological Survey ...	1	245	5
Government Chemical Laboratory ...	28	91	13
Explosives Branch ...	14	...	...
School of Mines ...	...	1	...
Health—Commissioner of Pub- lic Health ...	220	...	9
Hospitals ...	101	...	3
Agriculture ...	113	...	623
Public Works ...	10	1	116
Main Roads ...	2	...	...
Metropolitan Water Supply ...	7	...	1,841
Treasury—Government Stores Workers' Homes Board ...	136	3	1
Police—Criminal Branch ...	...	1	...
Liquors Inspection Branch ...	106	...	...
Crown Law ...	12	...	...
Factories ...	3	...	...
Forests ...	4	...	...
Lands ...	7	...	92
Chief Secretary's—Aborigines State Hotels State In- surance ...	...	8	...
Local Governing Bodies ...	1	...	...
Agricultural Bank ...	7	...	...
Miscellaneous ...	...	...	4
Public Pay ...	45	517	448
Public Free ...	15	453	2
Totals ...	845	2,610	3,163
Grand Total ...	6,618		

The most numerous groups of materials dealt with in each section were:—

Section I.

Human poisoning exhibits	152
Cow's milk	73
Human milk	72
Anaesthetic ether	64
Animal viscera	60
Drugs and medicines	32

Section II.

Ores and tailings for gold assay ..	2,019
Minerals for determination	297
Tin ores	202
Lime	75
Assay weights for standardisation ..	43
Iron ores	33

Section III.

Sewage	..	..	..	..	1,666
Water	..	..	..	..	706
Wheat	..	..	..	..	294
Soils	..	..	..	..	196
Fertilisers	..	..	..	..	56
Fodders	..	..	..	..	56

The other materials submitted for investigation covered an extremely wide range.

It is impossible to give a statistical account of the time and energy devoted to giving advice to Government Departments and the public on the most varied problems, to attendance in courts of law, to visiting factories and other working places where atmospheric pollution is suspected, etc.

Foods and Condiments.—Of the rather small number of samples dealt with under this heading, viz., 163, the number which was below Health Act standards was 24, equal to 18 per cent., a very considerable improvement on last year's 47 per cent. The whole field of food supply has not, however, been covered and therefore it is impossible from the figures available to form any judgment as to the general quality of the State's food supply. The foods, etc., actually tested comprised: baking powder, butter, cornflour, cream, cream of tartar, dripping, essences, flour, honey, infants' food, jam, jelly crystals, desiccated milk, mince meat, pickles, pepper, sauces, sausages, tinned fruit, tripe, vinegar. The most serious adulteration observed was the addition of an appreciable amount of wheat starch to an otherwise watery series of jams. With the low price and abundance of fruit available, there is no excuse for this.

Milk.—The bovine milk supply is checked by the staff of the Co-operative Health Board's Laboratory and the Metropolitan Milk Board. In consequence it is usually only referee or other special samples, e.g., those calling for freezing point determination, that are submitted to the Government Laboratory. This accounts for the very small number received, viz., 73. The Government Laboratory possesses the only Hortvet cryoscope in the State. This instrument is used for deciding doubtful cases of watering of milk by determining the freezing point of the milk serum, a figure which varies only within very narrow limits in the case of unadulterated milk. The normal temperature has been fixed at 0.55 deg. centigrade below zero in a regulation under the Health Act. Adulteration with water raises this freezing point appreciably.

Practically the same number (72) of human milks was analysed. These came from the various Infant Health Centres, mostly from mothers whose children were not thriving in their early months. The following ranges were observed in the important constituents:—

	Observed figures. per cent.	Normal milk.
Fat	.. .. 1.00 to 8.10	3.5
Protein	.. .. 0.91 to 2.09	1.5
Lactose, etc.	.. .. 6.41 to 8.10	6.5
Ash	.. .. 0.17 to 0.45	0.2

The range in fat above and below the normal figure given in Health Act, Food and Drug Regulation 19, is noteworthy.

Beverages.—Only one sample of coffee and chicory, and four of soft drinks, were examined. The alcoholic liquors included nine samples of spirits, six of ale and stout, two of wine, and one of wine cocktail. No artificial sweetening or preservative was detected in the beers. Three hop beers were found to contain 4.24, 7.49, and 8.25 per cent. of proof spirit, as against 2 per cent. permitted by the Licensing Act without bringing a beverage within the definition of "intoxicating liquor."

Drugs.—Of the 100 samples of drugs and medicines examined, 64 were samples of ether for anaesthesia, mostly from the Perth Public Hospital. In previous years many such samples have failed to satisfy the British Pharmacopoeia requirement in regard to freedom from peroxides and aldehydes. This year there has been a very marked improvement in this respect, partly due to the better quality of the bulk consignments, and partly to better handling and storage, particularly the use of copper gauze suggested by us as a means of preventing peroxidation. Other drugs examined were:—

	Complied with B.P.	Did not com- ply with B.P.
Tincture of opium	.. 1	—
Thyroid tablets	.. —	4
Mercuric ointment	.. 1	2
A.P.C. tablets	.. .. —	1*
Potassium citrate	.. .. 2	—
Alkali bromide	.. .. 4	2
Phenobarbitone	.. .. 1	2
Extract of cascara	.. .. —	1
Aspirin tablets	.. .. —	1
Hydrogen peroxide	.. .. —	1
Eucalyptus oil	.. .. —	1†
Ephedrine hydrochloride	.. .. —	1
Morphine sulphate tablets	.. 1	—
Totals	.. .. 10	15

* Tender Board specification. † True to label, but derived from *E. amygdalina*, not now recommended as a source of medicinal oil.

Comment on these figures would be redundant.

Spectrographic investigations.—Additions made this year to our equipment for this purpose enabled some qualitative and quantitative work to be done on several important problems. The supposed effect of lead as a cause of enzootic ataxia of sheep at Gingen was gone into extensively. As a result it appeared certain that lead was not the cause of this disease, but that a deficiency in copper might be.

Toxicology.—A large number of poisoning cases were referred to us for determination of the presence and nature of the poison in human viscera, urine, hair, etc., as well as in bottles, tumblers, etc., found with affected persons. The majority of these cases were concerned with suicide or attempted suicide, but several with suspected industrial poisoning from arsenic and lead. One important murder case occupied a great deal of our time. Arsenic was involved, and was detected in a number of exhibits, but the two persons brought to court were found not guilty by the jury.

Metropolitan Water Supply and Sewerage.—The advisory committee appointed many years ago to deal with the city water supply has now been asked to deal also with sewerage. This committee, of which

I am a member, has met at regular intervals throughout the year, and has referred a large number of investigations to the Laboratory. The whole time of one of my chemists is occupied in this work, and part of the time of several others.

The water supply has improved through cutting out much of the bore water as the result of the large quantity of hill-stream water now available from the Canning River. The new dam across the Canning has impounded for the first time over 2,000 million gallons. At the beginning of December this water contained total solids in solution, 280 parts per million, and was faintly acid in reaction, pH 6.5, characteristic of dissolved carbonic acid.

Very extensive alterations have been made to the sewerage system during the year, involving this Branch in the investigation of no less than 1,670 samples of effluents, sludges, etc. The main reason for this is the change over from filter bed treatment at Belmont to coagulation and sludge digestion at Subiaco and Swanbourne. One of my chemists spent a large proportion of his time testing and advising at these two plants.

A second pollution survey of the ocean, for a radial distance of half a mile round the main outfall, revealed a very satisfactory state of affairs, no appreciable pollution being detectable by chemical or bacteriological tests beyond a quarter of a mile from the outlet.

Cereals.—The principal items under this heading are the wheat samples from the Government crop competition, the Royal Agricultural Society's bagged wheat competition, and the variety and other trials from the State Research Stations at Merredin and Wongan Hills. These totalled 289 samples. In addition 28 samples of flour, mostly derived from these wheats, were analysed and otherwise investigated. Of by-products only two samples of bran and two of pollard were examined, all with satisfactory results.

The only other grain examined was barley, of which five samples were received.

Noxious Vapours in Factories.—As honorary inspectors under the Factories Act, Mr. Hood and myself have examined several working places, where complaints had been made of the presence of injurious fumes. The places visited and conditions complained about were:—

E. S. Simpson:

Two fertiliser factories: rock phosphate dust and hydrofluoric acid vapours.

Trenches for new sewers: hydrogen sulphide.

Sewage treatment works: hydrogen sulphide and organic fumes from putrefactive matter.

J. C. Hood:

Steel works: fumes from welding flux (silicon, manganese, fluorine), and tar fumes.

Garage: dust from adjacent boiler house which burns sawdust, paper, and other scrap material.

Sewage treatment works: hydrogen sulphide.

In no case were the conditions considered to be seriously detrimental to health, but recommendations were made for their amelioration.

In addition a glyptal lacquer used in a certain factory was analysed and found to be made with a coal tar solvent containing toluene, xylene and cumene. It was complained quite rightly that the constant use of this lacquer caused headaches and other unpleasant symptoms to appear.

In connection with the death of three men from inhaling concentrated hydrogen sulphide when they descended a gold mine at Kunaalling which was being unwatered after long disuse, a report was submitted to the Hon. Minister, and afterwards published in the Press, on the risk of dangerous accumulations of this gas in old mine workings, especially those in which rotting timber and other organic matter is submerged in saline waters carrying several parts per cent. of sulphates in solution.

Mining Exhibition.—In October a mining exhibition was opened for a week in Perth, and accorded Government support in organisation and by exhibits. This Branch was represented by (1) a series of wall diagrams illustrating graphically various phases of the mining industry, (2) an exhibit illustrating all the stages in a fire assay for gold, (3) an exhibit illustrating all the stages in a wet assay for iron. The exhibition was both instructive and popular and served to impress the importance of the mining industry on the minds of city dwellers and the farming community assembled in the city for the annual Agricultural Show.

North-West Tantalum Ores and Asbestos.—The lode and alluvial deposits of manganotantalite at Wodgina, Tabba, Strelley and McPhee's Range continue to supply a large part of the world's demand for tantalum, and assays of all export samples have been made here. Much of the ore now goes to Japan. The associated rare metal, niobium, has hitherto found no commercial uses, but a demand for it appears to be likely in the near future. Altogether 20 ores were assayed for tantalum, niobium and also tin, with which our ores are always more or less contaminated.

Mr. Bowley, Assistant Government Analyst and Mineralogist, was able this year for the first time to inspect the North-West deposits, and at the same time to examine several of the important chrysotile mines in the same district. With the very high prices now ruling for asbestos, we are constantly having to answer inquiries regarding our local deposits, and the quality of the mineral contained in them. The best quality chrysotile in the State is that at Soanesville between the Shaw and Turner Rivers, and at Meilga in the Ashburton Valley. The mineral from both places is valued now at over £100 sterling a ton.

Greenbushes Tin Ores.—There has been a revival of tin-mining at Greenbushes, and to assist in its expansion the Government put down nine bores in search of deep alluvial ore. The cores from these bores, to the number of 169, were assayed here for tin. This proved a difficult and tedious operation, as the mechanical and heavy liquid (bromoform) concentrates obtained in the first stage of the assay, consisted very largely of ilmenite, with only minor proportions of cassiterite. Ilmenite has always been a troublesome constituent of Greenbushes alluvial ores both from the assayer's and metallurgist's standpoints. It is derived from the greenstone schists in which most of the primary stanniferous pegmatites occur.

Assay Weights.—The accuracy of the small weights known as "riders," used in all gold assays, is a matter of the greatest importance in view of the present very high value of gold, quoted in the last week of December at £A8 16s. 2d. per troy ounce. In checking such weights against National Physical Laboratory standards, for our own use and that of the State batteries, new riders, even by well-known makers, have been found as much as 5 per cent. in error, a very serious matter in valuing ores and tailings.

New Mineral Records.—The following noteworthy mineral occurrences were recorded during the year:

Ytrotantalite, Split Rock Station, N.W.: This extremely rare mineral was found to occur as coarse angular pebbles in considerable quantity (about 15 per cent.) with cassiterite and monazite at a point 14 miles north of Eley's Well. It is a tantalate of yttrium and erbium.

Anthophyllite, Marvel Loch: An unusual amphibolite rock collected by officers of the Geological Survey at several points near Marvel Loch was found to be composed almost entirely of this rare amphibole, which is a hydrous silicate of magnesium. It does not appear to have been recorded often previously in Australia.

Apatite and Dufrenite, Gingin: In consequence of reports and specimens submitted to me by a prospector, I spent a day with him at Poison Hill, four miles north of Gingin. Here very large numbers of coprolites (impure apatite, fluophosphate of calcium) were found in the Upper Greensand of the Cretaceous Beds. Associated with them were large bright green masses of dufrenite (hydrous phosphate of iron).

Dravite, various localities: A review of 200 specimens of tourmaline, from various places in the State, revealed the fact that much of the black so-called schorl (iron tourmaline) was in reality dravite (magnesia tourmaline). Practically all that of microfibrinous "woody" habit was found to be dravite.

Elbaite, Spargoville, Cen.: Some specimens of dark green translucent tourmaline found here were proved to belong to the species elbaite (lithia tourmaline). Several stones approaching gem quality were obtained.

Mr. Bowley has a number of other interesting mineral records in his report (see page 114).

Publications.—During the year the following scientific papers were published:—

- G. E. M. Dean (with L. J. Samuel): "Western Australian F.A.Q. Wheat." *Jour. Agr. W.A.* 13, p. 500.
 "Good Bread": *Jour. Aust. Chem. Inst.* 3, p. 212-216.
 E. S. Simpson: "Contributions to the Mineralogy of W.A. Series IX." *Jour. Roy. Soc. W.A.* 22, p. 1-18.
 "Dangers of hydrogen sulphide in old mine workings." *Daily Press.*
 B. L. Southern (with L. J. H. Teakle): "The Soils of the Esperance Plains." *Jour. Agr. W.A.* 13, p. 444-450.

The following broadcast addresses were delivered by various members of the Staff:—

- Dangerous trades (J. C. Hood).
 The mining industry and the chemist (H. P. Rowledge).
 Nitrogenous fertilisers (B. L. Southern).

Good bread (G. E. M. Dean).

The winning of natural phosphates (F. W. Steel).

Sectional Reports.—I attach reports by the three supervising chemists on the work of their individual sections. These contain a number of interesting and valuable comments on the work carried out by themselves and their assistants.

EDWARD S. SIMPSON, D.Sc., B.E., F.A.C.I.,
 Government Mineralogist and Analyst.

Perth, 20th February, 1937.

SECTION I.—FOODS, DRUGS, AND TOXICOLOGY.

By H. E. Hill, A.I.C., A.A.C.I.

During the year 845 samples were examined, compared with 864 for 1935. Again a considerable variety of materials, falling into 82 distinct classes, has been received. This in itself to some extent prevents the examination of a greater number of samples, as the section is somewhat handicapped by the lack of facilities for keeping apparatus permanently assembled. However, in some directions, such as foods and liquors, more samples could be handled if departments, instead of sending spasmodic individual samples of one kind or several of different kinds, would submit a number of similar materials at regular intervals. Provided adequate warning is received of the intention to send a batch of samples of one type, especially when only one or two constituents are required to be determined, very little more work is involved in doing six or eight samples than is required for one.

The chief classes of work performed were as follows:—

Foods.—The number examined was 232, or 36 less than the previous year. These were sent in mainly by the Department of Public Health and the Government Tender Board, the latter in connection with the allocation of contracts and the testing of supplies for Government institutions. The following table summarises the more numerous groups of foods examined and the results in the light of the Food and Drug Regulations of the Health Act and the Government Tender Board Specifications.

Foodstuff.	No. of samples received.	No. below standard.	Remarks.
Milk	69	19	Adulteration with water and abstraction of fat.
Jam	20	11	Foreign vegetable matter (wheat starch), artificial colouring.
Jelly Crystals ...	18	0	All complied with specification.
Sauces, pickles and chutney	14	2	Artificial colouring undeclared.
Butter	12	0	All complied with regulations.
Margarine and edible fats	3	2	Dripping artificially coloured.
Vinegar	7	2	Not genuine malt vinegar.
Tripe	7	5	Excessive alkalinity.
Self-raising flour	5	2	Deficient in carbon dioxide.

With regard to milk, 22 of the samples received were from one country town with special requests for freezing point determinations by the cryoscope. This resulted in the detection of systematic watering (in 11 samples) which in most

cases would not have been detected by the ordinary chemical analysis. This laboratory possesses the only Hortvet cryoscope in the State, and it is surprising that more health authorities do not take advantage of it.

Proceedings were taken by the Department of Public Health for excess alkali in a number of samples of tripe (pH greater than 8.0). It was contended in one case by the defence that the moist tripe sample could have derived its alkalinity from the grease-proof paper in which it was wrapped by the inspector prior to being delivered to the analyst. The magistrate declined to record a conviction, although an officer of this branch showed in evidence that greaseproof paper similar to and from the same supply as that which had been used was slightly acid, which is the normal condition of most if not all of the greaseproof papers on the market.

An unusual case of adulteration met with was the addition of starch in the form of wheat flour to jam. This was found in the jam of five different varieties made by one firm, evidently having been added for the purpose of thickening.

During the year an interesting case came up in connection with the addition of sulphite preservative to sausages. An analyst in private practice acting for a country health authority found sulphur dioxide to the extent of 9.1 grains per lb. two days after the taking of the sample. The vendor, on being apprised of an impending prosecution, had his duplicate sample analysed, when only a trace was found. At the order of the Court, 40 days later the third portion or umpire sample, which had been kept in cold storage in the interim, was analysed in this laboratory, the quantity of sulphite found being 0.21 grains of sulphur dioxide per pound. The defendant, while stating that the meat he used for sausage-making was fresh mutton, beef and pork, openly admitted that on arrival from the slaughter yards the surface of the meat was dusted with a sulphite preservative, but denied using any appreciable quantity. It was questioned whether sausages containing a quantity of 9 or 10 grains of sulphites to the pound would lose this by decomposition during a period of 40 days in cold storage. Since the authorities in the literature are divided on this point, experiments were conducted in this laboratory by Mr. F. J. Malloch to test the matter. Sausages and sausage meat were made under his supervision containing known added amounts of preservative in the form of a commercial sodium sulphite preservative and potassium metabisulphite. Samples after testing initially were wrapped in greaseproof paper and then in brown paper bags, sealed and stored for 40 days at approximately 30° F. The following table summarises the results:—

Material.	Preservative added.	Amount added. SO ₂	Grains per Pound.	
			Amount found immediately. SO ₂	Amount after 40 days storage. SO ₂
Exp. 1—Sausages	Pot. metabisulphite	9.0	7.38	6.15
Exp. 2—Sausage meat	" " "	3.5	3.23	1.68
	" " "	9.0	7.83	7.06
Exp. 3—Sausages	Commercial sulphite preservative	3.5	2.87	1.97
Exp. 4	" " "	10.5	9.54	10.42
	" " "	4.0	3.47	3.35

All the samples on storage for 40 days had dried out considerably (two samples lost 26.4 per cent. in weight), to such an extent that in one case (Exp. 3), whilst the total sulphur dioxide in the sample was less than at first, the proportion per cent. was somewhat greater. It was concluded that sausages and sausage meat containing approximately 9 grains of sulphur dioxide per pound still retain the greater part of their original sulphur dioxide content after storage for 40 days at approximately 30° F. At the adjourned proceedings on production of these results in evidence, the magistrate accepted them, and dismissed the case against the defendant.

Drugs.—One hundred (100) samples of drugs were examined during the year. The greater part of these was made up by 63 samples of anaesthetic ether, most of which were from the Perth Hospital. Supplies on arrival at the hospital are tested for conformity with the British Pharmacopoeia standards for peroxides and aldehydes, and faulty consignments are rejected. Twenty-five samples of miscellaneous B.P. preparations and drugs were tested by arrangement with the drug officer of the Department of Public Health. Some of the results obtained indicated the need for regular testing of supplies. Four samples of thyroid tablets were found to contain only about one-fifth of the nominal amounts, the tablets being stated to be of ½ grain, 1 grain, 2 grains and 2½ grains content. They had apparently been made up with the dried equivalents of the stated weights of fresh, moist gland, which is contrary to the requirements of the B.P. and the B.P. Codex, as all doses are now referred to the desiccated and standardised powder. Of three samples of mercury ointment two were deficient in mercury content. Slight deficiencies were noted in samples of sodium bromide (excess moisture), potassium bromide (bromide content), and phenobarbitone tablets (purity and content of phenobarbitone).

Seven samples of quack remedies, consisting of powders and tablets given by an unauthorised practitioner to a person suffering from cancer, were examined for the Department of Public Health. They consisted mainly of powdered buchu leaves, some with and some without jalap or cascara sagrada. Judging by previous samples from the same source, the prescriber uses these materials as a sort of universal remedy.

Toxicology.—One hundred and fifty-two (152) samples, specimens and exhibits were examined for poisonous substances, compared with 150 for 1935. There were 128 exhibits in connection with 60 cases of poisoning or suspected poisoning sent in by district coroners or the Perth Hospital. Many of these were suicides, and evidence at a number of inquests was given by myself or Mr. Malloch. The poisons found fall into the following groups:—Lysol 11, arsenic 5, cyanide 5, strychnine 3, iodine 2, phenol, chloral, formalin, alcohol, luminal, mercurchrome, potassium permanganate, eucalyptus oil and calamine lotion, one each. In 41 cases negative results were obtained. In one case of poisoning by lead arsenate, in which a charge of murder was made, I gave evidence at the inquest and at the subsequent proceedings in the higher Court. Fifteen samples of urine were examined, taken from persons thought to be suffering from chronic lead or arsenic poisoning, usually of an occupational nature.

In connection with the poisoning of animals and animal diseases, 60 specimens were examined, thirty of which were cases of poisoning or supposed poisoning of horses, sheep and cattle, dogs, poultry and bees. The remainder were submitted by the Veterinary Pathologist for chemical and spectrographic examination to ascertain the cause of "Gingin disease" (*Enzootic ataxia*) of sheep. These are described in a later section.

Liquors.—Twenty-two (22) samples of liquors were examined, comprising beer and stout (6), hop beer (4), spirits (9), wine (2) and wine cocktail (1). Most of these were from the Liquors Inspection Branch of the Police Department, but 8 samples of spirits were sent in by the State Hotels Department as a check on the quality of supplies received and bottled. One hydrometer was received for testing.

Government supplies other than foodstuffs.—These included 41 samples of cleaning and other materials such as soaps (12), boot, metal and floor polish (19), petrol (4), phenyle (5), candles, salt and starch, examined for the Government Tender Board. There was a slight falling-off in the number of these materials compared with previous years, due to more specifications for both these and provisions being brought into force at the instigation of this branch, with the consequent elimination from the tenders of some unsatisfactory lines. This has simplified both the tendering and testing, and with specifications in force check samples can be taken at any time during the currency of the contract.

Miscellaneous samples.—These included the following matters:—

Human milks.—Seventy-two samples were analysed for infant welfare clinics and the King Edward Memorial Home, an increase of 22 over the previous year.

Various.—Cattle dips (27), miscellaneous insecticides (10), fireworks and explosives (12), paints (7), pest destroyers (7), bitumen and pitch (3), boiler scales and incrustations (3), supposed petroleum residues (5), tanbarks (6), sewage effluent (4).

Investigatory work.—Several lines of investigation have been followed up during the year, the main one being spectrographic analysis, which is at present occupying the whole of Mr. Chapman's time. The work undertaken is enumerated under the several headings below:—

Spectrographic analysis.—A search was made for toxic or deficient elements which might be responsible for the Gingin disease of sheep. The Veterinary Pathologist (Dr. H. W. Bennetts) submitted a number of specimens of liver, brain, spinal cord, bones and urine of control and affected animals. As certain of the pathological symptoms pointed to the possibility of lead being the toxic agent some work was done on the spectrographic determination of lead, but it was early recognised that the colorimetric dithione method was more satisfactory. It was shown by this method that specimens from affected lambs and sheep did not contain appreciable quantities of lead in excess of the controls. Livers showed nil to 0.8 parts of lead per million (control nil), ribs 4 to 8 (control 2), brain nil to 0.6 (control nil). Certain evidence from spectroscopic examination of viscera and the ammonium chloride used in feeding experi-

ments points to a deficiency of copper, and future work will be directed towards that end.

Spectrographic work to confirm the incidence of cobalt as the responsible factor in the Denmark wasting disease is at present being undertaken.

Sanitation of factories.—Mr. J. C. Hood has paid several visits in his capacity as an honorary inspector under the Factories Act, at the request of the Chief Inspector of Factories, to sites where injurious effects on workers were suspected. These included visits to an electro-welding plant (fumes from fluxes used), pipe-coating plant (tar fumes), and sewerage excavations (sulphuretted hydrogen). A number of samples were taken for analysis, comprising fluxes (3), dust and sawdust (4), gases and air (3) and water. A sample of paint responsible for the illness of a worker using it on the inside of a tank was examined for harmful constituents.

Natural vegetable products.—When time has permitted, chemical investigation has been made of natural vegetable products of scientific and possibly economic interest.

A specimen of the flowers of *Eremaea bufortoides*, a plant found growing in the Hill River district, was examined to determine the nature of the sticky exudation which covers the buds and flowers in large quantities. This was found to be a wax having certain chemical characteristics of scientific interest, but of no economic value.

Another plant product which is being examined is the rhizome of the black kangaroo-paw (*Macropidia fuliginosa*). This secretes a brilliant violet pigment which is probably one of the anthocyanins.

Mr. Chapman has made a preliminary examination of the fruit of the so-called quinine tree (*Petalostigma quadriloculare*) which is found in Kimberley, north of Wyndham. The fruits, which are orange-yellow when ripe and about one inch in diameter, are extremely bitter, and are said to be a useful medicine and vermifuge for horses. No quinine or other alkaloid was found in the fruits, but the bitter taste is due to the presence of a glucoside or other bitter principle.

Miscellaneous investigations, advice, etc.—Information and advice has been given to various Government departments and members of the public.

SECTION II.

Mineralogy, Mineral Technology and Geochemistry.

By H. Bowley, F.A.C.I.

Two thousand six hundred and ten (2,610) samples were entered for examination during the year, a falling off of 1,424 from the figure for the previous year. The decline is due mainly to the fact that only 2,019 gold assays were received against 4,034 for the year 1935. This may be accounted for by the decision of some of the mining companies, who had been submitting a large number of bore cores for gold assay, to establish their own assay offices, and to the completion of the boring programme of other companies.

In spite of the smaller numbers entered during the year it was found impossible to accede to all the requests made to have work done here, owing to the increase in the number of samples requiring extensive chemical, optical and physical examinations. Con-

sequently a number of samples of this type, submitted by the Government Geologist, were not entered in the register, being held over till the new year.

The section was somewhat disorganised during the year owing to changes of staff and the absence for six months of one professional officer on long service leave.

It is with extreme regret that I have to record the loss of Mr. D. G. Murray, Mineralogist and Chemist, who was retired early in the year on account of ill-health. His retirement was followed, in a few months, by his death. Mr. Murray joined the staff of the Geological Survey Laboratory in 1904. On the amalgamation of that Laboratory with that of the Government Analyst, he was transferred to this section as mineralogist and chemist. During his association with the department he made many valuable contributions to our knowledge of the properties and constitutions of Western Australian minerals. He was particularly skilled in the chemistry of the rare earths and rarer metals, and the whole of his work showed evidence of careful thought and a high degree of accuracy combined with an extensive knowledge of this particular branch of science. His early demise was possibly due to some extent to the unhealthy nature of the work, and to the unsatisfactory conditions under which it had to be carried out.

In this connection I would point out, when the present laboratories were erected, that the poisonous effects of the toxic vapours of many of the chemicals used in analytical chemistry and their serious effect on the health of the chemists was not fully realised, with the result that the necessary ventilation to deal with them was not provided. Although a ventilating system has been installed recently for the removal of hydrogen sulphide from the cupboard used for generating that gas, no satisfactory provision has been made in the laboratories to protect the chemist who must necessarily be exposed for considerable periods to its effect when filtering and otherwise dealing with solutions containing it. The serious effect of this gas, in particular, on the health of the chemist, was recognised recently when dealing with a large number of tin assays, all of which required treatment with hydrogen sulphide. I must, therefore, emphasise most strongly the necessity of providing a modern and efficient ventilating system in the present laboratory in order to protect the health of those employed here.

A start was made towards the end of December with the installation of oil fired melting and muffle furnaces for assaying in the mineral section. This should increase the efficiency of the section and enable the Branch to deal expeditiously with a larger number of gold assays, than was possible under the old conditions of coke and charcoal fired furnaces.

The vacancy caused by the retirement of Mr. D. G. Murray was filled by the promotion of Mr. J. N. A. Grace to the position of mineralogist and chemist, and the appointment of Mr. S. E. Terrill, B.Sc., to the position rendered vacant by Mr. Grace's promotion.

During June I was provided with the opportunity to accompany Mr. T. Blatchford of the Australian Mines and Secretariat, Ltd., on a visit to that portion of the Pilbara district embracing Nullagine, Marble Bar, and the interesting tantalite localities at Wodgina and Tappa, as well as the asbestos deposits at Lionel and Bullock Well. Unfortunately, although a large number of specimens were collected on the tour, it has not been possible, up to the present, owing to conditions in the laboratory, to deal with them in detail. In company with Mr. H. Hansen of Marble

Bar, who has an intimate knowledge of the locality, I visited the reputed chrysotile asbestos deposit at Wyman's Well to the south-east of Marble bar, but failed to locate any asbestos of that type. The fibrous mineral seen in the small shafts and tunnels in serpentine in this area was harsh and brittle and highly silicified; in no case was any soft asbestiform mineral recognised either on the dumps or in the workings. I was unable to go down any of the shafts, but examined the tunnels, one of which was about 30 feet in length.

Gold Assays.—In addition to the 1,954 samples received specifically for gold assay it was considered advisable to assay a further 65 samples for that metal. Of these, 1,152 consisted of battery tailings received from the State Batteries Branch for check and umpire assay. A further 474 samples, consisting mainly of bore cores forwarded by various mining companies, were paid for, and the balance (393) represented samples submitted by prospectors under the free assay regulation. In a number of cases the mineral constituents of samples received under the free assay regulation were determined, and in others they were assayed for various other metals also.

Assay Materials.—Advice was tendered to various manufacturers in their attempts to produce assay materials from local minerals. In two cases their endeavours were attended with a reasonable amount of success, the results obtained on testing these materials in this laboratory were as follow:—

Mabor substitute. Cupels made from a mabor substitute gave the following figures for the absorption of gold. The material was tested by cupelling in it 0.5 gramme of pure gold with 1.25 grammes of silver and 3 grammes of lead in an assay muffle furnace. The resulting cornets were parted with nitric acid, the loss of gold determined, and the results averaged. In all five tests were carried out. Five cupels made from commercial mabor were tested under identical conditions for comparison.

	Local mabor substitute.		Commercial mabor.		
	Grammes.	Per cent.	Grammes.	Per cent.	
Mean loss of gold00035	.070	.00034	.068

Although such a loss would be appreciable in bullion assaying, it would be inappreciable in assaying ores and tailings, and would of course be allowed for in the usual way in the case of bullion.

Assay crucibles. The texture of the crucibles examined was satisfactory, no cracks being visible on the inside surface. They were tested for failure on heating by making up a charge of an oxidised gold ore with the usual fluxes for assaying and fusing in a coke-fired furnace. On completion of the fluxing the charge was poured and the crucibles allowed to cool. This procedure was repeated until the crucibles failed. The number of heatings before failure was as follows:—

Crucible No.	1.	2.	3.
Number of heatings before failure	5	9	6

The refractoriness of the materials used in the manufacture proved satisfactory, no distortion of the original shape being noticed at the end of the test. These results are very encouraging and would probably be improved by the use of grog to replace some of the quartz used in the manufacture.

Assay Weights.—Forty-three assay riders were received from both official and private sources for

checking by this office against National Physical Laboratory standards. It was only in isolated instances that they agreed with the reputed weight.

Zinc shavings for Cyanide Plants.—Samples of Australian and imported zinc shavings were examined for lead content. The former contained a trace only of lead, whilst the latter showed 0.87 per cent. of that metal.

Tantalum Ores.—During the year 38 tantalum bearing ores were examined. Of these twelve represented parcels of ore prepared for sale overseas, eleven of them to Japan and one to America. The whole of the ore in these parcels was produced in the Pilbara district, coming from Tabba Tabba, Wodgina, Strelley, and Pilgangoora (McPhees Range). The average grade of ore raised appears to be tantalic oxide, 67 per cent.; niobic oxide, 6 per cent.; tin oxide, 9 per cent.

Of eight samples submitted by prospectors, six came from the Pilbara district, and two from Greenbushes. One sample from 2 miles north of M.L. 36 at Wodgina consisted of a mixture of microlite, tapiolite, and cassiterite, with a little limonite, garnet, quartz and kaolin. It assayed Ta_2O_5 , 71.5 per cent.; Nb_2O_5 , 1.4 per cent.; SnO_2 , 10.7 per cent.

Manganotantalite, manganocolumbite, tapiolite, columbite and cassiterite were present in a series of samples from 23 miles south of Tambourah in the Pilbara district. In one sample of detrital ore from this area, practically the whole of the coarse material over $\frac{1}{2}$ inch grade consisted of columbite with an average specific gravity of 6.04, indicating the presence of 42 per cent. of tantalic oxide and 40 per cent. of niobic oxide. The material under $\frac{1}{2}$ inch grade consisted of low grade tantalite, associated with a little tapiolite and microlite. The average specific gravity of the tantalite in the finer grade was 6.91, representing approximately 62 per cent. of tantalic oxide. A second sample from this locality, consisting of tantalite, columbite, cassiterite, limonite, magnetite, garnet, quartz and felspar and assaying Ta_2O_5 , 49.5; Nb_2O_5 , 15.6; SnO_2 , 8.6 per cent., could easily be improved in grade by reconcentrating.

Columbite, associated with a little low grade tantalite, from 2 miles north of Wodgina gave an average specific gravity of 6.36, equal to Ta_2O_5 , 46; Nb_2O_5 , 36 per cent. Individual pieces ranged in specific gravity from 6.07 representing Ta_2O_5 , 36; Nb_2O_5 , 42 per cent., to 6.69 indicating Ta_2O_5 , 56; Nb_2O_5 , 28 per cent. A sample of partly crushed ore received from 1 mile north of the old Congo Lease at Mt. Francisco gave a figure for specific gravity of 6.53, which placed it practically on the border line between columbite and tantalite.

Columbite associated with some cassiterite and tantalite was received from 2 miles north of Greenbushes. The balance of the samples entered under this heading were Departmental samples for partial analysis in order to definitely establish their mineralogical identity.

Tin Ores.—Besides tantalum ores containing tin, 173 samples of pure tin ores were entered for assay during the period under review. Of these 169 represented borings of alluvial ground on the Greenbushes Tin Field which were submitted by the Government Geologist. The accurate assaying of the samples presented some difficulty owing to the presence of titanium and at times copper. The concentrates obtained from them by vanning and subsequent separation with bromoform contained a prepondering amount of ilmenite, whilst in a large number of cases the amount of cassiterite did not exceed one per cent. The small amount of copper present in some of them was in the form of chalcopyrite.

A sample of detrital ore from a prospecting trench on Split Rock Station 14 miles north of Eleys in the North-West Division contained approximately 60 per cent. of cassiterite. The other minerals noted in this ore were dull brown monazite, brownish black glassy ytrotantalite, coated with a brown alteration product and small amounts of quartz, haematite, biotite mica and plagioclase felspar.

Lime.—In all 40 samples of burnt lime were analysed during the period under review. Of these 34 represented samples of lime purchased for use by the State Batteries Branch. The samples were taken on delivery at the various State Batteries throughout the State and forwarded to this office in air-tight containers. With one exception the total lime after ignition exceeded 80 per cent., and in a large number of instances exceeded 90 per cent. The highest figure obtained was 95.77 per cent. This sample, which was taken on delivery at the Kalgoorlie State Battery, gave the following results on analysis: Total lime, 93.89; free lime, 91.23; ignition loss, 1.96; total lime after ignition (calculated) 95.77 per cent. The average figures obtained for the whole of the samples purchased for State Battery purposes were: Total lime, 81.80; free lime, 74.40; ignition loss, 8.33; total lime after ignition (calculated), 89.19 per cent.

That it is possible to obtain high grade limestone in the metropolitan area, and that the practice adopted for burning is capable of producing high grade burnt lime is indicated by the figures obtained on two samples taken at the kiln from two different sources shown hereunder:—

	A.	B.
	Per cent.	Per cent.
Total Lime, CaO ...	97.16	94.57
Free Lime, CaO ...	95.98	92.58
Ignition Loss ...	.77	1.03

Siliceous Earth.—A sample of imported "amorphous silica" used as a filler in asphalt road construction was examined in order to ascertain if a local raw material could be suggested as a substitute. The figures obtained for this, as well as a local naturally occurring siliceous earth, which warrants further experimenting with to determine its suitability for use in road construction, are given below.

MINERALOGICAL EXAMINATION.

Chemical Composition.	Imported—Quartz.		Local—Quartz with a little kaolin.			H ₂ O (hyg.)	Undetermined.
	SiO ₂	Al ₂ O ₃ Fe ₂ O ₃	H ₂ O (comb)	H ₂ O (hyg.)	Trace.		
Imported per cent. ...	99.11	.45	.28	Nil	.16		
Local, per cent. ...	95.30	Present	1.05	.79	Traces.		
Grading Test.							
Grade (linear mesh) ...	+ 30	+ 60	+ 90	+ 120	+ 200	— 200	
Imported, per cent. ...	Nil	.05	.15	.20	1.85	97.75	
Local, per cent. ...	Trace	.05	.10	.35	2.37	97.13	

LEVIGATION OF MATERIAL PASSING 200 MESH.

	Suspended material after—			Sediment after 1½ minutes.	Total.
	5 minutes.	3 minutes.	1½ minutes.		
Imported, per cent. ...	40.50	15.30	21.95	20.00	97.75
Local, per cent. ...	39.50	14.75	24.80	28.08	97.13

The local material, owing to its fine and angular grain, is well suited for use in the manufacture of abrasive soaps and cleansers. It may also be used to some extent in the pottery industry to reduce shrinkages.

Clays.—Six clays were examined with a view to determining their suitability for use in the ceramic industry. Of these two were terra-cotta clays suitable for the manufacture of house bricks and roofing tiles. One sample was a fine-grained refractory clay burning to a pure white at temperatures up to 1,250° C. Although this clay is not suitable for use by itself for the manufacture of any article on account of lack of strength when burnt, it could be used in the production of white ware, after an admixture of suitable clays and felspar to impart the necessary strength and density to the finished ware. Of the remainder, two were coarse refractory clays which might be used for making firebricks and firelumps, and the other was a fine-grained stoneware clay showing evidence of incipient vitrification when fired to a temperature of 1,150° C.

Mineral Determinations.—The identification of minerals represents an important activity of this section. During the year 307 separate samples were entered for examination. In the case of the many personal inquiries made, when it was possible to definitely identify the mineral on a visual examination, the inquirer was verbally informed of the result and the samples were not recorded in the registers. A greater number of requests for mineral determinations were made by the Government Geologist during the period under review than in the previous year, and it is expected that owing to the increasing activities of the Geological Branch, we shall be called upon to do more work in this direction in future.

Miscellaneous Mineral Notes.

Andalusite (aluminium silicate), Marvel Loch (Cen. Div.) Abundant black crystals of graphitic andalusite occur in a weathered graphitic schist at the Jacoletti G.M. Pink andalusite, much of it in large ill-defined crystals singularly free from foreign inclusions, occurs in a weathered graphitic slate near the S.W. corner of P.A. 4295. Pebbles of black graphitic andalusite were also obtained from the west shore of a lake, east of 13 M.P., Yellowdine-Parker's Road.

Apatite (fluorophosphate of lime), Bullsbrook (S.W. Div.)—Apatite in the form of dark grey nodules (coprolites) was encountered at a depth of 100 feet in a bore at the Pearce Aerodrome.

Chromite (chromite of iron), Marvel Loch (Cen. Div.)—The black concentrate obtained from a gold ore from the Alexander G.M. contained about 70 per cent. of chromite associated with some magnetite and ilmenite.

Cobaltite (sulpharsenide of cobalt), Ravensthorpe (S.W. Div.)—Cobaltite associated with pyrite was present to the extent of about 18 per cent. in an auriferous schist received from one mile N.W. of Ravensthorpe.

Corundum (aluminium oxide), Marvel Loch (Cen. Div.)—A boulder of corundum intergrown with muscovite and schorl was recorded from west of the town-site.

Monazite (phosphate of cerium, lanthanum and thorium), Split Rock Station (N.W. Div.)—Irregular flat pieces of brown monazite ranging in specific gravity from 4.75 to 5.00 were recorded from 13 miles north of Eleys.

Pyromorphite (chlorophosphate of lead), Cue (Mur. Div.)—The heavy yellowish mineral present

in small quantities in a gold ore from P.A. 2405, two miles west of Cue, proved to be pyromorphite.

Staurolite (hydrous silicate of iron and aluminium), Marvel Loch (Cen. Div.) and Mt. Broome (Kim. Div.)—Staurolite occurring as black rectangular prisms was recognised in a grey graphitic slate from G.M.L. 3542. Deep gray prisms of andalusite, up to 10 x 5 x 5 mm., were present in the same specimen. Staurolite was also recorded from the vicinity of Mt. Broome.

Stibiconite (hydrous oxide of antimony), Mt. Seabrook (Mur. Div.)—Specimens of stibiconite associated with cervantite, quartz and limonite were received from Mt. Seabrook.

Sulphur, Toodyay (S.W. Div.)—A yellowish grey earth having a slight odour of sulphur dioxide, which came from four miles south of Toodyay, contained 0.79 per cent. of free sulphur. Melanterite (hydrous ferrous sulphate), copiapite (basic ferric sulphate), epsomite (hydrous magnesium sulphate) and gypsum (hydrous calcium sulphate) were also present.

Tamarugite (hydrous sulphate of sodium and aluminium), Wagina Creek (Mur. Div.)—Tamarugite was the principal constituent of an efflorescence from Wagina Valley, a tributary of the South Irwin Valley. The other constituents were halite (sodium chloride), pickeringite (hydrous sulphate of magnesium and aluminium), and a little gypsum.

Vanadinite (chlorovanadate of lead), Western Shaw (N.W. Div.) and Parker's Range (Cen. Div.)—This mineral was present in small amounts in a gold ore from Western Shaw, whilst a yellowish concentrate received from the Centenary Lease at Parker's Range consisted mainly of vanadinite associated with free gold.

Yttrotantalite (tantarate of yttrium), Split Rock Station (N.W. Div.)—Detrital angular pieces of brownish black glassy yttrotantalite with a thin coating of a dull brown alteration product and ranging in specific gravity from 5.21 to 5.78 were received from 14 miles north of Eleys.

Mineral analyses.—Complete mineral analyses were made of the following:—

Minerals.

Nickeliferous actinolite, Wellington Mills.

Almandine (3), Marvel Loch; Gahnite, Goyamin; Pisanite, Ravensthorpe.

Rocks.

Chloritoid rock, Mt. Magnet; Anthophyllite rock, Marvel Loch; Leucite rock, Mt. North.

Exhibits.—Two exhibits were prepared by this section for display at the Mining Exhibition held on the Government House Ballroom in October. One was a comprehensive exhibit illustrating the various stages of the fire assay for gold, from the preparation and sampling of ores and tailings to the final weighing of the recovered parted gold. The other showed the volumetric method for determining the iron content of an iron ore by titration with potassium permanganate.

SECTION III.

AGRICULTURE, WATER SUPPLY AND SEWERAGE.

By A. J. Hoare, A.A.C.I.

Three thousand one hundred and sixty-three (3,163) samples were entered for examination during the year. This exceeded the figure for the previous year by 1,332.

Staff.—Miss H. T. Cole, B.Sc., A.A.C.I., who was a most capable and efficient chemist, resigned from the permanent staff in October, and her successor had not been appointed at the end of the year. Mr. Ailsop, B.Sc., A.A.C.I., has been engaged full time on sewage work for the greater part of the year. It was found necessary to turn away private work, other than for farmers, graziers and market gardeners, because of the number of samples submitted by other Government Departments for examination.

Soils.—The number of soils received for analysis this year totalled 196. Of these 95 were submitted by the Department of Agriculture, the information desired requiring more detailed examination than is usually made. These samples were received from Lake King area (soil survey); Bridgetown (die back in apple trees); Waroona (potato diseases); Cranbrook (heavy manurial dressings), and the Kimberley Division (red and black soils). The Forests Department submitted 83 samples for mechanical and chemical analyses; these were all in connection with the growth of young pine, jarrah and karri trees, and were collected from the plantations at Cundinup, Inglehope, Big Brook, Myalup, Ludlow, Jarrahwood and Ashendon. The Government Geologist submitted five soils from the South Yilgarn Goldfield which were for mechanical analysis only. The balance of the soils were examined for water soluble salts and reaction (pH); these in the most part came from farmers or market gardeners.

Fertilisers.—The total number of fertilisers received during the year was 56; of which 42 were official samples submitted by the Inspector under the Act. 90.5 per cent. of these complied with the regulations under the Fertiliser Act, 1928. The balance of the samples were superphosphate as supplied under contract to the various Government research stations and farms, and five from farmers or market gardeners.

Fungicides and Insecticides.—Only four samples were received under this heading, the analyses being required for registration purposes, under the Plant Diseases Act.

Fodders.—I have included under this heading grasses, silage, meat meal, blood meal and chaff. The Department of Agriculture submitted 56 samples in all for examination. Thirty-one of these were grasses collected during 1933 and 1934 at Turee Station in the Upper Ashburton Valley. The varieties submitted were wind grass, weeping grass, kangaroo grass, crabhole (claypan) grass, Mitchell grass and Flinders grass. The figures obtained for these samples will form the basis of a report by the Plant Nutrition Officer, to be published during 1937. Twelve samples of meal from various sources, also one blood meal and two specimens of chaff, all used in feeding experiments, were also examined for their feeding value. The nine silage samples, taken from seven different farms, were also examined for the determination of their feeding values.

Waters.—The total number received during the year was 706, of which 99 were from the Metropolitan Water Supply Department collected from the various sources of supply (reservoirs and streams) to the metropolitan area. These waters were all of good potable quality. The same department also submitted 35 samples of ocean water, taken at and near the sewage ocean outfall; these will be dealt with under sewage. The Department of Works and Labour submitted 112 samples, comprising country town sup-

plies, trial bores for stock purposes, water from cement-lined mains, also fibrolite mains and several from streams, a well and a bore at the new aerodrome at Bullsbrook (these were for the Commonwealth Department of Works), also regular samples from the Mundaring reservoir and the Mt. Charlotte reservoir, Kalgoorlie.

The Department of Agriculture sent in 39 samples during the year, the majority of them coming from the banana plantations, lower Gaseoyne settlement area. Some of these were very close to, if not above, the safe upper limits of soluble salts for irrigation waters. Farmers, stock owners and market gardeners submitted 390 samples for testing, being an increase of 151 over those received for the previous year. Unfortunately a fair number of them were far too saline to be used for any purpose. Waters received from other private sources numbered 40, and were submitted by gold mining companies; a local manufacturer of cement linings for water mains, and a country butter factory. Owing to the number of samples received for analysis from Government departments, a number of private applicants for water analyses had to be refused. The balance of the samples were odd ones sent in by other Government departments or institutions.

Sewage.—The starting up of the new sewage treatment works at Swanbourne and Subiaco has entailed a large amount of chemical supervision, and travelling between the works and the laboratory by the advising chemist, Mr. Ailsop. The total number of samples entered for the year was 1,666. Up to date, the new plants seem to be working satisfactorily.

A further batch of ocean water samples taken at the sewage outfall north of the Cottesloe beaches was examined during the year for total phosphorus, total nitrogen, and the 4-hour oxygen absorbed test. No indication of pollution could be detected a few hundred yards from the shore. The action of hydrogen sulphide on the cement sewage mains and the pre-chlorination of crude sewage have also occupied the attention of the chemist.

Barley.—Only five samples were received during the year; three of these were locally grown and were examined for their nitrogen content. The question as to why prepared barley water should turn on occasion a pinkish-brown colour was referred to this Department by the Commissioner of Public Health. Two samples were examined and it was found that a neutral or slightly acid water did not give a coloured extract; when the water is slightly alkaline, however, as would be the case where new cement or cement-lined mains are in use, then the pink to red colour was developed. It was considered that there is nothing injurious in reddish coloured barley water.

Zante Currants.—Thirty-six samples of currants grown under different fertiliser treatments, sent in by the Fruit branch of the Agricultural Department for the estimation of sugar, were found to range from 78.3 to 98.3 per cent. of invert sugar, calculated on a dry basis. The original moisture ranged from 67.8 to 80.2 per cent.

Cement and Sand.—The Metropolitan Water Supply Department submitted 37 samples of bulk cement, used in the construction of the Canning Dam, for the estimation of sulphates. In addition 41 samples of sand used in this work were received for mechanical analysis.

Toxic Paralysis.—The Animal Nutrition Officer of the Agricultural Department sent in twelve samples of bones from sheep used in connection with the ex-

periments conducted at Meekering. The bones (femur and humerus) from six sheep were examined for nitrogen, total ash, calcium and phosphorus, the figures for which were reported on the moisture and fat free basis.

Lime.—Only one sample of lime was examined; this was to be used in connection with the treatment of sewage at the Swanbourne works.

Hops and Hop Plants.—In connection with the investigation of hop growing at Pemberton, three samples of cured hops were received for examination, the varieties being "Golden Cluster," "Californian," and "Bavarian." The analyses entailed the determination of moisture, nitrogen, total ash, silica free ash, potassium, phosphorus, alpha-resin, beta-resin, and the calculation of the preservative value from the last two determinations. The Agricultural Department also sent in three samples comprising leaves, petioles and bines of a hop plant; these were examined for total ash, silica free ash, potash and phosphoric oxide.

Miscellaneous Investigations.—Several odd samples were dealt with, such as: marl, shell grit (for poultry), a deposit on the metal screen of a water meter, coprolite, coprolitic greensand, the identification of a calcium phosphate compound, crushed diorite and diorite dust (for concrete making), section of a glazed earthenware sewer pipe that had been in use for 20 years (action of hydrogen sulphide on the cement jointing), calcareous sand, dust from the flues of a cement works (value as a fertiliser), two samples of liquor used in the treating of animal bristles for brush and broom making (effect on cement sewer mains), a sample of mabor and one of mabor substitute (for mechanical analysis). These were sub-

mitted by various Government Departments and by private individuals for analysis and report.

Bran and Pollards.—Only four samples were received and they were submitted by the Inspector under the Feeding Stuffs Act. The samples, two of bran and two of pollard, came from country flour mills and yielded figures within the limits of variation allowed under the Act for moisture, crude fibre and ash.

Flour.—Twenty-eight samples were analysed during the year; of these 26 came from the Department of Agriculture, three being export flours. Five were obtained from the milling of local and Eastern States f.a.q. wheats, a low-grade flour from Java, and 17 obtained from the milling of wheats grown at the Merredin and Wongan Hills research stations. One sample was received from the Tender Board, and one from a local flour mill.

Wheat.—The number of wheat samples received during the year totalled 294, an increase of 203 over those received for the previous year. The samples comprised 143 from crop competitions, 80 from the Merredin and Wongan Hills research stations, five f.a.q. export wheats, and 66 in connection with the Royal Agricultural Society wheat-growing competitions. All of the samples were ground in a Wiley mill, the moisture and nitrogen estimated and a Pelshenke test made on each sample. Some of the wheats from the two research stations (27 in all) were milled in the experimental mill, and as stated above, a general analysis made of the flour obtained therefrom. Ten of these flours had to be carried over into 1937.

The five f.a.q. wheats were treated as above, and the figures obtained are as follow:—

Report on Five F.A.Q. Wheats from the different States for 1935-36 season.

Lab. Number ...	4482	4483	4484	4485	4491.
State ...	N.S.W.	Vic.	S.A.	W.A.	N.S.W.
Condition ...	Bag Sound	Sound	Sound	Sound	Bulk. Sound
Grain Analysis—					
Moisture (%) ...	12.00	11.80	11.60	11.60	11.47
Bushel Weight Found (lbs.) ...	63½	63¼	63¼	63½	63¼
" " Declared (lbs.) ...	64	63½	63½	63½	64
Weight of 1,000 grains (grams.) ...	43.98	38.67	41.24	39.13	43.30
Milling Analysis—					
1st Flour (%) ...	60.0	63.1	61.6	63.5	64.3
2nd Flour (%) ...	12.5	10.1	10.9	8.9	9.6
Total Flour (%) ...	72.5	73.2	72.5	72.4	73.9
Bran (%) ...	14.2	17.9	17.1	18.8	15.7
Pollard (%) ...	13.3	8.9	10.4	8.8	10.4
Wheat Meal Analysis—					
*Protein (N x 5.83) (%) ...	11.60	10.90	11.43	9.68	11.49
Pelshenke Test Time Factor (minutes)	48	35	44	38	48
Pelshenke Test Time Factor, specific protein quality ...	4.1	3.2	3.8	3.9	4.2
*Ash (%) ...	1.42	1.47	1.49	1.46	1.42
Flour Analysis: (1st Flour)—					
Lab. Number ...	5301	5302	5303	5304	5305
Moisture (%) ...	13.30	13.30	13.16	13.05	13.20
†Protein (N x 5.7) (%) ...	10.43	9.46	9.86	8.38	10.09
†Ash (%) ...	0.54	0.55	0.53	0.51	0.55
†Gluten Wet (%) ...	32.76	30.08	30.96	26.39	32.41
† " Dry (%) ...	10.40	9.31	9.85	8.59	10.52
†Strength, Water absorption (%) ...	54.8	53.8	54.2	53.6	55.3
†Maltose figure K. J. (%) ...	1.65	1.59	1.45	1.76	1.48
Original pH ...	6.2	6.2	6.2	6.2	6.2
Buffer value ...	1.0	1.0	1.0	1.0	1.0
Flour Colour					
Pekar A ...	5.0	5.0	5.0	5.0	5.0
" B ...	4.5	4.5	4.5	4.5	4.5
" C ...	4.0	4.5	4.5	5.0	4.0
†Petrol figure Kent Jones ...	8.1	7.3	6.5	7.5	7.1
Maltose in 2nd Flour					
K. Jones ...	3.61	2.66	1.70	2.22	3.11

* On a standard moisture basis of 10%.

† On a standard moisture basis of 12%.

DIVISION VIII.

Annual Report of the Chief Inspector of Explosives for the Year 1936.

The Under Secretary for Mines.

I have the honour to submit, for the information of the Honourable the Minister for Mines, in compliance with Section 45 of "The Explosives Act, 1895," my report on the working of the Branch for the year 1936.

The year has been one of further steady progress in the volume of work done, due to the continued development of the mining industry in the State, which has necessitated the use of an increased quantity of explosives.

Table No. 1 gives particulars of the explosives imported into the State during the year, and Table No. 2 shows a comparison of the various explosives imported during the past five years.

TABLE NO. I.

Importations of Explosives into Western Australia during 1936.

Explosives.	Quantity in lbs.
Gelignites	1,007,050
Gelatine Dynamite	2,457,450
Blasting Gelatine	72,500
Permitted Explosives	70,300
Powder, Blasting and Pellet	151,250
Miscellaneous	5,000
Total	3,763,550
Detonators	No. 2,673,000
Safety Fuse	Yards. 6,926,400

TABLE NO. II.

Comparison of Explosives imported into Western Australia during the past Five Years.

Explosive.	1932.	1933.	1934.	1935.	1936.
	lbs.	lbs.	lbs.	lbs.	lbs.
Gelignites	1,067,250	1,125,700	1,411,900	1,519,050	1,007,050
Gelatine Dynamite	617,200	797,950	1,432,650	1,543,750	2,457,450
Blasting Gelatine	336,600	314,350	143,700	175,050	72,500
Permitted Explosives	38,050	149,750	75,350	111,800	70,300
Powder, Blasting and Pellet	136,875	127,500	146,250	110,000	151,250
Miscellaneous ... ..	...	...	...	...	5,000
Totals	2,194,975	2,415,250	3,209,850	3,459,650	3,763,550
Detonators, No.	2,370,000	3,310,000	2,644,000	4,316,000	2,673,000
Fuse, Yards	2,880,000	3,770,400	4,322,000	4,704,000	6,926,400

The increase in the quantity of explosives required for mining within the State put a heavy strain, at times, on the storage accommodation at the Woodman's Point Explosives Reserve. In order to relieve this, and assure the holding of stocks sufficient for any emergency that might arise, Messrs. Nobel (Australasia) Proprietary, Ltd., built two new magazines at Fremantle and one at Kalgoorlie.

In 1930 the explosives required for this State arrived in three shipments, whereas in 1936 twelve consignments arrived. From this it will be readily seen that the work of the Branch has greatly increased, and this in turn is reflected in every other phase of the activities of the small staff of the Branch, and I cannot speak too highly of the efficient and creditable manner in which Mr. Bennett conducted the work of the Branch during my absence on long service leave.

Each consignment of explosives has been tested, not only for chemical stability, but for sensitivity, which has a definite and direct bearing on the products of combustion, which affect the health of the miners.

It is with great satisfaction that I have to record that all the explosives imported into the State during the year have given high and satisfactory tests for velocity of detonation, which assures in use in mines the production of a minimum of the harmful gas carbon monoxide.

The following table, No. 3, gives the tests and analyses made during the year:—

Table No. III.

Tests and Analyses made during 1936.

Heat Tests	1,473
Fuse Tests	640
Velocity of Detonation	114
A.D.C. Tests	15
Fireworks Tests	65
Complete Analyses	12
Miscellaneous	7
Tests of Detonators	36

An endeavour is made, as far as possible, to keep all explosives under observation until such time as they go into actual use, and by this means the miner is assured that the explosives he is using, if properly treated, will give a maximum of efficiency with a minimum of the deleterious gases which, under certain conditions of mining, become a source of danger.

The distribution of explosives in the different classes of industry was as follows:—

Table IV.

Distribution and Consumption of Explosives during year 1936.

	Lbs. used.	Percentage of total.
Gold Mining	3,795,100	92.5
Agriculture and Land clearing ...	36,700	.9
Government Departments, Railways, Public Works and Water Supply	96,600	2.3
Quarrying	111,400	2.7
Coal Mining	49,000	1.1
Lead and other base metals ...	12,900	.3

The development of our mineral resources is resulting in the use of explosives over a much wider area than was the case five years ago, which means greater distances have to be travelled in connection with the necessary inspections for the purpose of ascertaining whether the Explosives Act and the Regulations made thereunder are being reasonably complied with.

It has been possible to visit most centres during the year, and it is gratifying to note that it was not necessary to institute proceedings against any person for breaches of the Act or Regulations, but it was necessary to destroy the following explosives as being unfit for use:—

Table V.

Destruction of Explosives during 1936.

Date.	Place.	Kind and Quantity.	Remarks.
9-1-36	Fremantle	163 lbs. Gelignite 60%	Owing to inertness.
"	do.	100 lbs. A.N. Gelatine Dynamite "75"	Owing to absorption of moisture.
28-1-36	do.	2,000 Electric Detonators	Owing to deterioration.
"	do.	40 lbs. Blasting Gelatine	Owing to exudation.
25-2-36	Bridgetown	6 lbs. Gelignite	Chemical deterioration.
4-3-36	Gnowangerup	25 lbs. Gelignite	Absorption of moisture.
14-5-36	Fremantle	25 lbs. Gelatine Dynamite	do. do.
23-10-36	Harvey	2 lbs. Gelignite	Chemical deterioration.
29-10-36	Pemberton	3 lbs. Gelignite	do. do.
30-10-36	Manjimup	250 Detonators	Damaged by water.
15-11-36	Ravensthorpe	2 lbs. Gelignite	Owing to exudation
24-11-36	Collie	250 lbs. Powder	Absorption of moisture.

In January an explosion took place in a magazine situated on the Explosives Reserve at Marble Bar. At the time of the explosion there were only a few cases of explosives stored in the magazine, but the explosion completely wrecked the building and also a larger magazine nearby.

Valuable assistance was given by officers of the Police Department, and very thorough investigations were made with a view to obtaining evidence that might assist in establishing the cause of the explosion. From the evidence collected, the following present themselves as being possible causes for the explosion:—

1. Something being done in the magazine by some person. This does not seem likely, as the person who held the only key states that he last visited the magazine on the 10th December, and the inquiries do not suggest that the magazine was broken into unlawfully.

2. Fire from outside the building from which a spark may have entered and set alight to the interior. There was no evidence of fire round the building.

3. The building being struck by lightning. This may be just a possible explanation as there was an electric storm about 6 o'clock, and the building may have been set on fire by lightning.

4. Chemical deterioration of the nitro glycerine compounds brought about by atmospheric conditions, or set up by an acid produced through the contact of white ants to a point where spontaneous combustion took place. This possibility is the most feasible explanation although it is claimed that the stocks were all fresh. This

statement is open to doubt as it is often found that small quantities of explosives are overlooked when fresh stocks are placed in a magazine, and therefore are not delivered in rotation as received. If the statement that the stocks were fresh is correct, it is hard to understand that deterioration could have set in to a point where spontaneous combustion would cause the explosion. Therefore the contact with white ants appears to offer the most reasonable explanation for this explosion.

The question of the effect of white ants coming into contact with the nitro glycerine explosives is being investigated, and it is hoped that definite evidence will be obtainable on which valuable opinions can be based.

The numbers of licenses issued for the storage and sale of explosives are given in Table No. 6.

Table No. VI.

Licenses issued during 1936.

Magazines on Government Reserves	48
Magazines used by Government Departments	33
Magazines on Private Property	48
Store Licenses—	
Mode (a)	106
Mode (b) ... ..	...
Fireworks only	255
Importation Licenses	2

No fresh authorisations of explosives were made during the year.

T. N. KIRTON,
Chief Inspector of Explosives.

22nd March, 1937.

WESTERN



AUSTRALIA

DEPARTMENT OF MINES

MINING STATISTICS
1936

MINING STATISTICS TO 31st DECEMBER, 1936.

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TABLE I.

COMPARISON OF TONNAGE OF ORE TREATED AND GOLD YIELD REPORTED TO THE MINES DEPARTMENT FOR YEARS 1929 TO 1936, INCLUSIVE.

Goldfield.	District.	1936.		1935.		1934.		1933.		1932.		1931.		1930.		1929.	
		Ore treated.	Gold.	Ore treated.	Gold.	Ore treated.	Gold.	Ore treated.	Gold.	Ore treated.	Gold.	Ore treated.	Gold.	Ore treated.	Gold.	Ore treated.	Gold.
		Tons (2,240lbs.).	Fine ozs.														
Kimberley	.....	84-00	323-40	136-00	390-49	.....	225-02	.....	182-29	.....	63-70	.....	1-54	.....	62-97	.....	184-27
Pilbara	Marble Bar	7,320-30	8,188-50	6,945-00	5,338-02	6,547-75	4,880-10	4,174-60	4,590-79	3,164-00	3,712-86	2,802-25	3,933-15	1,153-00	2,252-26	1,403-00	2,286-50
Do.	Nullagine	2,118-55	1,602-37	1,690-75	1,075-31	55-50	440-48	79-00	317-40	5-00	227-14	5-00	60-90	.....	15-66	.....	22-60
Ashburton	.....	328-00	308-77	204-00	131-98	.....	70-16	.....	34-55	5-00	11-58	.....	25-61	.....	3-33	.....	8-66
Gascoyne	.....	.....	.....	.....	131-98	.....	70-16	.....	34-55	5-00	11-58	.....	25-61	.....	3-33	.....	8-66
Peat Hill	.....	7,421-27	2,108-47	7,453-00	1,738-14	10,200-85	3,074-59	7,104-50	3,094-14	6,653-30	2,190-72	6,986-45	3,049-58	1,940-50	1,074-33	2,278-00	1,085-52
East Murchison	Lawlers	1,368-25	1,479-69	2,716-50	1,358-18	1,245-50	2,005-05	1,096-00	1,176-32	1,061-50	1,075-72	28-55	899-80	44-28	478-11	.....	348-87
Do.	Wiluna	566,186-25	119,633-58	480,666-00	114,241-03	501,388-75	129,335-44	441,197-50	118,384-12	336,427-85	99,953-67	210,942-25	60,808-31	1,151-25	784-53	484-00	1,836-15
Do.	Black Range	26,329-03	6,672-80	12,162-87	3,061-02	7,819-70	5,810-26	8,020-50	4,501-57	7,086-50	4,713-01	3,433-77	1,952-42	524-25	1,190-55	1,088-05	1,481-23
Murchison	Cue	82,833-32	31,107-13	30,402-58	13,148-17	7,442-10	5,053-13	8,058-50	5,437-42	5,308-75	5,253-20	3,900-68	2,777-65	3,301-00	2,299-54	3,042-00	1,731-83
Do.	Meeekatharra	57,086-24	17,432-97	60,213-72	18,776-53	61,248-87	16,015-95	56,139-97	15,903-81	47,875-60	15,213-14	37,323-76	16,289-68	32,197-00	14,658-15	35,386-70	16,956-59
Do.	Day Dawn	2,080-75	1,220-14	2,858-06	840-59	2,837-00	1,080-03	2,302-50	1,281-57	2,488-03	1,689-53	1,946-09	3,870-24	1,166-89	1,312-88	442-00	1,323-25
Do.	Mt. Magnet	69,025-00	18,733-03	54,050-05	12,331-63	9,477-44	4,345-25	11,445-79	5,483-62	9,063-72	5,303-60	6,203-52	3,220-33	4,593-04	2,855-46	6,500-50	3,414-93
Yalgoo	.....	12,703-25	6,807-92	18,859-55	7,693-24	10,374-35	6,421-22	9,004-50	5,175-89	10,650-50	5,426-14	8,347-25	3,686-48	2,828-75	2,191-14	4,250-00	2,611-60
Mt. Margaret	Mt. Morgans	6,192-50	3,473-78	10,000-15	4,286-23	2,926-25	1,990-66	3,319-63	2,220-17	2,407-50	1,123-45	738-20	697-32	370-55	587-94	444-85	956-09
Do.	Mt. Malcolm	128,784-66	47,390-18	100,213-20	37,802-41	124,358-50	44,018-73	128,986-10	44,504-49	129,475-00	43,456-81	108,907-30	42,057-11	103,976-00	38,453-03	106,084-82	31,266-48
Do.	Mt. Margaret	122,174-55	44,738-84	66,929-25	22,854-15	7,993-06	4,774-50	4,248-75	2,885-21	2,477-40	1,106-08	1,707-75	731-34	893-00	423-63	112-00	556-24
North Coolgardie	Menzies	24,004-96	12,156-32	7,946-63	6,389-83	7,418-95	6,640-67	4,296-00	5,132-60	2,408-91	3,241-68	1,981-75	4,553-78	9,958-73	5,868-57	1,505-50	2,752-46
Do.	Ularring	2,756-04	3,154-35	1,228-88	1,054-17	3,281-78	3,932-84	1,006-50	3,761-03	722-00	838-92	571-50	606-72	264-24	206-27	637-00	571-37
Do.	Niagara	2,693-28	1,418-62	3,587-70	1,782-23	1,435-20	777-29	746-75	580-53	1,047-00	709-23	905-65	570-00	167-20	354-31	350-90	275-72
Do.	Yerilla	19,174-75	5,673-63	2,385-55	1,787-91	2,788-83	2,111-19	1,514-50	1,122-09	1,914-49	1,594-34	1,642-50	1,535-45	589-50	599-15	298-00	150-97
Broad Arrow	.....	32,629-46	19,532-01	23,106-25	13,636-83	12,881-73	8,070-74	11,572-00	10,723-64	9,506-30	8,281-05	6,746-12	4,915-99	4,618-00	2,465-00	15,517-90	8,755-59
N.E. Coolgardie	Kanowna	2,955-00	1,954-65	2,149-44	1,673-52	2,244-54	1,765-67	1,211-50	962-90	993-34	728-81	609-42	539-76	104-12	480-24	492-10	616-36
Do.	Kurnalpi	458-28	210-48	886-25	493-47	1,322-75	1,152-98	129-30	124-92	96-25	164-89	234-00	248-88	154-50	178-39	125-60	192-65
East Coolgardie	East Coolgardie	1,079,393-02	397,530-31	897,633-10	305,773-25	897,986-99	333,433-36	819,836-86	359,172-72	703,960-03	364,999-80	530,298-74	337,367-69	458,950-91	328,488-30	437,208-16	282,386-57
Do.	Bulong	2,183-91	950-78	3,202-75	1,176-29	1,773-11	841-31	1,024-00	535-75	847-14	619-51	728-72	471-95	154-30	136-87	92-88	163-82
Coolgardie	Coolgardie	16,649-06	10,582-73	17,773-91	11,575-52	16,296-29	10,063-11	13,642-25	9,436-86	10,390-60	7,499-53	10,456-52	8,869-93	3,139-44	2,890-88	2,324-98	2,544-26
Do.	Kunallaling	11,550-18	5,886-09	6,365-61	4,835-15	2,789-22	1,617-24	2,208-85	1,379-85	2,787-05	1,771-44	2,798-33	1,446-81	1,680-25	816-41	1,895-50	904-41
Yilgarn	.....	111,175-52	49,533-13	41,628-16	28,491-76	45,476-10	25,989-64	33,619-06	22,355-86	22,208-55	14,778-42	16,241-14	9,293-71	8,564-20	6,372-87	2,985-83	4,700-81
Dundas	.....	91,603-87	31,130-93	43,921-00	19,009-56	20,268-00	12,432-52	8,551-00	4,238-09	4,489-00	2,501-41	6,382-50	3,276-97	2,636-20	2,014-49	3,040-00	1,651-36
Phillips River	.....	2,659-82	1,247-76	2,112-06	1,250-81	2,976-00	1,007-72	4,059-00	1,388-65	1,071-10	617-05	97-25	163-89	185-00	140-54	249-00	189-72
Outside proclaimed Goldfield	.....	121-00	237-88	404-00	627-78	76-25	427-49	273-35	804-20	429-25	554-34	95-00	117-60	37-35	100-08	.....	59-55
Totals	.....	2,492,034-05	852,421-72	1,909,831-97	646,149-82	1,772,931-36	639,871-38	1,588,978-76	636,928-27	1,327,020-66	599,420-77	982,162-71	518,044-96	645,344-35	419,767-09	628,400-47	372,064-29
Value at £4 4s. 11-45d. per ounce	.....	£3,620,854	19s. 9d.	£2,744,668	4s. 3d.	£2,717,999	2s. 4d.	£2,705,497	11s. 8d.	£2,546,175	19s. 0d.	£2,200,513	14s. 0d.	£1,783,056	2s. 5d.	£1,600,427	12s. 7d.

TABLE II.

PRODUCTION OF GOLD AND SILVER FROM ALL SOURCES, SHOWING IN FINE OUNCES THE OUTPUT AS REPORTED TO THE MINES DEPARTMENT DURING 1936, AND THE TOTAL PRODUCTION TO DATE.

Kimberley Goldfield.

(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 1936.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.
Hall's Creek ...	...	Voided leases and sundry claims	...	...	...	...	...	...	517.55	540.44	...
Mt. Dockrell ...	(81) ...	Mt. Miniard ...	...	...	84.00	86.86	...	...	184.00	169.71	...
	85 ...	Western Lead ...	...	...	...	...	...	...	...	2.43	...
		Voided leases and sundry claims	...	...	...	...	...	...	80.00	487.06	...
Ruby Creek ...	...	do. do. do.	...	...	...	...	...	...	12,784.50	9,562.41	...
The Brockman ...	...	do. do. do.	...	...	...	...	...	...	3,814.75	3,224.73	...
The Mary ...	...	Voided leases ...	...	...	...	...	...	...	399.00	210.03	...
The Panton ...	...	Voided leases and sundry claims	...	...	...	...	...	...	37.70	153.71	...
		<i>From Goldfield Generally:—</i>										
		Reported by Banks and Gold Dealers ...	236.54	...	...	...	...	5,527.96	...	.75	1.54
		Totals ...	236.54	...	84.00	86.86	...	5,527.96	...	17,818.25	14,352.06	

Pilbara Goldfield.

MARBLE BAR DISTRICT.

Bamboo Creek ...	856 ...	Bulletin ...	...	5.05	474.00	128.31	...	...	5.05	1,373.00	462.23	...
	870 ...	Expectation ...	...	...	20.00	46.56	...	13.54	18.24	138.00	909.49	...
	850 ...	Federation ...	...	...	...	...	...	...	...	242.00	512.12	...
	866 ...	Greater Eonnie Doon (1935), Limited...	...	...	681.00	316.48	...	...	...	1,265.00	488.27	...
	866 ...	(Bonnie Doon) ...	...	...	...	...	...	...	...	204.00	78.03	...
	707 ...	Kitchener ...	...	...	326.00	201.86	...	...	...	7,211.00	12,445.38	...
	921 ...	Mickey ...	...	...	201.00	47.46	...	...	...	201.00	47.46	...
	740, 794 ...	Mt. Prophecy Leases ...	...	...	260.00	259.18	...	...	...	4,965.50	6,027.93	...
	740 ...	(Mount Prophecy) ...	...	...	...	...	...	...	1.11	1,040.50	1,898.07	...
	794 ...	(Perseverance) ...	...	...	...	...	...	...	...	290.50	584.21	...
	817 ...	Prince Charlie ...	...	3.68	22.00	23.30	...	...	3.68	1,466.75	2,399.89	...
	907 ...	Princess May ...	...	4.87	108.00	131.17	...	...	4.87	123.50	166.50	...
	865 ...	Queen ...	...	...	48.00	29.22	...	...	...	450.90	315.64	...

	924	...	True Blue ... ..	...	...	63-00	8-94	...	...	...	63-00	8-94	...
			Voided leases ... ..	...	...	...	...	...	...	...	527-61	15,837-10	23,839-30
			Sundry claims ... ..	...	...	161-00	62-39	...	8-97	...	307-83	3,421-35	2,562-99
Boodalyerrie	...	...	Voided leases and sundry claims	...	...	...	...	...	...	...	299-23	120-25	587-86
Lalla Rookh	931	...	Ellerin ... ..	...	...	14-00	19-60	...	...	...	...	14-00	19-60
	861	...	Lalla Rookh ... ..	...	...	20-00	8-71	...	...	...	...	267-50	478-55
			Voided leases and sundry claims	...	...	...	...	...	...	4-78	11,159-50	11,820-44	574-01
Marble Bar	930	...	Alexander ... ..	...	...	57-00	21-47	...	...	...	...	57-00	21-47
	854	...	Coongan Star ... ..	...	...	40-00	77-08	...	...	...	...	792-00	1,913-07
	927	...	Halley's Comet ... ..	...	...	331-00	996-37	...	...	...	...	331-00	996-37
	912	...	Homeward Bound ... ..	...	...	428-00	231-08	...	...	...	...	665-00	309-08
	914	...	Jo-Jo ... ..	...	...	176-00	130-83	...	...	...	...	245-00	193-35
	926	...	Leviathan ... ..	...	...	140-00	66-08	...	...	...	...	140-00	66-08
	845, 869	...	Outward Bound leases	...	...	271-80	162-92	...	...	...	...	539-80	372-00
	845	...	(Outward Bound) ... ..	...	...	...	...	...	...	...	...	1,543-50	1,873-91
	869	...	(Outward Bound East)	...	...	...	...	...	...	...	...	30-00	26-79
	(876)	...	Progress ... ..	...	...	13-00	11-37	...	...	...	...	257-00	206-81
	909	...	Stray Shot ... ..	...	...	44-00	14-82	...	...	...	...	44-00	14-82
	922	...	Tom Thumb ... ..	...	...	163-00	109-07	...	...	...	...	163-00	109-07
	844, 851	...	Viking leases ... ..	...	...	39-00	19-78	...	...	...	...	942-00	744-21
	844	...	(Anglo French) ... ..	...	...	...	...	...	...	...	...	467-00	706-25
	851	...	(Viking) ... ..	...	...	...	...	...	...	...	...	34-50	45-52
			Voided leases ... ..	...	...	...	...	...	...	...	181-87	22,530-45	28,497-98
			Sundry claims ... ..	...	69	1,257-50	828-51	...	65-71	...	158-31	12,106-64	9,597-45
North Pole	...	...	Voided leases and sundry claims	...	...	...	...	...	...	...	...	598-50	470-08
North Shaw	925	...	Big Bertha ... ..	...	...	121-00	52-47	...	...	...	...	121-00	52-47
			Voided leases ... ..	...	...	...	...	...	7-53	...	...	863-45	910-91
			Sundry claims ... ..	...	...	150-50	109-48	...	2-84	567-06	...	150-50	109-48
Pilgangoora	879	...	Birthday Gift ... ..	...	...	112-00	16-48	...	8-34	...	...	408-00	68-74
	873	...	Boolarina ... ..	...	...	...	...	...	...	...	...	95-00	31-38
	(871)	...	Lynas G.Ms., Ltd. ... ..	...	...	280-00	23-87	...	...	...	...	280-00	23-87
			Voided leases and sundry claims	...	...	...	...	...	169-39	...	8-13	664-60	206-29
Sharks	868	...	Mount Ada ... ..	...	...	82-50	118-89	...	...	...	...	738-50	973-95
			Voided leases ... ..	...	...	...	...	...	...	...	...	27-00	60-48
			Sundry claims ... ..	...	...	116-50	179-24	...	162-10	25-90	...	789-50	1,231-39
Talga Talga	(913)	...	Jubilee ... ..	...	...	139-50	71-70	...	...	...	...	393-50	133-90
	915	...	North Star ... ..	...	...	79-00	230-49	...	...	...	...	149-00	319-65
			Voided leases ... ..	...	...	...	...	...	...	...	83-83	574-50	975-98
			Sundry claims ... ..	...	...	176-50	98-97	...	64-70	70-65	1,527-65	1,202-64	...
Tambourah	...	...	Voided leases ... ..	...	...	...	...	...	...	...	73-90	1,524-50	1,844-52
			Sundry claims ... ..	...	4-72	145-50	124-85	...	80-05	280-56	1,241-75	1,318-31	...
Warrawoona	...	...	Voided leases ... ..	...	...	...	...	...	...	...	16-99	10,094-80	18,185-64
			Sundry claims ... ..	...	...	397-50	168-85	...	70-98	586-98	2,419-54	3,176-54	...
Western Shaw	...	...	Voided leases ... ..	...	...	...	...	...	...	...	...	1,222-50	957-80
			Sundry claims ... ..	...	...	5-50	7-76	...	22-34	67-47	42-50	66-70	...
Wyman's Well	Voided leases and sundry claims	85-98	1,144-65	1,720-43

TABLE II.—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 1936.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.
Yandicoogina ...	874 ...	Uncle Tom ...	...	...	64·00	29·96	...	...	...	217·00	275·92	...
		Voided leases ...	...	...	...	...	...	...	140·76	2,743·20	5,827·24	...
		Sundry claims ...	...	...	80·00	113·06	...	4·32	238·35	346·75	490·28	...
		<i>From District generally:—</i>										
		Sundry parcels treated at:										
		State Battery, Bamboo Creek ...	...	...	...	548·56	...	...	...	...	6,236·28	79·90
		State Battery, Marble Bar ...	...	...	12·00	2,179·41	...	...	...	12·00	* 3,220·64	...
		Lalla Rookh Battery ...	...	...	...	...	...	...	...	...	186·65	...
		Various Works ...	...	...	...	...	...	...	...	237·95	* 1,204·91	...
		Reported by Banks and Gold Dealers ...	137·62	5·27	...	...	...	13,388·69	422·09	...	...	...
		Totals ...	143·03	18·87	7,320·30	8,026·60	...	14,070·43	4,181·23	119,369·18	162,830·20	652·91

NULLAGINE DISTRICT.

Eastern Creek ...	...	Voided leases ...	...	...	...	...	...	...	8·19	4,571·00	8,964·03	11·77
		Sundry claims ...	...	...	235·50	143·44	...	...	3·77	993·50	1,130·62	16·90
Elsie ...	...	Voided leases ...	...	...	...	...	...	...	...	586·25	1,675·91	...
		Sundry claims ...	...	...	10·00	20·17	...	...	...	44·25	105·66	...
McPhee's Creek ...	...	Voided leases ...	...	...	...	...	...	...	...	113·00	137·92	...
		Sundry claims ...	...	...	38·00	58·53	...	...	...	61·00	81·61	...
Middle Creek ...	230L ...	All Nations ...	...	...	119·50	45·64	...	...	...	160·75	60·20	...
	229L ...	Barton ...	...	...	...	...	...	...	...	34·50	30·10	...
	231L ...	Blue Spec ...	...	...	109·00	54·94	...	...	...	144·50	86·21	...
		Voided leases ...	...	...	...	...	...	...	...	6,848·90	8,603·45	...
		Sundry claims ...	...	...	435·50	197·18	...	...	...	1,122·00	816·19	...
Mosquito Creek ...	234L ...	Ahema ...	...	...	...	...	...	...	...	130·00	27·82	...
	235L ...	Beatrice ...	...	43	40·00	10·65	...	...	43	376·00	121·86	...
	252L ...	Marjie ...	...	...	33·00	113·46	...	...	...	33·00	113·46	...
	236L ...	Western ...	...	...	20·00	6·09	...	...	...	31·00	9·62	...
	237L ...	Yates... ..	...	...	...	...	...	...	...	130·00	29·35	...
		Voided leases ...	...	...	...	...	...	1·07	21·42	7,259·80	12,464·00	...
		Sundry claims ...	...	...	674·00	280·28	...	...	168·71	2,920·44	3,447·22	...

Nullagine ...	228L ...	Chrysler ...	...	...	53.00	29.66	...	...	18.83	75.00	166.43	...
		Voided leases ...	...	...	...	...	...	...	13.96	7,453.25	11,335.12	...
		Sundry claims ...	26.87	...	92.05	48.36	...	210.64	210.96	4,325.30	9,631.61	...
20-Mile Sandy ...	233L ...	Billjim ...	...	...	43.50	15.21	...	...	...	43.50	15.21	...
		Voided leases ...	...	...	...	...	...	...	3.20	5,093.70	7,786.99	...
		Sundry claims ...	...	...	215.50	140.25	...	33.10	20.55	3,780.15	4,475.19	...
<i>From District generally :-</i>												
Sundry Parcels treated at Various Works ...			...	...	...	...	...	...	112.50	*5,770.12	...	
Reported by Banks and Gold Dealers ...			391.71	19.50	...	...	...	7,846.88	64.25	...	24.77	...
Totals ...			418.58	19.93	2,118.55	1,163.86	...	8,091.69	534.27	46,443.29	77,110.67	28.67

Ashburton Goldfield.

Mt. Edith...	...	Sundry claims ...	...	...	...	...	...	...	...	5.00	3.97	...
Mt. Mortimer	...	do. ...	...	...	...	...	...	364.63	315.64	...	...	74.47
Paulsens ...	32 ...	Melrose ...	...	...	328.00	246.39	...	...	...	328.00	246.39	5.63
		Sundry claims ...	...	...	...	16.88	...	...	...	204.00	68.72	...
Uaroo ...	...	Voided leases ...	...	...	...	...	...	...	...	...	...	7,713.22
<i>From Goldfield Generally :-</i>												
Reported by Banks and Gold Dealers ...			45.50	...	...	...	...	8,575.72	16.59	...	7.12	...
Totals ...			45.50	...	328.00	263.27	...	8,940.35	332.23	537.00	326.20	7,793.32

Gascoyne Goldfield.

Bangemall	...	Voided leases and sundry claims	...	...	...	...	...	88.97	39.77	387.00	517.29	...
<i>From Goldfield generally :-</i>												
Reported by Banks and Gold Dealers ...			...	...	...	...	...	483.35	1.80	...	...	...
Totals ...			...	...	...	...	...	572.32	41.57	387.00	517.29	...

Peak Hill Goldfield.

Egerton ...	...	Voided leases ...	...	...	...	...	...	60.86	30.91	4,725.25	2,019.78	...
		Sundry claims ...	...	...	215.02	173.08	...	235.35	23.51	1,308.77	679.87	...
Horseshoe ...	...	Voided leases ...	...	...	...	...	...	...	1,962.66	728.38	1,973.46	2.00
		Sundry claims ...	...	...	17.25	81.04	...	15.70	828.34	118.30	180.74	...
Jimblebar ...	...	Voided leases and sundry claims	...	...	...	...	...	13.79	238.70	8,574.30	3,136.11	58
Mt. Fraser ...	...	Voided leases ...	...	...	...	...	...	...	...	389.50	320.96	...
		Sundry claims ...	...	...	25.00	21.56	...	88.28	40.61	341.75	288.22	...

TABLE II.—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 1936.					TOTAL PRODUCTION.					
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	
Mt. Seabrook	541P	Mt. Seabrook No. 1	...	5·05	100·50	92·47	...	...	5·05	236·50	251·42	...
	542P	Mt. Seabrook No. 2	...	...	56·50	29·17	...	...	...	56·50	29·17	...
		Sundry claims	...	...	...	...	...	...	...	682·60	624·25	...
Peak Hill	512P	Atlantic	...	...	516·75	48·91	...	...	...	1,598·75	224·31	...
	510P	Atlantic North	...	...	131·00	64·61	...	...	...	384·00	223·02	...
	507P	Central	...	...	1,892·75	125·99	...	...	...	1,892·75	125·99	...
	511P	Commercial	...	...	808·75	112·17	...	...	...	2,615·25	381·95	...
	531P	Condor	...	...	...	...	...	...	...	48·75	8·50	...
	448P	Evening Star	...	35·80	...	...	...	...	53·77	6,421·50	4,677·79	...
	(548P)	Heins Find No 1	...	...	550·00	63·90	...	...	...	550·00	63·90	...
	514P	Jasper Bar	...	...	88·00	109·32	...	...	...	586·25	676·86	...
	508P	Mount Pleasant	...	...	47·50	99·29	...	...	...	660·00	258·19	...
	506P	No. 1 North	...	...	75·00	45·40	...	...	...	3,960·95	866·45	...
	492P	North Star	...	...	1,579·75	183·22	...	23·20	52·05	6,881·00	917·28	...
	520P	Stella Ray	...	1·61	2·11	311·00	27·93	...	1·61	2·11	2,332·00	253·46	...
		Voided leases	837·53	497,990·58	239,068·51	2,285·63
		Sundry claims	...	4·70	...	985·50	257·95	...	60·40	254·13	30,875·60	8,205·68	...
Ravelstone	...	Voided leases and sundry claims	...	...	...	...	...	...	101·64	4,773·45	3,400·85	...
Wilgeena	...	Voided leases	...	...	...	...	...	...	23·54	128·50	146·79	...
Wilthorpe	...	do.	...	...	...	...	...	...	...	47·00	20·93	...
	...	Sundry claims	...	...	21·00	5·14	...	...	...	89·00	25·71	...
Yowereena	...	Voided leases and sundry claims	...	...	...	...	...	...	...	78·00	222·73	...
<i>From Goldfield generally:—</i>													
Sundry Parcels treated at:													
		Pegler's Cyanide Plant, Egerton	...	...	...	94·15	...	...	...	...	94·15	...
		Westralia Tailings Treatment Plant	...	...	...	113·41	...	...	...	...	113·41	...
		State Battery, Jimblebar	...	...	...	...	...	...	...	...	865·09	...
		State Battery, Peak Hill	...	...	...	240·81	...	...	3·05	15·00	* 4,932·18	...
		Various Works	...	...	...	...	...	...	...	30·00	* 3,978·33	...
		Reported by Banks and Gold Dealers	...	...	...	...	...	...	2,209·75	422·51	...	...
		Totals	45·14	73·81	7,421·27	1,989·52	...	2,708·94	4,880·11	579,120·18	279,256·04	2,288·21	

East Murchison Goldfield.

LAWLERS DISTRICT.

Bronzewing	...	...	Voided leases and sundry claims	...	...	...	...	...	...	...	476.00	326.09	1.94
Corktree	...	...	do. do. do.	...	...	...	...	...	...	55.40	3,780.00	3,302.19	...
Kathleen Valley	1300	...	Mt. Pascoe	...	...	103.25	32.34	...	...	...	103.25	32.34	...
	1301	...	Mt. Pascoe South	...	...	16.50	12.80	...	...	.64	36.50	24.81	...
	1268	...	Nil Desperandum	...	1.82	117.00	34.25	...	...	2.64	157.00	70.83	...
		...	Voided leases	...	...	...	...	...	...	141.57	76,601.25	47,639.33	...
		...	Sundry claims	...	2.21	352.50	72.47	...	4.53	516.38	3,262.25	1,413.84	...	
Lawlers	(1244)	...	Daisy Queen	...	...	43.50	16.21	...	...	...	79.50	26.20	...
	1256	...	Leinster	...	...	20.00	1.65	...	...	...	20.00	1.65	...
	1280	...	Right Bower	...	...	35.00	3.33	...	...	...	43.00	7.37	...
	(1257)	...	Vivien	...	...	39.00	14.42	...	...	...	39.00	14.42	...
	1249	...	Waroonga Extended	...	13.02	30.00	12.85	...	13.02	...	168.50	77.29	...	
	1236	...	(Waroonga G.M. Co., Ltd.)	...	...	...	...	...	...	...	...	1,103.80	...
	1240	...	(Waroonga West)	...	...	...	...	...	...	...	...	35.84	...
		...	Voided leases	...	...	...	...	...	...	690.66	1,282,641.22	490,501.56	14,350.93
		...	Sundry claims	...	38.20	6.71	217.00	113.79	284.95	358.74	13,602.98	7,961.68	268.34	
Sir Samuel	1305	...	Mt. Harris	...	...	185.00	123.51	...	...	...	185.00	123.51	...
	1238	...	Vanguard	...	...	18.00	50.93	...	...	...	296.00	169.06	...
	1239	...	Westralia	...	...	38.50	180.68	...	...	...	1,307.50	547.28	...
		...	Voided leases	...	...	...	...	...	...	359.03	266,862.55	139,302.36	10,225.58
		...	Sundry claims	...	50.42	8.39	163.00	82.58	50.42	31.10	5,466.75	3,724.51	...	
<i>From District generally :-</i>														
Sundry Parcels treated at:														
		...	McPherson's Cyanide Plant	...	...	...	382.18	...	...	...	...	...	* 2,730.66
		...	Nil Desperandum Cyanide Plant	...	...	...	112.01	...	...	...	...	...	124.63
		...	White's Cyanide Plant	...	...	...	20.69	...	...	...	...	...	1,115.08
		...	State Battery, Sir Samuel	...	...	10.00	1.52	...	...	...	43.50	...	* 1,973.95
		...	Various Works	...	...	...	...	...	...	...	1,699.50	23,548.57	935.06
		...	Reported by Banks and Gold Dealers	...	81.53	9.18	...	...	6,170.53	95.75	...	7.01	...
Totals				...	183.17	28.31	1,388.25	1,268.21	...	6,523.45	2,251.91	1,656,871.33	725,905.86	25,782.88

WILUNA DISTRICT.

Coles	...	...	Voided leases	...	...	...	...	...	...	...	416.25	86.38	...
		...	Sundry claims	...	...	725.25	274.44	...	...	...	2,285.25	992.71	...
Collavilla	...	...	Voided leases and sundry claims	...	...	...	...	...	...	...	1,548.00	517.75	...
Corboys	(601j)	...	Alta Garfagnana	...	...	34.00	10.18	...	...	...	140.00	87.51	...
	(490j)	...	Corboy's Reward	...	...	71.00	47.19	...	...	...	951.50	630.84	...
	359j	...	Corboy's Reward North	...	...	...	...	...	...	...	1,454.75	1,067.56	...
	(604j)	...	Lucca	...	...	75.00	45.73	...	...	...	123.00	68.68	...
	467j	...	Merrington Consols	...	...	...	...	...	...	...	158.00	42.97	...
	435j	...	Old Toscana	...	...	75.00	66.63	...	...	...	362.00	209.17	...
	433j, 434j,	...	Waratah G.Ms., No Liability	...	...	...	23.40	...	...	...	12.00	* 354.94	...

TABLE II.—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 1936.					TOTAL PRODUCTION.				
			Alluvial.	Dolled and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dolled and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.
Corboys—continued.	433J, 434J ...	(Waratah leases) Voided leases Sundry claims ... ..	...	...	...	...	...	...	308·00	233·62	...
			...	...	...	...	...	1·25	2,552·50	2,718·81	5·00
			...	...	421·25	369·28	...	17·36	4,760·85	3,249·63	...
Gum Creek ...	...	Voided leases and Sundry claims	...	...	...	...	...	...	1,750·75	710·27	...
Mt. Eureka ...	621J, 622J ...	Wonga Wal Mining Co., N.L. Voided leases Sundry claims ... ..	...	...	63·50	36·55	...	...	63·50	36·55	...
			...	...	...	...	...	...	73·75	56·50	...
			...	...	98·00	42·88	...	...	375·75	373·63	...
Mt. Keith ...	463J, 545J ... 464J 464J, etc. ...	Pomme d'Or G.M. Co., N.L. Wiluna South (Waldeck's G.M. Co.) Voided leases Sundry claims ... ..	...	...	789·00	587·14	...	...	6·35	4,783·00	1,905·27
			...	...	95·75	92·28	...	...	...	95·75	92·28
			...	...	153·00	56·85	...	...	...	449·50	407·97
			...	...	...	...	...	...	8·29	8,431·75	6,954·65
			...	...	220·25	208·42	...	4·81	88·11	2,876·50	2,050·01
New England ...	587J 605J (591J) 466J	Bill's Find Lowlands New Golden Way Simms' Find Voided leases Sundry claims ... ..	...	...	65·00	36·31	...	...	...	166·00	219·58
			...	...	336·50	156·81	...	...	...	615·50	395·24
			...	...	15·00	8·69	...	...	...	162·00	101·89
			...	...	47·00	67·13	...	...	...	339·00	579·80
			...	...	...	...	...	...	57·54	1,910·00	1,057·99
			...	...	194·50	129·00	...	...	5·78	1,962·00	1,556·71
Wiluna ...	432J 452J 552J (590J) 607J 10J, etc. ... 10J, 91J, 333J, 337J 625J 6J, 7J, 12J, etc.	Brilliant Brilliant Extended Florence No. 3 Hidden Treasure Jubilee Moonlight Wiluna G.Ms., Ltd. Prior to transfer to present holders Palmer's Puzzle Wiluna Gold Mines, Ltd. Prior to transfer to present holders Voided leases Sundry claims ... ..	...	...	115·00	18·21	...	...	...	1,191·25	218·57
			...	...	420·75	119·46	...	...	...	873·25	275·76
			...	...	...	...	...	...	...	1,023·50	192·84
			...	...	23·50	7·41	...	...	...	98·25	46·82
			...	...	662·25	299·11	...	...	...	1,156·75	655·83
			...	...	3,612·50	1,152·64	...	...	...	3,612·50	1,152·64
			...	...	...	...	...	...	...	36,975·50	14,174·75
			...	...	226·25	50·37	...	...	...	226·25	50·37
			...	...	557,099·00	113,494·56	...	...	...	2,510,270·00	621,936·73
			...	...	...	...	...	...	...	341,730·57	133,457·92
			...	...	...	...	...	...	565·19	134,619·00	77,999·03
			...	...	548·00	153·40	...	105·39	182·85	20,674·40	9,188·95

<i>From District generally:—</i>											
Sundry Parcels treated at:											
Corboys Reward North Battery	...	...	...	...	8.24	...	...	...	...	456.04	...
Tuscana Cyanide Plant	...	...	...	...	553.19	...	...	...	...	1,197.63	...
State Battery, Wiluna	...	...	...	...	1,505.57	...	...	...	592.00	* 19,992.45	218.70
Sundry Parcels treated at various Works	...	...	...	...	...	...	...	...	...	781.64	12.68
Reported by Banks and Gold Dealers	...	9.43	1.41	...	...	...	39.25	41.87	...	...	...
		9.71	2.80	566,186.25	119,621.07	...	166.81	957.23	3,092,170.07	908,536.88	450.03

BLACK RANGE DISTRICT.

Barrambie	972B	...	Sheelite	...	27.00	28.00	...	...	105.50	108.88	...
	976B	...	Sheelite North	...	61.75	70.74	...	...	92.75	92.83	...
		...	Voided leases	...	...	...	...	22.49	17,359.42	16,200.76	125.60
		...	Sundry claims	...	24.24	...	...	3.53	157.76	696.55	812.30
Bellchambers	...	...	Voided leases and sundry claims	...	...	...	...	111.80	492.52	648.45	...
Birrigrin	...	...	Voided leases	...	...	...	...	820.68	12,042.93	15,086.09	...
	...	...	Sundry claims	...	82.25	55.24	...	175.40	2,471.80	1,231.47	...
Curran's Find	...	...	Voided leases	...	...	...	18.24	222.89	7,252.25	3,116.68	...
	...	...	Sundry claims	...	145.00	29.86	...	29.38	1,938.50	774.62	...
Erroll's	...	...	Voided leases	...	...	...	14.17	152.29	14,170.50	9,328.92	...
	...	...	Sundry claims	...	360.50	76.53	6.53	399.11	896.75	524.62	...
Hancock's	...	...	Voided leases	...	...	...	...	6,523.59	31,706.00	32,931.86	55.72
	...	...	Sundry claims	...	554.25	218.49	4.21	127.33	5,849.25	2,465.97	...
Maninga Marley	1031B	...	Bulletin	...	202.75	86.93	...	...	202.75	86.93	...
	...	...	Voided leases	...	...	...	...	195.20	60,474.23	48,313.69	22.55
	...	...	Sundry claims	...	244.25	94.10	...	158.16	2,502.75	1,641.81	...
Montagu	967B, 998B	...	North End leases	...	4,409.00	726.81	...	...	12,680.45	1,921.48	...
	953B, etc.	...	Swan Bitter G.M. Co., N.L.	...	10,488.00	2,139.83	...	5.78	18,157.25	6,101.44	...
	...	...	Voided leases	...	...	...	...	94.39	9,133.40	7,223.46	...
	...	...	Sundry claims	...	304.25	125.03	...	71.09	4,423.60	2,968.33	...
Nunngarra	1032B	...	Two Mile	...	82.25	14.53	...	...	82.25	14.53	...
	...	...	Voided leases	...	...	...	25.94	952.34	9,696.50	4,922.75	...
	...	...	Sundry claims	42	148.75	22.03	50.27	1,458.06	5,785.40	2,654.28	...
Sandstone	(1005B)	...	Black Range Trafalgar	...	86.75	10.79	...	...	208.75	35.03	...
	(1006B)	...	Black Range Trafalgar No. 1	...	10.00	3.97	...	...	29.00	9.98	...
	959B	...	Bonny Note...	...	...	...	...	136.06	537.75	686.59	...
	1017	...	Hacks	...	16.00	1.67	...	...	16.00	1.67	...
	958B	...	Lady Mary	...	605.00	294.64	...	...	3,675.25	3,531.41	...
	1030B	...	Lady Rini	...	312.50	64.74	...	...	312.50	64.74	...
	1011B	...	Sonny Boy	...	27.50	3.21	...	...	362.25	112.55	...
	...	...	Voided leases	...	...	...	4.75	3,611.46	689,638.97	443,326.69	11,754.22
	...	...	Sundry claims	...	386.25	51.92	41.17	1,370.23	12,002.90	6,188.72	...

TABLE II.—Production of Gold and Silver from all sources, etc.—continued.

EAST MURCHISON GOLDFIELD—continued.

BLACK RANGE DISTRICT—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1936.					TOTAL PRODUCTION.						
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.		
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.		
Youanmi ...	960B ...	(Youanme) ...	...	...	...	...	...	...	38.50	3.91	...
	960B, etc. ...	Youanmi Gold Mines, Ltd. ...	...	...	7,645.53	1,422.08	73.55	...	7,645.53	1,422.08	73.55	
		Voided leases ...	...	...	...	...	...	...	...	...	...
		Sundry claims ...	...	...	129.50	17.31	...	...	126.92	18.79	4,608.55
		<i>From District generally:—</i>												
		Sundry Parcels treated at:												
		North End Cyanide Plant ...	...	...	...	514.89	...	...	...	...	2,196.67
		Parkinson's Cyanide Plant ...	...	...	...	55.80	...	...	...	...	386.35
		State Battery, Sandstone ...	...	...	...	482.53	...	...	...	244.00	* 20,029.42
		State Battery, Youanmi ...	...	...	...	...	...	...	...	40.00	* 4,971.77
		Various works ...	...	...	...	...	...	...	...	37.00	* 5,939.54
		Reported by Banks and Gold Dealers	14.56	1.53	1,435.51	48.33	20.38		
	Totals ...				14.98	25.77	26,329.03	6,632.05	73.55	1,605.75	16,989.53	1,297,442.73	826,449.34	16,699.72

Murchison Goldfield.

CUE DISTRICT.

Cuddingwarra ...	2129 ...	Behring Treasure ...	...	...	35.50	350.81	...	...	...	55.55	553.94	...
	2050 ...	Little Bell ...	...	...	...	...	...	...	4.49	579.75	60.95	...
	2175 ...	Golden Gate ...	...	...	15.75	13.04	...	...	...	15.75	13.04	...
	2090 ...	Shaughran ...	...	1.12	111.50	28.83	...	...	1.12	384.00	92.19	...
	2171 ...	Well Caught ...	...	...	51.00	63.63	...	...	...	51.00	63.63	...
		Voided leases ...	...	...	...	...	...	10.59	124.53	100,692.61	55,168.28	100.71
	Sundry claims ...	...	...	154.42	85.28	...	8.97	158.23	5,998.94	3,908.67	9.00	
Cue ...	2088 ...	Mug's Luck ...	...	...	173.25	95.10	...	...	...	317.50	134.56	...
	2173 ...	New Salisbury Plain ...	...	...	157.50	47.13	...	...	...	157.50	47.13	...
	2112 ...	Primrose ...	...	...	...	...	...	...	...	143.75	117.43	...
	(2114) ...	Queen of the May ...	...	...	31.50	5.91	...	...	...	31.50	5.91	...
	2084 ...	Trovato di Pietro ...	...	...	205.50	137.05	...	...	1.77	1,470.50	757.94	...
	(2089) ...	Young Australia ...	...	...	207.00	66.78	...	...	...	1,593.77	1,455.55	...
		Voided leases ...	...	...	...	...	...	41.26	548.38	281,798.37	216,373.03	66.63
	Sundry claims ...	...	...	1,960.75	545.76	...	164.64	666.90	31,909.74	16,085.04	...	

Eelya	...	...	Voided leases and sundry claims	...	...	...	...	...	...	110.64	1,699.65	2,472.26	...
Mindoolah	...	...	do. do. do.	...	...	...	...	...	3.07	28.77	10,415.60	6,729.54	42.97
Reedy	...	2092 ...	Culculli North	...	...	81.25	39.33	...	...	...	173.50	111.99	...
	...	1977, etc.	Triton Gold Mines, N.L.	...	...	77,757.00	26,811.48	2,633.87	...	...	100,064.00	34,043.02	3,187.95
	...	1977 and 1981	Prior to transfer to present holders	...	...	...	...	...	...	...	14,492.50	7,073.36	5.00
	...	2121, etc.	Turn of the Tide G.Ms., Ltd.	...	...	359.50	131.45	...	...	...	975.50	212.77	...
	...	2117 ...	Western G.Ms., N.L.	...	...	3.50	1.74	...	...	...	63.50	81.74	...
			Voided leases	...	...	...	...	...	...	214.65	1,590.50	6,470.58	...
			Sundry claims	...	...	160.55	55.64	...	169.59	90.61	2,570.05	1,311.88	...
Tuckabianna	...	2067 ...	Buttercup 2	...	...	78.25	11.11	...	...	...	3,695.75	694.68	...
	...	2130 ...	Garibaldi	...	...	48.35	393.86	...	...	...	48.35	393.86	...
	...	2174 ...	Vienna	...	...	25.50	9.93	...	...	...	25.50	9.93	...
			Voided leases	...	...	...	...	...	...	162.70	7,595.50	5,347.58	...
			Sundry claims	...	17.92	99.00	18.28	...	24.06	258.36	2,633.85	1,790.91	...	
Tuckanarra	...	2079 ...	Batchelor	...	17.95	79.00	89.76	...	...	17.95	332.00	284.04	...
	...	2176 ...	Kingfield	...	...	49.00	59.32	...	...	...	49.00	59.32	...
			Voided leases	...	...	...	...	...	14.65	3,072.74	18,725.65	21,741.55	172.77
			Sundry claims	...	...	709.00	301.25	...	115.23	688.52	8,162.98	9,558.93	...
Weld Range	...	2080 ...	Tyrano	...	...	46.00	21.81	...	...	23.64	515.75	471.21	...
			Voided leases	...	...	...	...	...	...	...	30.00	15.20	...
			Sundry claims	...	...	233.75	76.76	...	...	3.90	1,028.25	677.31	...
			<i>From District generally :-</i>											
			Sundry Parcels treated at:											
			State Battery, Cue	...	...	...	1,177.28	...	...	...	12.75	* 11,986.08	...
			State Battery, Tuckanarra	...	...	...	191.35	...	...	...	518.50	* 5,000.95	...
			Various Works	...	...	...	...	...	...	...	6,925.52	* 29,371.15	1,147.77
			Reported by Banks and Gold Dealers	...	235.09	5.38	...	...	2,307.93	64.44	...	18.82	...
			Totals	...	235.09	42.37	82,833.32	30,829.67	2,633.87	2,859.99	6,242.34	607,544.38	440,765.95	4,732.80

MEEKATHARRA DISTRICT.

Abbotts	...	1799N ...	Mt. Vranizan	...	...	148.50	105.29	...	...	...	148.50	105.29	...
	...	1726N	Murchison King	...	...	224.25	519.88	...	...	...	302.75	755.15	...
			Voided leases	...	...	...	...	...	...	26.45	35,210.60	37,124.40	...
			Sundry claims	...	...	919.77	407.22	...	...	5.29	2,441.52	1,631.17	...
Burnakura	...	(1734N)	Federal City No. 2	...	...	40.25	5.22	...	...	...	40.25	5.22	...
			Voided leases	...	...	...	...	...	...	3,239.43	38,671.45	30,653.86	26.90
			Sundry claims	...	...	76.25	18.77	...	12.51	81.11	774.80	442.39	...
Chesterfield	...	(1689N)	Margueritta	...	...	24.00	9.43	...	...	...	113.00	38.75	...
			Voided leases	...	...	...	...	...	29.02	420.32	6,756.26	7,445.01	80
			Sundry claims	...	...	90.50	35.42	...	...	41.63	669.55	641.62	...
Gabanintha	...	1759N ...	Lillian Extended	...	...	164.50	93.52	...	...	...	261.00	160.68	...
	...	1801N ...	Mountain View	...	2.77	...	...	...	...	2.77	...	...	...
	...	1725N ...	New Brew	...	...	105.00	150.81	...	...	...	215.00	295.00	...
	...	(1706N)	Faugh-a-Ballagh	...	...	...	...	...	...	...	64.75	8.57	...

TABLE II.—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 1936.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.
Gabanintha—contd.	(1724N) ...	Two Bobs ... ..	...	...	13.75	2.91	...	...	...	38.50	7.32	...
		Voided leases ... ..	...	...	...	...	...	16.93	21,918.00	13,447.58	815.57	...
		Sundry claims ... ..	...	...	122.25	66.20	...	16.78	147.72	2,387.25	1,549.64	...
Garden Gully ...	(1702N) ...	Kyarra ... ..	...	...	6.50	4.96	...	...	...	6.51	6.56	...
	1719N ...	Sabbath ... ..	...	...	74.50	68.13	...	...	...	199.75	260.46	...
		Voided leases ... ..	...	...	...	...	...	26.36	74.91	29,854.06	21,435.37	1,102.59
		Sundry claims ... ..	...	...	402.50	207.78	...	...	5.38	1,498.69	1,126.07	...
Gum Creek ...	1663N ...	Koldarra Rose ... ..	...	...	40.00	34.66	...	...	...	40.00	99.18	...
		Voided leases ... ..	...	...	...	...	...	25.27	91.96	3,853.08	3,718.81	...
		Sundry claims ... ..	...	...	8.00	7.03	...	...	84.86	671.00	610.68	...
Holden's ...	1551N ...	New Waterloo ... ..	...	...	...	2.68	...	...	...	398.00	92.57	...
		Voided leases ... ..	...	...	...	...	...	...	18.00	16,593.00	6,401.50	...
		Sundry claims ... ..	...	...	...	...	...	164.95	49.07	400.15	274.11	...
Jillawarra ...	...	Voided leases ... ..	...	...	...	...	...	...	1,134.68	1,499.55	2,801.53	...
		Sundry claims ... ..	...	...	12.25	5.44	...	173.02	150.04	281.75	201.97	...
Meeka Pools ...	...	Voided leases and sundry claims	...	...	...	...	...	...	2.84	345.15	287.65	...
Meekatharra ...	1569N ...	Commodore ... ..	...	...	...	...	...	...	...	781.50	611.18	...
	1765N ...	Danube ... ..	...	...	359.75	78.45	...	...	...	359.75	78.45	...
	1749N ...	Halcyon ... ..	...	...	...	...	...	...	...	44.50	14.07	...
	1735N ...	Halcyon Extended ... ..	...	...	...	...	...	...	...	14.00	10.16	...
	1466N ...	Haveluck ... ..	...	...	...	...	...	...	...	1,738.30	1,612.07	...
	1559N ...	Ingliston ... ..	...	...	42.50	37.66	...	...	...	279.00	389.20	...
	1542N, etc. ...	Ingliston Albert's leases ... ..	...	...	558.75	346.34	...	...	...	2,062.70	1,026.71	...
	475N, 515N, etc. ...	Ingliston Consols Extended leases ... ..	...	...	37,204.00	7,221.07	...	...	...	800,784.22	343,928.02	...
	475N ...	(Ingliston Consols Extended) ... ..	...	...	...	...	...	...	...	1,536.25	4,248.25	...
	477N, 814N ...	(Fenian leases) ... ..	...	...	...	...	...	...	...	322,317.69	273,278.92	...
	1539N ...	Ingliston South ... ..	...	...	5,354.00	2,970.00	...	...	...	11,273.25	9,893.05	...
	1594N ...	Lucky Hit ... ..	...	6.24	...	...	...	...	6.24	40.75	11.86	...
	533N ...	Marmont ... ..	...	...	520.75	345.57	...	...	...	56,611.20	40,874.10	...
	580N ...	Marmont Extended ... ..	...	...	...	...	...	...	...	1,432.95	1,388.46	...
	580N, 888N ...	(Marmont Extended leases) ... ..	...	...	...	...	...	...	...	195.00	167.64	...
	1654N ...	Mary ... ..	...	...	34.00	28.76	...	...	...	34.00	28.76	...
	1547N, 1576N ...	Meekatharra Central Gold, N.L. ... ..	...	...	...	...	...	...	...	1,668.00	450.38	...
	1547N, 1576N ...	(Lady Central leases) ... ..	...	...	...	...	...	...	11.06	2,951.42	5,198.33	...
	1577N ...	Mopoke ... ..	...	...	332.00	89.06	...	...	...	533.25	139.90	...
	1565N ...	New Gwalia ... ..	...	...	...	...	...	...	...	918.90	476.69	...

	1603N ...	Patricia ...							40.75	153.87	85.23	
	1571N ...	Phar Lap ...			518.25	489.11				1,798.00	845.97	
	1574N, 1529N, etc.	Prohibition G.M. Co., N.L.			417.75	66.25				417.75	66.25	
	1529N, 1540N...	(Prohibition G.M. Co., N.L.)								29,422.00	4,971.30	
	1574N ...	(Rough up) ...								5,796.00	707.90	
	1760N ...	Stockholm ...			108.00	63.07				108.00	63.07	
	1552N ...	United ...								136.75	121.82	
		Voided leases ...						3.88	913.46	356,080.29	196,447.38	2,454.74
		Sundry claims ...	1.88	25.67	438.75	175.72		229.71	442.88	16,970.20	7,766.40	
Mistletoe ...		Voided leases ...						4.15	1,000.24	417.00	486.21	
		Sundry claims ...		7.49				119.14	71.85	19.75	2.03	
Mt. Maitland ...		Voided leases ...								88.00	80.11	
		Sundry claims ...			12.00	6.77				273.00	203.96	
Munara Gully ...		Voided leases ...								13,167.75	6,489.65	
		Sundry claims ...		18.16	92.00	27.36			29.78	569.25	193.62	
Nannine ...	1700N, 1564N, etc.	Aladdin G.Ms., Ltd.			3,754.00	359.94				5,965.00	517.80	
	1564N ...	(Queen of the Lake)								3,914.10	457.70	
	1700N ...	(Champion Extended)								11.05	52.62	
	1580N ...	aledonian ...			80.25	21.04				210.75	121.40	
	1645N ...	Champion ...			30.50	15.27				30.50	15.27	
	1644N ...	Champion South								30.00	11.91	
	1746N ...	Jubilee ...		39.64	34.75	88.99			39.64	53.55	377.38	
	(1750N) ...	Klondyke ...	3.23					3.23				
	1715N ...	Nannine Mine			11.00	8.88				11.00	8.88	
	1582N ...	Pearl ...			470.00	146.18				647.00	262.19	
	1716N ...	Pearl South			30.00	11.33				30.00	11.33	
		Voided leases ...						34.02	599.40	92,371.55	68,570.59	167.45
		Sundry claims ...		34.17	286.12	268.22		97.99	801.77	5,149.10	4,174.97	
Quinns ...	1634N, 1635N...	Commonwealth leases			2,540.00	852.59				4,367.00	1,440.82	
	1699N ...	Nowthanna Central			108.50	26.15				187.25	88.37	
		Voided leases ...						7.30	1,186.50	24,425.66	10,639.36	90.70
		Sundry claims ...			170.50	95.86		15.07	1,174.90	3,055.90	2,418.51	
Ruby Well ...		Voided leases ...								7,443.00	3,988.36	
		Sundry claims ...		20.07	37.00	75.86		1,015.87	409.39	467.25	609.19	
Stake Well ...		Voided leases and sundry claims						31.91	234.85	22,113.60	10,068.50	
Star of the East ...		do. do. do.								27,371.62	20,400.37	
Yaloginda ...	(1711N) ...	Blue Bird ...			575.50	74.43				767.75	108.44	
	(1747N) ...	Ormaston ...			42.75	8.74				14.56	208.50	124.84
		Voided leases ...						19.03	1,756.35	26,474.79	13,877.56	8.68
		Sundry claims ...		45.51	450.10	242.69		61.89	600.80	5,752.32	3,256.04	
	<i>From District generally :-</i>											
	Sundry Parcels treated at:											
		State Battery, Meekatharra				790.58				29.00	*16,731.22	19.00
		Various Works				17.34				172.75	*6,071.35	342.17
		Reported by Banks and Gold Dealers	419.08	14.43				10,819.64	83.66		2.64	
	Totals		424.19	214.15	57,086.24	16,794.63		12,910.74	15,012.46	2,027,908.10	1,198,392.76	5,028.90

TABLE II.—Production of Gold and Silver from all sources, etc.—continued.

MURCHISON GOLDFIELD—continued.

DAY DAWN DISTRICT.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1936.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.
Day Dawn	641D	Creme d'Or	...	...	127.50	246.33	...	...	...	127.50	246.33	...
	639D	Lone Hand	...	...	177.00	249.68	...	...	...	193.75	262.79	...
	573D	Mountain View	...	...	384.50	59.91	...	...	94.05	1,406.78	1,444.70	...
	640D	New Ballarat	...	...	50.00	52.31	...	...	...	131.50	73.06	...
	576D	New Fingal	...	...	68.75	8.57	...	6.12	6.84	1,278.50	620.45	...
		Voided leases	...	...	...	...	...	160.64	645.24	1,915,971.83	1,219,846.28	169,210.44
		Sundry claims	...	...	282.50	214.66	...	41.11	363.89	9,236.46	5,117.72	...
Lake Austin	536D, etc.	Lake Austin Eureka G.M. Co., N.L.	...	...	...	.71	...	...	...	500.00	38.02	...
	536D	(Eureka)	...	...	...	...	...	1,297.51	...	145.26	3,748.25	...
	586D, 577D, etc.	New Golconda Mines, N.L.	...	...	480.75	167.45	...	...	...	480.77	194.45	...
	577D, 586D	Prior to transfer to present holders	...	...	...	...	...	...	175.57	443.75	123.70	...
		Voided leases	...	...	...	...	...	601.92	1,591.39	29,954.12	45,477.99	...
		Sundry claims	...	...	32.50	3.67	...	59.07	574.20	2,680.89	945.26	...
Mainland	...	Voided leases	...	...	...	...	...	.41	3,296.77	7,575.62	25,026.07	...
	...	Sundry claims	...	...	22.25	5.85	...	4.74	697.41	906.20	525.89	...
Pinnacles	642D	Baby Mine	...	...	13.50	10.15	...	...	...	13.50	10.15	...
	594D	Dalmatia	...	...	81.00	14.31	...	...	...	270.25	47.45	...
	599D	Eclipse	...	...	163.25	53.04	...	...	...	245.75	64.87	...
		Voided leases	...	...	...	...	...	4.90	1,213.68	17,137.75	9,507.94	...
		Sundry claims	...	...	197.25	103.88	...	...	427.32	2,768.57	1,213.93	...
		<i>From District generally:—</i>										
		Sundry Parcels treated at:										
		Various Works	...	...	...	...	...	...	16.61	940.75	1,741.97	...
		Reported by Banks and Gold Dealers	26.56	3.06	...	1,806.24	30.2577	...
		Totals	2,080.75	1,190.52	...	2,685.15	10,430.73	1,992,409.50	1,136,278.04	169,210.44

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MOUNT MAGNET DISTRICT.

Lennonville	1343M	Canterbury	23.25	2.91	23.25	2.91	...
	1309M	Galtee Moore	55.75	21.99	...
	1335M	Piedmont	...	...	73.00	27.41	...	...	...	73.00	27.41	...
	1283M	Welcome	...	12.79	427.00	85.77	...	...	12.79	828.02	203.03	...
	(1284M)	Welcome Extended	...	...	341.25	69.45	...	...	...	395.50	80.49	...
		Voided leases	...	...	...	...	...	...	3,196.79	141,578.03	124,531.88	458.82
		Sundry claims	...	5.44	820.75	176.44	...	19.14	104.87	9,534.82	4,182.56	...

Mt. Magnet	1323M	Acquaintance			21-50	4-52				63-50	25-62		
	1334M	Black Cat			301-75	515-04			2-12	301-75	515-04		
	1351M	Bonny Venture			10-14	16-00			10-14	16-00	43-70		
	1251M	Broken Bond			87-73	151-50	103-28			87-73	331-25	788-51	
	(1279M)	Corona G.Ms., N.L.				178-00	125-65				255-75	180-29	
	1337M	Eclipse				29-50	69-54				29-50	69-54	
	1255M	Edward Carson				897-00	1,784-64				1,598-25	2,085-33	
	1286M	Evening Star			36-37	12-00	20-21			36-37	48-82	607-68	
	(1314M)	Evening Star Extended				112-50	36-15				222-75	87-16	
	1332M	Fine Cut				32-00	31-60				38-75	47-41	
	1271M, 1273M	Foster's leases				1,449-00	138-32		1-43		1,569-75	150-91	
	1254M	Golden Age			2-64	80-50	62-71			45-00	258-03	536-84	
	1287M	Havelock				651-75	165-71				801-50	219-20	
	1320M	Hesperus Dawn				14-50	5-80			5-56	14-50	5-80	
	1282M	Hill 50 G.M., No Liability				4,341-00	1,270-66				4,341-00	1,270-66	
	1333M	Lady Jean				57-25	180-28				57-25	180-28	
	1242M	Lucky Hit				302-25	44-37				1,729-75	453-83	
	1339M	Mars				224-00	46-34				224-00	46-34	
	1256M	Morning Star				13-25	3-90				110-2-4	32-04	
	1215M, etc.	Mt. Magnet G.Ms., Ltd.				54,760-00	10,519-00				107,323-00	19,231-13	
	1215M	(Hill 60)									25,457-00	11,620-09	
	1274M	Nathan				739-50	100-53				2,508-00	503-37	
	1246M	Neptune									239-75	474-88	
	1281M	Saturn				390-75	50-32				574-50	74-92	
	(1321M)	South Lease				8-00	21-02				38-25	49-39	
	1322M	Three Boys				20-50	47-06				51-53	169-65	
		Voided leases							27-83	8,733-42	379,526-75	217,190-07	714-36
		Sundry claims		101-38	130-03	2,099-25	793-64		107-82	1,514-86	41,619-90	24,044-42	
	Mt. Magnet East		Voided leases and sundry claims						63-29	801-75	5,940-53	3,240-04	
	Moyagee		Voided leases							5-08	5,058-85	7,529-73	
			Sundry claims			206-50	188-43		2-83	129-92	1,213-75	1,268-98	
	Paynesville	1342M	Lady Maud			71-00	18-48				71-00	18-48	
	1245M	Milgoo Mine			40-00	118-21				180-50	484-48		
		Voided leases							1,613-34	97-27	549-10		
		Sundry claims	3-36	1-84	119-00	36-08		3-36	524-83	749-07	1,322-01		
<i>From District generally :-</i>													
Sundry Parcels treated at :													
Empress Cyanide Plant													
State Battery, Boogardie													
Various Works													
Reported by Banks and Gold Dealers													
			19-68	2-25				1,930-43	22-17		12-38	1-00	
Totals			124-42	291-35	69,025-00	18,317-26		2,156-13	16,846-74	735,285-94	465,237-23	1,174-18	

Yalgoo Goldfield.

Bilberatha		Voided leases								642-00	276-13	
		Sundry claims			241-55	91-89			5-33	2,063-55	1,110-28	
Carlamitda	1095	Reliance			383-00	144-14		1-28		490-50	180-29	
		Voided leases								947-32	524-72	3-30
		Sundry claims			29-50	10-76				1,174-00	469-03	

TABLE II—Production of Gold and Silver from all sources, etc.—continued.

YALGOO GOLDFIELD—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1936.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.
Field's Find	907, 909, 985, 986	Brown's Reward Leases	...	...	...	...	...	...	4,840.55	3,876.07	...
	1116	Field's Find No. 2 South	...	...	108.50	16.01	...	...	108.50	16.01	...
	1109	Mt. Laws	...	...	28.00	3.74	...	...	28.00	3.74	...
	1115	Rose Marie	...	...	202.50	67.41	...	...	202.50	67.41	...
		Voided leases	...	...	...	...	...	226.72	38,302.80	27,245.64	...
		Sundry claims	293.00	57.95	...	5.77	166.07	4,216.50	1,594.50	...
Goodingnow	1122	Adeline	...	59	36.00	20.95	59	36.00	20.95	...
	1063	Ark	...	...	30.50	23.87	...	...	244.50	108.47	...
	1102	Astor	...	...	235.50	53.66	...	...	452.50	152.16	...
	1025	Carnation	...	...	624.00	833.43	...	...	3,146.55	3,804.62	...
	1049	Lake View	...	...	859.50	377.31	...	...	2,882.00	1,555.21	...
	(1075)	Lake View West	...	...	18.00	8.93	...	...	18.00	8.93	...
	1124	Marigold	...	...	90.00	64.31	...	...	90.00	64.31	...
	1090	Orchid	...	...	1,402.50	800.90	...	...	1,758.50	1,029.74	...
	1098	Princess Mary	...	...	205.00	40.38	...	...	311.50	97.66	...
	1085	Sweet William	...	...	190.50	71.03	...	...	308.00	119.16	...
		Voided leases	146.70	272.73	31,359.06	37,921.31	...
		Sundry claims	649.50	251.09	...	148.00	128.40	8,292.75	4,551.57	...
Gullewa	1123	Golden Stream	...	...	59.50	21.69	...	...	59.50	21.69	...
	1096, etc.	King Solomon's Mines, Ltd.	...	...	70.00	21.96	...	...	164.00	73.79	...
	1047	Mugga King	...	...	158.50	88.03	...	...	963.50	468.89	...
	1065	Shenandoah	...	...	...	...	...	...	428.00	330.09	...
		Voided leases	...	...	...	...	...	78	23,074.50	15,137.98	...
	Sundry claims	...	...	218.00	89.12	...	...	170.45	3,641.75	1,795.39	...
Kirkalucka	1118	April Fool	...	...	19.00	19.53	...	...	19.00	19.53	...
		Sundry claims	...	...	84.00	50.87	...	4.14	199.80	106.72	...
Messenger's Patch	1010, 1011	Gnow's Nest Leases	...	...	384.50	143.94	...	...	1,780.75	1,341.42	...
		Voided leases	...	...	...	...	...	321.80	36,823.76	26,254.41	1,083.01
		Sundry claims	...	...	87.05	12.22	...	463.12	333.98	1,288.35	504.20
Mt. Farmer		Voided leases	...	...	...	...	...	...	64.00	40.19	...
		Sundry claims	...	...	...	...	...	...	158.75	73.62	...
Mt. Gibson	(1017)	Golden Harp	...	...	20.00	17.84	...	...	92.00	85.13	...
		Voided leases and sundry claims	...	...	...	...	...	33.06	1,110.85	1,062.73	...
Ninghan		do. do. do.	...	...	...	...	...	334.75	124.69	...	

Noongal	1020	Don Bradman	114.50	29.10	...	...	165.50	34.37	...
	(1099)	Lady Lydia	68.55	8.42	...	...	346.05	43.97	...
	953	Revival	84.00	15.61	...	...	2,247.75	1,095.81	...
	(1064)	Right One	25.00	4.55	...	...	202.50	111.66	...
		Voided leases	...	...	...	7.88	27.78	3,660.95	2,356.96
		Sundry claims	491.05	187.54	...	34.55	303.93	5,524.30	2,373.28		
Nyounda		Voided leases	...	...	...	...	217.63	416.00	183.91
		Sundry claims	163.50	24.38	...	...	4.28	272.00	65.92
Pinyalling		Voided leases	...	...	...	...	1.36	2,281.60	902.03
		Sundry claims	160.50	58.72	...	...	2.59	750.50	377.59
Retaliation	1046	Alma May	140.75	77.52	...	...	...	358.75	223.74
	1023, etc.	Atlas Gold Mines	942.50	280.74	...	...	...	942.50	280.74
	1023	(Hayes Reward)	...	...	...	...	...	117.50	52.30
		Voided leases and sundry claims	...	...	...	...	...	1,563.00	810.90
Rothsay	1013, etc.	Rothsay Gold Mines, N.L.	...	667.00	...	...	...	7,595.00	2,285.68
	1013, etc.	Prior to transfer to present holders	...	...	...	...	...	415.50	176.15
		Voided leases	...	...	...	...	...	9,360.25	3,560.38
		Sundry claims	323.25	126.26	...	...	...	5,399.50	2,250.03
Wadgingarra		Voided leases	...	...	...	...	...	541.61	600.91
		Sundry claims	82.55	21.23	...	...	...	1,714.30	435.23
Warda Warra	1108	Mistake	307.00	43.65	...	...	...	307.00	43.65
	1001, 1040	Western Queen (1936), N.L.	1,210.00	556.79	...	...	...	1,210.00	556.79
	1001, 1040	(Western Queen Leases)	...	...	...	...	...	8,403.00	4,958.42
		Voided leases	...	...	...	...	...	51.50	24.70
		Sundry claims	90.00	15.38	...	...	...	913.75	361.10
Warriedar	1081	Highland Chief	146.50	17.38	...	...	...	625.00	63.21
		Voided leases	...	...	...	...	...	12,237.00	4,320.14
		Sundry claims	468.00	117.12	...	...	2.84	7,551.85	1,699.25
Yalgoo		Voided leases	...	...	...	...	3.23	6,314.50	9,965.18
		Sundry claims	359.00	81.40	...	...	23.56	2,111.25	925.73
Yuin	1682	Royal Standard	788.00	217.55	...	...	...	1,203.00	343.85
		Voided leases	...	...	...	...	127.12	66,048.50	27,365.63
		Sundry claims	11.00	1.85	...	...	4.70	335.50	67.53
<i>From Goldfields generally:—</i>											
Sundry Parcels treated at:											
		Revival Cyanide Plant	...	304.08	...	...	...	...	495.04
		State Battery, Payne's Find	...	201.19	...	...	...	38.50	*2,787.98
		State Battery, Warriedar	...	107.84	...	...	...	...	6,011.86
		State Battery, Yalgoo	...	83.00	...	...	...	...	589.02
		Shenandoah Cyanide Plant	...	143.71	...	...	...	...	143.71
		Various Works	...	...	...	9.42	...	664.00	*2,131.66
		Reported by Banks and Gold Dealers	7.73	4.63	...	851.99	35.62	...	26.67		
Totals			7.73	5.22	12,703.25	6,794.97	1,668.71	2,418.69	324,008.25	213,314.39	1,250.41

TABLE II.—Production of Gold and Silver from all sources, etc.—continued.

Mt. Margaret Goldfield.
MOUNT MORGANS DISTRICT.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1936.					TOTAL PRODUCTION.					
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	
Australia United ...	...	Voided leases and sundry claims ...	...	...	...	...	...	2,492.61	17,064.94	25,473.28	1.76	
Eucalyptus ...	(420F) ...	Round Hill ...	...	...	25.00	10.97	...	13.79	68.00	62.20	...	
		Voided leases ...	...	...	...	...	...	2,864.77	1,351.35	3,020.68	...	
		Sundry claims ...	...	85	154.50	63.21	...	412.51	879.25	952.60	...	
Korong ...	...	Voided leases and sundry claims ...	...	...	...	...	17.95	107.20	3,162.28	3,833.74	...	
Linden ...	396F, etc. ...	Bindah Gold Mines, Ltd. ...	...	...	...	...	...	...	478.00	80.41	...	
	(480F) ...	Compensator ...	...	...	37.00	21.60	...	...	520.00	280.32	...	
	494F ...	Local Lady ...	...	...	159.00	59.79	...	...	159.00	59.79	...	
	484F ...	Mount Celia ...	...	...	541.00	100.18	...	...	541.00	100.18	...	
		Voided leases ...	...	...	...	...	7.53	553.16	54,091.31	41,661.53	68	
		Sundry claims	1.77	1,120.00	507.99	...	104.91	112.37	12,826.35	8,107.70	...	
Mt. Howe ...	...	Sundry claims ...	...	...	...	...	...	...	79.00	55.75	...	
Mt. Margaret ...	418F, etc. ...	(Mt. Margaret Mines, N.L.) ...	...	...	824.00	307.09	...	...	890.25	332.37	...	
	418F, etc. ...	Westralia Renown Mines, N.L. ...	...	...	1,319.00	539.00	...	...	1,319.00	539.00	...	
		Voided leases ...	...	...	...	...	37	...	6,412.89	4,290.53	12.55	
		Sundry claims ...	...	...	...	...	25.22	99.24	841.60	470.72	...	
Mt. Morgans ...	5F, etc. ...	Westralia Renown Mines, N.L. ...	...	...	...	120.00	...	...	5,439.00	1,581.73	...	
	5F, etc. ...	(Westralia Mt. Morgans Mines, N.L.) ...	...	...	...	...	...	16.66	575,148.00	294,758.28	...	
		Voided leases ...	...	...	...	...	...	...	198,588.18	57,530.49	5552.63	
		Sundry claims	12.75	7.31	...	20.79	76.56	57,630.75	31,014.21	77.86	
			314.07	2,285.54	2,162.18	...	
Murrin ...	395F ...	Arthur Rymer ...	...	...	334.50	61.72	...	8.42	3,242.25	586.84	...	
	447F ...	Golden Spell ...	...	...	163.00	38.08	...	...	163.00	38.08	...	
	479F ...	Golden Treasure New ...	...	...	90.00	39.06	...	...	121.25	62.33	...	
	482F ...	Hill End ...	...	...	242.50	324.58	...	...	524.75	606.14	...	
	490F ...	Margaret Joyce ...	...	...	53.00	47.59	...	...	53.00	47.59	...	
		Voided leases ...	...	...	...	...	10.43	222.93	128,946.97	101,379.93	29.60	
		Sundry claims ...	35.35	5.36	523.50	252.33	...	51.15	444.72	4,286.03	3,401.53	...	
Redcastle ...	(488F) ...	Conundrum	57.50	46.01	57.50	46.01	...	
		Voided leases ...	...	...	...	...	4.49	436.54	3,758.45	3,952.34	...	
		Sundry claims	34.00	18.62	103.58	474.32	452.96	...	

Yundamindera ...	491f ...	Landed at Last ...	...	...	199.75	37.53	...	...	...	199.75	37.53	...
		Voided leases ...	...	...	...	...	...	...	80.47	71,621.35	48,098.48	5.82
		Sundry claims ...	...	15.24	302.50	121.57	...	...	102.81	4,979.25	3,918.46	...
		<i>From District generally :-</i>											
		Sundry Parcels treated at:											
		Rymer's Cyanide Plant ...	...	...	...	117.01	...	...	...	...	617.11	...
		State Battery, Linden ...	...	...	...	407.01	...	...	3.27	263.29	*7,324.44	...
		Various Works ...	...	...	...	...	...	...	...	1,257.81	*5,238.32	99.97
		Reported by Banks and Gold Dealers ...	...	151.35	15.61	...	...	2,314.08	66.48	10.30	56.69	...
		Totals	186.70	38.83	6,192.50	3,248.25	...	2,556.92	8,532.16	1,159,734.96	652,232.47	5,780.87

MOUNT MALCOLM DISTRICT.

Cardinia ...	...	Voided leases ...	...	...	...	...	...	13.87	1,591.66	1,631.74	3,613.33	...
		Sundry claims ...	...	...	323.50	67.94	...	4.25	60.73	789.75	283.90	...
Diorite ...	...	Voided leases ...	...	...	...	...	...	...	845.23	34,659.03	31,744.34	24.05
		Sundry claims ...	...	...	253.25	273.03	...	11.21	215.75	3,060.30	3,514.84	...
Dodger's Well ...	(1726c) ...	Champion ...	...	...	74.00	8.58	...	...	...	74.00	8.58	...
		Voided leases ...	...	...	...	...	...	...	57.90	1,299.30	1,927.94	...
		Sundry claims ...	...	12.55	32.00	13.33	...	.95	28.32	1,431.25	899.87	...
Lake Darlot ...	1727c ...	Corboy's Pinnacles Reward ...	...	...	68.00	52.35	...	...	...	68.00	52.35	...
	1577c ...	Darlot Mining Syndicate, Ltd. ...	...	13.65	...	...	...	...	33.76	13.00	26.12	...
	1728c, 1729c ...	Freeman's Leases ...	...	...	...	...	...	...	...	35.00	35.31	...
	1729c ...	Wilkinson ...	...	...	108.75	115.33	...	...	...	108.75	115.33	...
		Voided leases ...	...	...	...	...	...	...	4,448.42	66,684.21	49,267.54	...
		Sundry claims ...	...	...	32.75	35.60	...	67.68	550.95	5,889.34	4,324.72	2.60
Leonora ...	1594c, etc. ...	Leonora Central G.M. Co., N.L. ...	...	...	...	13.67	...	...	...	2,529.00	89.51	...
	1701c ...	New Year Gift ...	...	...	34.50	3.60	...	...	...	34.50	3.60	...
	190c, etc. ...	Sons of Gwalia, Ltd. ...	...	...	125,260.00	45,095.29	3,698.84	...	...	4,086,176.67	1,774,729.51	119,926.21
	198c, etc. ...	Prior to transfer to existing holders ...	...	...	...	...	...	...	...	109,081.00	55,989.21	8.66
	1557c ...	Tower Hill ...	...	.58	51.00	15.68	...	...	.58	80.05	31.87	...
	(1565c) ...	Tower Hill North ...	...	...	87.50	10.64	...	...	...	87.50	10.64	...
	(1646c) ...	Tower Hill South ...	...	...	22.00	3.97	...	...	...	22.00	3.97	...
	(1744c) ...	do. do. ...	...	...	17.00	1.81	...	...	...	17.00	1.81	...
		Voided leases ...	...	...	...	...	...	...	1,852.57	162,734.95	87,867.40	10.71
		Sundry claims ...	...	...	280.75	130.20	...	30.31	330.67	12,142.55	10,240.45	...
Malcolm ...	1717c ...	Great Northern ...	...	...	22.25	5.68	...	...	...	22.25	5.68	...
	1747c ...	Midas ...	...	...	305.00	114.99	...	...	...	305.00	114.99	...
		Voided leases ...	...	...	...	...	...	...	47.07	62,329.28	47,440.03	...
		Sundry claims ...	...	...	110.00	51.00	...	5.75	33.39	3,957.97	2,525.58	...
Mertondale ...	(1724c) ...	Eastern Districts G.M., Ltd. ...	...	...	15.25	6.01	...	...	...	30.25	33.57	...
	(1721c) ...	Lady Florence ...	...	...	31.50	10.59	...	...	...	31.50	10.59	...
		Voided leases ...	...	...	...	...	...	...	...	88,663.00	60,840.00	1,497.58
		Sundry claims ...	...	...	196.25	101.21	...	1.82	63.04	1,642.96	1,835.81	...
Mt. Clifford ...	1725c ...	Bannockburn ...	...	9.61	285.00	87.48	...	...	9.61	285.00	87.48	...
	(1650c) ...	Kangaroo ...	...	...	10.00	4.45	...	...	...	120.50	40.46	...
	1749c ...	Northwind ...	...	...	50.00	13.35	...	...	...	50.00	13.35	...
		Voided leases ...	...	...	...	...	...	...	1,613.74	6,174.46	15,342.05	...
		Sundry claims ...	...	...	416.50	201.25	...	53.98	280.57	4,368.60	2,952.36	...

TABLE II.—Production of Gold and Silver from all sources, etc.—continued.

MT. MARGARET GOLDFIELD—continued.

MT. MALCOLM DISTRICT—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1936.					TOTAL PRODUCTION.					
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	
Pig Well	...	Voided leases Sundry claims ... ..	...	...	48·00	8·22	...	...	...	34·61	13,587·32 2,846·15	14,676·58 1,208·08	63·68
Randwick	1601c, 1661c ...	Randwick Mines Amalgamated, Ltd. ... Voided leases Sundry claims ... ..	...	...	148·00	49·08	...	66·57	164·02	239·49 1,821·64	76·50 8,099·15 1,821·64	27·50 8,677·96 1,173·61	...
Webster's	(1568c) ...	C. & D. Voided leases Sundry claims ... ..	...	...	27·00	24·36	...	...	...	30·30 36·84	135·75 22,031·75 2,077·20	148·31 14,229·34 1,375·18	...
Wilson's Creek	...	Voided leases and sundry claims	...	...	...	...	...	...	4·24	...	448·00	214·88	...
Wilson's Patch	1748c 1597c (1573c) ...	Chien D'or Garibaldi Robert Voided leases Sundry claims ... ..	...	...	90·00	25·16	...	...	...	...	90·00 63·00 376·25 27,792·10 1,208·41	25·16 20·83 96·88 12,795·72 1,244·29	1·05
<i>From District generally:—</i>													
Sundry Parcels treated at:													
Park & Hunt's Cyanide Plant ... ..			...	...	...	177·51	...	...	...	...	...	494·34	...
Merton's Reward North Cyanide Works			...	...	...	179·94	...	...	...	...	...	248·08	...
Various Works ... ..			...	...	...	...	...	...	...	789·50	*20,200·60	123·15	...
Reported by Banks and Gold Dealers			198·68	98	...	5·17	...	3,079·13	183·45	9·50	32·04	...	...
Totals			198·68	37·37	128,784·66	47,054·13	...	3,407·34	12,856·24	4,738,081·88	2,232,913·47	121,657·69	...

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MOUNT MARGARET DISTRICT.

Burtville	2138t	Nil Desperandum	12·75	22·92	1,091·62	2,571·06	...
	2315t	Sailor Prince ... ..	...	...	49·00	12·54	...	...	...	209·00	61·56	...
	2341t	Sailor Prince South ... ..	...	...	99·75	63·31	...	...	...	430·25	207·07	...
		Voided leases ... ..	...	...	...	...	...	2·29	413·80	66,866·68	103,979·02	275·27
		Sundry claims ... ..	...	...	563·50	181·33	...	1·90	161·01	5,739·41	4,079·01	...

Duketon ...	(2366r)	Re-union ...	15-00	7-39	...	...	...	15-00	7-39	...
		Voided leases ...	...	...	...	3-54	3,213-21	31,485-42	22,318-21	...
		Sundry claims ...	8-50	15-41	...	...	65-43	382-00	509-79	...
Eagle's Nest ...	2385r ...	Blue-White Flag ...	76-75	8-48	...	...	...	76-75	8-48	...
	2384r ...	Safed ...	126-75	13-96	...	...	...	126-75	13-96	...
		Voided leases ...	...	...	...	...	145-34	331-00	1,215-78	...
		Sundry claims ...	21-50	10-72	...	11-45	456-10	512-25	242-81	...		
Erlistoun ...	2339r ...	Gloria ...	61-75	29-02	...	...	...	108-00	46-47	...
	2338r ...	Gladys ...	74-50	97-34	...	...	...	249-75	171-36	...
	2141r, etc. ...	King of Creation leases ...	7,908-00	1,084-26	...	...	...	13,723-00	3,199-66	...
	2383r ...	Nungal ...	37-75	6-38	...	...	...	37-75	6-38	...
	2345r, etc. ...	Western Mining Corporation, Ltd. ...	6,999-00	6,412-23	199-43	...	...	6,999-00	6,412-23	199-43
	2345r ...	(Morgood) ...	...	...	...	...	...	119-25	140-97	...
		Voided leases ...	...	...	...	...	...	40-97	27,882-32	18,744-51
		Sundry claims ...	576-55	231-71	...	1,179-43	117-37	3,890-79	2,769-47	...		
Euro ...	2376r ...	Euro ...	178-00	65-90	...	...	...	178-00	65-90	...
		Voided leases ...	...	...	...	...	65-14	91,556-25	37,582-89	...
		Sundry claims ...	51-75	9-10	...	...	46-52	980-25	586-41	...
Laverton ...	2216r ...	Beria Main Lode ...	182-50	22-87	...	...	...	370-25	56-18	...
	2373r ...	Fairfield ...	11-50	10-55	...	...	...	31-75	53-83	...
	2229r, etc. ...	Ida H. leases ...	...	...	...	...	...	2,641-50	377-10	...
	2260r ...	Just in Time ...	...	...	...	...	...	308-75	66-35	...
	715r, etc. ...	Lancefield (W.A.) Gold Mine, N.L. ...	104,355-00	34,747-19	...	...	...	166,400-00	53,801-49	...
	715r, etc. ...	Prior to transfer to present holders ...	...	...	...	...	...	941,424-98	360,139-22	51,882-27
	2382r ...	Pinnacles ...	49-50	7-78	...	...	...	49-50	7-78	...
	(2231r) ...	She's Right ...	46-25	6-94	...	...	...	950-00	479-76	...
	2322r ...	White Horse ...	78-50	41-89	...	...	...	157-25	53-63	...
		Voided leases ...	...	...	...	20-29	2,024-11	457,912-74	261,058-08	4,674-69
		Sundry claims ...	380-75	177-34	...	210-18	1,419-31	12,487-50	7,215-88	...		
Mt. Barnicoat ...	2336r ...	Lucky Jack ...	53-25	51-18	...	...	...	53-25	51-18	...
	2288r, etc. ...	New Ida leases ...	27-75	12-04	...	...	...	27-75	12-04	...
	2254r ...	Ulalla ...	...	...	...	...	...	327-50	71-86	...
	2313r ...	White Hope ...	31-00	3-55	...	...	...	280-00	26-30	...
		Voided leases and sundry claims ...	...	...	...	...	...	817-25	424-13	...
Mt. Shenton ...	...	Voided leases ...	...	...	...	...	...	15-00	26-65	...
		Sundry claims ...	97-75	71-15	...	...	...	178-50	158-83	...
<i>From District generally :-</i>												
Sundry Parcels treated at:												
		State Battery, Laverton ...	...	...	...	...	...	97-50	*4,279-88	15-64
		Ida H. Tailings Syndicate Plant ...	...	511-29	...	...	...	...	3,752-84	...
		Mary Mac Tailings Syndicate Plant ...	...	355-75	...	...	...	...	1,336-16	...
		Craiggiemore Cy. Works ...	...	320-00	...	...	...	...	363-52	...
		Various Works ...	...	...	...	...	...	157-00	*9,921-74	...
		Reported by Banks and Gold Dealers ...	105-23	22-09	...	2,308-95	49-81	...	10-08	...		
Totals ...			105-23	22-09	122,174-55	44,611-52	199-43	3,738-03	8,218-12	1,837,678-46	908,684-90	57,047-30

TABLE II.—Production of Gold and Silver from all sources, etc.—continued.

North Coolgardie Goldfield.

MENZIES DISTRICT.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1936.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.
Comet Vale	5590z ...	King of the Hills ...	...	...	...	...	...	...	...	7.08	...
	5591z ...	Post Town ...	...	...	...	...	...	...	...	2.07	...
	5217z, 5476z ...	Sand Queen Gladstone Mines, N.L. ...	...	...	9,165.00	2,137.12	2.14	...	25,243.00	9,124.80	2.14
	5217z, etc. ...	Prior to transfer to present holders	...	...	...	...	...	...	75,754.50	59,007.26	1,505.65
		Voided leases ...	...	...	...	...	...	419.74	148,614.97	119,396.26	3,839.28
		Sundry claims ...	...	...	...	...	...	40.19	1,550.91	810.04	...
Goongarrie	5662z ...	Dreadnought ...	...	...	12.00	18.29	...	...	...	12.00	18.29
	5522z ...	Esplein d'Or ...	...	...	16.50	19.84	...	...	...	66.25	44.17
	(5594z) ...	Milldyne ...	...	...	12.75	5.18	...	...	...	12.75	5.18
		Voided leases ...	...	...	...	...	...	.94	1,378.20	27,225.54	17,671.80
		Sundry claims ...	...	1.50	46.50	30.05	...	46.46	1,773.55	2,066.27	2,389.70
Menzies	5539z ...	(Aeroplane) ...	...	...	...	...	...	...	...	151.50	174.25
	5547z ...	Birthday Gift ...	...	...	25.00	17.80	...	...	...	118.50	143.66
	5543z ...	Black Swan ...	...	...	74.25	223.94	...	...	...	202.75	627.49
	(5615z) ...	Bonny Jim ...	...	...	16.00	5.30	...	...	...	16.00	5.30
	5636z ...	Cornwall ...	...	...	40.00	33.82	...	...	...	40.00	33.82
	(5630z) ...	Crown and Cross ...	...	...	9.50	11.65	...	...	...	9.50	11.65
	5628z ...	Donegal Sligo ...	...	...	157.00	85.78	...	...	...	527.00	355.86
	5562z ...	Dublin Proprietary	...	...	5.00	19.68	...	...	...	26.00	31.66
	5511z, 5554z etc.	First Hit G.M. (1934), N.L.	2,776.50	1,880.06	65.73	5,346.50	3,925.87	335.34
	5511z ...	(First Hit) ...	...	...	...	...	...	...	...	1,672.75	4,687.69
	(5613z) ...	Golden Age ...	...	...	13.00	24.23	...	...	...	13.00	24.23
	5542z ...	Good Block Lease ...	...	4.45	98.00	67.80	...	...	4.45	744.50	928.39
	5645z ...	Goodenough ...	...	...	67.00	25.01	...	...	...	67.00	25.01
	(5637z) ...	Good Prospect ...	...	...	8.50	6.67	...	...	...	8.50	6.67
	5484z, etc. ...	Happy Warrior Gold Mines, N.L. ...	...	...	285.96	132.77	...	...	...	285.96	132.77
	5484z ...	(Warrior) ...	...	...	...	...	...	...	...	1,691.00	799.18
	(5604z) ...	Kelly's Eye ...	...	...	66.25	17.63	...	...	...	98.25	31.96
	(5640z) ...	Lady Barbara ...	...	...	17.00	1.94	...	...	...	17.00	1.94
	5549z ...	Lady Harriet ...	...	...	...	...	...	...	...	121.00	42.87
	5652z ...	Lady Lal ...	...	...	18.50	7.14	...	...	...	18.50	7.14
(5611z) ...	Lady's Secret ...	...	...	22.50	8.32	...	...	2.84	57.50	22.01	
5575z, etc. ...	Lady Shenton Gold Mines (1934), N.L. ...	...	...	6,464.00	3,647.03	236.93	...	...	6,464.00	3,647.03	236.93
5592z ...	Lorna May ...	...	...	25.00	13.59	...	...	...	83.75	39.68	
5520z ...	Mignonette ...	...	...	36.00	36.41	...	...	...	148.50	182.44	
5548z ...	Miss Dolly ...	...	...	22.25	34.13	...	...	...	77.75	237.13	
5596z ...	New Florence ...	...	...	31.50	2.47	...	...	...	54.50	11.16	
(5661z) ...	Pharoah ...	...	1.01	10.00	25.89	...	...	1.01	10.00	25.89	

	(5646z)	Pieton G.M.	...	...	35-00	8-33	...	...	...	35-00	8-33	...
	(5512z)	Resurrection	...	...	12-00	17-19	...	...	...	742-50	747-09	...
	5666z	Spion Kopp	...	...	22-25	15-77	...	...	...	22-25	15-77	...
	5663z	Springfield	...	...	24-00	7-20	...	...	...	24-00	7-20	...
	5584z	Sydney	...	...	35-00	71-28	...	...	...	153-00	415-27	...
	(5633z)	Xury	...	...	12-00	1-53	...	...	...	12-00	1-53	...
		Voided leases	...	...	...	...	...	45-42	1,072-03	898,698-05	705,220-69	11,341-73
		Sundry claims	...	...	30-80	672-00	416-39	48-75	499-39	27,761-76	21,481-48	776-49
Mt. Ida	(5659z)	Birthday Gift	...	...	16-00	4-37	...	...	...	16-00	4-37	...
	5653z	Boudie Gold Mines, Ltd.	...	...	45-00	9-25	...	...	...	45-00	9-25	...
	5626z	Bungarra	...	...	638-00	116-65	...	...	...	1,878-00	293-75	...
	(5639z)	Campagnolo	...	...	60-00	49-78	...	...	1-43	230-00	277-85	...
	5658z	Carida	...	...	46-75	56-66	...	...	...	53-75	70-16	...
	5668z	Federation	...	...	85-00	194-31	...	...	...	85-00	194-31	...
	(5552z)	Federation	...	...	52-00	27-14	...	...	...	128-00	44-74	...
	5667z	Golden Ridge	...	...	486-50	272-65	...	...	...	486-50	272-65	...
	(5634z)	Ida Queen	...	...	22-00	7-70	...	...	...	35-75	15-60	...
	5551z, etc.	Mt. Ida Gold Mines, Ltd.	...	...	806-25	571-23	19-78	...	...	894-75	624-45	19-78
	(5622z)	Nellie Bly	...	...	108-00	31-78	...	...	...	108-00	31-78	...
	5651z	Temora	...	...	291-50	135-25	...	...	...	291-50	135-25	...
	5537z	Timoni	...	...	...	8-05	...	...	...	1,512-75	737-95	...
	5597z	Unexpected	...	...	57-00	14-50	...	...	...	57-00	14-50	...
		Voided leases	...	...	...	...	...	...	78-26	58,935-87	68,859-24	106-63
		Sundry claims	...	...	17-57	902-25	433-65	48-14	33-04	10,612-58	5,350-29	...
Twin Hills		Voided leases and sundry claims	...	...	...	...	...	...	307-60	309-27	...	...
	<i>From District generally :-</i>													
	Sundry Parcels treated at:													
		Balkis' Cyanide Plant	...	...	...	21-94	...	...	...	...	251-58	188-70
		Quinlan's Cyanide Plant	...	...	...	...	...	...	...	...	1,234-58	...
		Thompson's Cyanide Plant	...	...	...	549-98	...	...	...	...	562-27	...
		Lady Harriet Cyanide Plant	...	...	...	248-68	...	...	...	279-50	*10,300-28	30-00
		Mt. Ida State Battery	...	...	...	167-60	...	...	...	1,866-25	*5,370-61	...
		Various Works	...	...	...	...	...	...	...	2,512-30	*32,764-32	1,624-70
		Reported by Banks and Gold Dealers	...	...	35-36	60-01	35-00	7-72	1,248-57	264-17	35-00	7-72
		Totals	35-36	115-34	24,004-96	12,006-12	324-58	1,438-28	5,568-30	1,306,437-06	1,080,273-52	20,007-37

ULARRING DISTRICT.

Davyhurst	1015U	Enterprise G.Ms., N.L.	...	...	100-00	21-55	...	...	...	100-00	21-55	...
	(1041U)	Golden Eagle	...	...	401-00	54-53	...	...	...	655-50	130-54	...
	1051U	Golden Pole	...	...	458-50	135-24	...	...	...	482-59	150-58	...
	1042U	Great Hope	...	...	270-00	122-61	...	...	...	363-50	201-29	...
	(1052U)	Hard Hit	...	...	10-00	3-54	...	...	...	10-00	3-54	...
	1040U	Lights of Israel	...	...	161-00	81-58	...	...	...	490-00	144-74	...
	1016U	New Callion	...	...	100-00	17-63	...	...	...	240-00	49-29	...
	1027U	Rosalie	...	...	410-00	77-35	...	...	...	1,115-00	230-74	...
	1033U	Waihi	...	...	69-50	26-88	...	...	...	69-50	26-88	...
		Voided leases	...	...	...	...	...	2-93	144-42	155,923-23	123,203-12	5,403-14
		Sundry claims	...	...	475-04	171-96	...	...	37-98	9,184-44	4,451-41	...
Mulline	1019U, 1018U	Lady Gladys G.Ms., N.L.	...	...	...	...	...	...	...	1,126-00	2,016-74	...
	1019U	(Zora Extended)	...	...	...	...	...	...	...	3-50	727-95	...

TABLE II.—Production of Gold and Silver from all sources, etc.—continued.

NORTH COOLGARDIE GOLDFIELD—continued.

ULARRING DISTRICT—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1936.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.
Mulline—continued	1066U	Lady Mabel ... ..	...	...	24.00	43.60	...	...	...	24.00	43.60	...
		Voided leases ... ..	...	...	...	...	...	...	274.09	100,501.72	100,000.89	530.75
		Sundry claims ... ..	...	13.16	139.50	113.45	...	...	117.90	7,767.64	6,991.32	69
Mulwarrie	1061U	Oakley ... ..	...	...	137.50	86.88	...	...	...	240.50	149.82	...
		Voided leases ... ..	...	...	...	...	...	...	56.84	18,564.68	25,694.23	38.47
		Sundry claims ... ..	...	...	...	...	...	...	56.78	2,532.60	2,246.09	...
Ularring	...	Voided leases and sundry claims	...	...	...	...	...	...	563.34	9,653.60	13,799.60	...
		<i>From District generally:—</i>										
		Sundry Parcels treated at:										
		Howell's Cyanide Works ... ..	...	...	...	65.02	...	...	...	...	87.11	...
		Golden Pole Cyanide Works ... ..	...	...	...	693.49	...	...	...	...	2,444.09	...
		Waihi Cyanide Plant ... ..	...	...	...	451.61	...	...	...	...	827.45	...
		State Battery, Mulline ... ..	...	...	...	387.03	...	...	...	639.99	*15,369.29	...
		State Battery, Mulwarrie ... ..	...	...	...	578.96	...	...	...	613.18	*5,954.50	...
		Various Works ... ..	...	...	...	...	...	...	15.82	205.15	722.41	...
		Reported by Banks and Gold Dealers	4.57	3.71	...	...	...	53.60	27.80	...	5.78	...
		Totals	4.57	16.87	2,756.04	3,132.91	...	56.53	1,294.97	310,506.32	305,694.55	5,973.05

NIAGARA DISTRICT.

Desdemona	858G	Desdemona ... ..	...	...	81.50	40.52	...	...	1.39	129.75	64.58	...
	846G	Six O'clock ... ..	...	...	94.00	19.84	...	...	...	94.00	19.84	...
		Voided leases ... ..	...	...	...	...	...	...	5.73	9,585.25	7,471.39	12.04
		Sundry claims ... ..	...	...	87.50	42.72	...	...	8.99	1,510.45	719.51	...
Kookynie	868G	Altona ... ..	...	7.03	11.50	12.86	...	...	7.03	11.50	12.86	...
	821G	(Cosmopolitan South Extended) ... ..	...	...	1,001.03	506.63	...	...	...	1,942.73	1,327.93	...
	874G	New Cumberland ... ..	...	...	79.00	34.36	...	...	...	79.00	34.36	...
	810G, etc.	Two D's Leases ... ..	...	...	140.00	230.90	...	...	...	1,590.00	555.85	...
		Voided leases ... ..	...	...	...	...	...	...	267.56	735,409.93	389,417.58	5,375.97
		Sundry claims ... ..	...	...	148.75	76.99	...	56.74	99.84	6,157.80	5,215.15	...
Niagara	873G	Peter Pan ... ..	...	...	199.00	58.38	...	...	...	199.00	58.38	...
		Voided leases ... ..	...	...	...	...	...	...	104.54	84,472.50	51,887.97	...
		Sundry claims ... ..	...	...	264.75	93.68	...	28.10	97.22	12,737.16	7,532.96	...

Tampa	861G	Dahlia								67.75	81.64		
	(869G)	Dunluce G.M.			179.75	30.38				179.75	30.38		
	809G	Fortune			38.75	28.43				95.25	211.17		
	(870G)	Secession			47.00	5.43				47.00	5.43		
	880G	Tranquil Toiler			48.25	87.82				48.25	87.82		
		Voided leases							41.58	49,302.07	22,404.80	174.24	
		Sundry claims			242.50	117.86		28.21	259.12	5,216.08	3,139.01		
	<i>From District generally:—</i>												
	Sundry parcels treated at:												
		Various Works								1,220.50	*15,923.54	41.7	
	Reported by Banks and Gold Dealers			24.79				1,533.25	813.23	63.53			
	Totals			24.79	7.03	2,663.28	1,386.80		1,646.30	1,706.23	910,095.72	506,265.68	5,603.42

YERILLA DISTRICT.

Edjudina	1078R	Ace of Hearts			78.75	34.96				543.75	316.64		
	1179R	Eureka								118.00	45.50		
	1134R	Fingall								29.00	10.1		
	1010R, 1011R	(Neta Leases)								738.75	559.80		
	1123R	Seventy-two			20.75	14.40				103.75	74.28		
		Voided leases							18.44	32,466.45	41,885.18	37.79	
	Sundry claims				107.75	63.03		26.89	6,429.83	4,555.20			
Patricia	1080R, 1081R	Kimberley Oil Options, N.L.			1,060.25	1,303.34				3,866.75	5,034.62	25.40	
		Voided leases								43.25	12.85		
		Sundry claims								35.00	17.76		
Pingin	(1178R)	Mona May Gold Mine		1.35	128.00	45.13			1.35	193.00	66.72		
		Voided leases							46.99	14,637.80	10,306.68		
		Sundry claims		4.84	264.25	92.48			150.04	4,780.59	3,082.73		
Yarri	1126R, etc.	Edjudina Gold Mining Co., N.L.			15,177.00	2,331.40	288.21			15,177.00	2,331.40	288.21	
	1126R	(Chateau Tanunda)								124.50	38.89		
	1189R	East West Gold Reefs			125.75	48.35				125.75	48.35		
	1174R	Mt. Wallbrook			257.75	32.92				463.75	80.27		
	1187R	Wallaby			14.00	2.22				14.00	2.22		
	1162R	Wallaby Central			276.00	77.27				564.00	251.05		
		Voided leases						6.30	87.08	37,835.25	19,760.20	2.00	
		Sundry claims		.49	985.75	226.89		.87	5.80	9,696.60	4,220.50		
Yerilla		Voided leases							3,107.25	16,161.93	12,733.54	13.93	
		Sundry claims			42.50	19.32		19.30	27.05	2,512.83	1,447.62		
Yilganie	1159R	Big Wonder			53.50	7.00				53.50	7.00		
	1193R	Melody Mine			32.50	133.65				32.50	133.65		
	1176R	Yilganie Queen			295.00	640.04				468.50	1,042.58		
		Voided leases								292.75	351.14		
		Sundry claims		.44	255.25	120.05		121.67	78.20	1,167.55	979.04		
<i>From District generally:—</i>													
Sundry Parcels treated at:													
	State Battery, Yarri					466.55				271.50	*5,803.20	3.50	
	Various Works							2.17		642.25	*6,049.24		
	Reported by Banks and Gold Dealers			7.51				1,070.43	159.59		45		
	Totals			7.51	7.12	19,174.75	5,659.00	288.21	1,220.74	3,708.68	149,590.08	121,248.31	370.83

TABLE II.—Production of Gold and Silver from all sources, etc.—continued.

Broad Arrow Goldfield.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1936.					TOTAL PRODUCTION.					
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	
Balgarric ...	...	Voided leases and sundry claims	...	...	...	...	...	...	10.94	94.05	6,631.25	5,317.53	1.38
Bardoc ...	2108w	A.I.	...	...	...	...	...	...	...	...	51.00	10.54	...
	2102w	Despatch	...	...	153.00	34.09	...	...	...	...	196.75	57.32	...
	(2065w)	Gabatepe	...	...	16.00	11.07	...	...	...	...	32.25	16.60	...
	2127w	Ora Munda	...	11.38	.05	9.12	...	...	...	11.38	.05	9.12	...
	2079w	Wycheproof	...	11.45	...	...	...	...	...	11.45	473.00	238.61	...
	1 33w	Zoroastrian	...	...	243.00	39.84	...	...	...	23.25	622.45	249.67	...
		Voided leases	...	...	...	...	...	...	...	1,863.68	73,513.05	51,875.49	203.60
		Sundry claims	40	70.42	567.05	322.17	...	54.22	824.15	8,870.61	5,478.66	...	
Black Flag ...	2128w	King Edward	...	1.22	...	...	...	...	...	1.22	...	...	...
	2137w	Royal Standard	...	...	35.50	11.45	...	...	...	...	35.50	11.45	...
		Voided leases	...	...	...	...	...	...	27.81	375.73	41,651.54	25,218.13	...
		Sundry claims	...	...	512.26	193.46	...	710.99	226.40	5,783.32	3,729.13	...	
Broad Arrow ...	(1973w)	Agnetta	...	...	57.00	22.76	...	...	...	9.52	530.00	175.37	...
	(2088w)	Barrier	...	...	16.00	3.99	...	...	...	...	57.50	21.26	...
	2083w	Broad Arrow Consols	...	75.74	100.15	205.90	...	...	80.71	141.80	238.49	...	
	2095w	Cameo	...	...	101.50	25.63	...	...	...	...	101.50	25.63	...
	2138w	Daisy	...	...	.17	25.57	...	...	...	...	.17	25.57	...
	2134w	Donelda	...	...	48.00	70.58	...	...	...	...	48.00	70.58	...
	1996w	Doris	...	...	14.50	16.40	...	...	...	...	33.50	75.91	...
	1984w	Duchess	...	...	18.00	12.56	...	...	...	...	33.00	20.94	...
	2039w	Golden Arrow	...	...	732.00	88.15	...	...	...	...	1,832.00	229.78	...
	2075w	Golden Basin No. 6	...	8.75	415.00	63.93	...	...	8.75	427.00	69.70	...	
	2074w	Golden Basin No. 7	...	...	1,810.00	261.04	...	...	...	1,951.00	290.98	...	
	2115w	Golden Crown	...	...	18.02	31.42	...	...	...	...	18.02	31.42	...
	1958w	Grace Darling	...	...	49.00	34.25	...	...	...	...	1,466.75	1,314.37	...
	2097w	Liberty East	...	.98	32.00	11.87	...	...	.98	85.00	35.78	...	
	2136w	Mt. Pleasant	...	...	132.00	18.34	...	...	...	...	132.00	18.34	...
	1771w	North Duke	...	...	10.00	7.50	...	...	1,533.79	192.80	628.42	...	
	1933w	(Oversight Tara United)	...	35.54	14.00	12.13	...	...	1,131.72	380.54	822.18	...	
	(2107w)	Star of W.A.	...	...	85.00	12.24	...	...	...	...	85.00	12.24	...
	2106w	Trump	...	77.90	21.50	58.87	...	...	...	98.18	21.76	407.73	...
	(1968w)	Victory	...	25.63	...	...	...	...	...	52.62	15.50	15.15	...
		Voided leases	...	...	...	...	...	...	54.85	6,915.18	119,740.49	102,297.32	18.85
		Sundry claims	...	33.99	1,899.04	741.58	...	997.89	1,636.18	17,554.69	10,579.40	...	
Canegrass ...	2028w	Big Four	...	...	98.00	75.96	...	...	...	...	157.00	111.25	...
		Voided leases and sundry claims	...	...	...	...	...	...	234.56	954.80	800.82	...	

Carnage		Voided leases						176.04	659.31	2,402.00	2,170.67	
		Sundry claims				82.83	178.88			807.58	542.31	
Cashmans	2046w	Lady Evelyn		1.17	51.00	17.54			1.17	51.00	24.63	
		Voided leases						67.51	793.44	7,849.65	6,976.37	
		Sundry claims		2.75	99.50	50.73			39.55	784.50	246.74	
Christmas Reef		Voided leases							.29	710.52	183.65	
		Sundry claims		60.64	323.07	609.55			232.90	1,554.42	1,465.25	
Fernbark	(1956w)	Golden Arrow North			103.75	73.36				1,308.75	569.52	
	2121w	Mt. Hardy		4.42	93.00	19.46			4.42	93.00	19.46	
		Voided leases								1,116.50	1,231.54	
		Sundry claims			191.66	92.41				760.61	581.68	
Grant's Patch	1941w, 1979w	Bent Tree leases			601.00	88.69				4,221.50	1,239.51	
	1936w	Dundas G.Ms., N.L.			971.00	301.27				2,096.00	711.82	
	1936w	(Wentworth)								4,642.00	1,689.27	
	1962w, 1967w, etc.	Ora Banda Amalgamated Mines, N.L.			13,193.00	7,284.42				13,193.00	7,284.22	
	1962w, etc.	Prior to transfer to present holders			2,001.00	1,132.54				12,424.50	9,540.07	
	(1983w)	Ora Banda South			176.00	51.98				580.75	258.04	
	(1972w)	Renown		2.59	.10	16.25			258.52	39.85	190.14	
	1953w	Wentworth South			84.00	26.90				944.00	257.40	
		Voided leases								379.50	88.28	
		Sundry claims		1.64	72.02	10.21			318.49	1,944.54	1,309.45	
Ora Banda	1336w, 1399w, etc.	Associated Northern Ora Banda, N.L.			51.00	8.38				51.00	8.38	
	1336w, 1399w, etc.	Prior to transfer to present holders								315,958.95	123,252.22	1,664.70
	(2038w)	Last Hope			245.00	76.56				485.00	204.45	
	(2110w)	Mac Ray			143.00	24.54				143.00	24.54	
	2116w	Mighty Atom			213.00	87.91				213.00	87.91	
	2117w	Missed Chance			295.00	102.39				295.00	102.39	
	1944w (1371w), 1943w, etc.	Ora Banda United Mines, Ltd.			1,524.50	41.20				1,524.50	41.20	
		Prior to transfer to present holders								76,612.22	14,630.93	
	2092w	P.W.B.			369.00	174.12				519.00	292.82	
	2142w	Wotan			37.00	56.57				37.00	56.57	
	(2094w)	Yellow Belle			69.55	246.86			58.00	99.55	392.62	
		Voided leases							771.75	21,089.30	10,424.60	
		Sundry claims		10.10	948.00	367.94			152.80	6,364.75	2,640.53	
Paddington	2122w	George and Mary			10.00	1.50				10.00	1.50	
	(2077w)	George Edward			92.00	16.01				255.00	54.81	
	2114w	Lone Oak	8.58		45.00	56.13		8.58		45.00	56.13	
	2105w	Minnie Palmer			2,067.00	127.75				2,067.00	127.75	
	1985w	Mt. Corlac			117.00	21.84				179.25	103.73	
	2060w	Paddington Gift			85.75	12.77				85.75	12.77	
	2059w	(Paddington North)								52.00	9.50	
	(2058w)	Red Poppy		.77					.77	14.50	6.44	
		Voided leases						5,557.72	257.75	175,644.08	82,350.43	18.96
		Sundry claims		2.26	150.50	68.01		1,714.16	29.88	12,743.56	7,567.42	
Riches Find	2129w	Three Eights			91.50	102.89				91.50	102.89	
		Sundry claims		1.25	118.00	157.57			67.31	493.25	852.10	

TABLE II.—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 1936.					TOTAL PRODUCTION.					
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	
Siberia	Voided leases	1·07	2,552·69	926·97	31,268·13	...
		Sundry claims ... ..	...	91	458·50	134·23	...	289·06	1,138·00	18,697·29	11,865·69	...
Smithfield	2139w	Mountain Maid ... ..	...	...	92·46	77·36	...	...	...	92·46	77·36	...
		Voided leases ... ..	...	...	...	...	...	...	...	1,050·75	221·65	...
		Sundry claims ... ..	...	...	146·60	71·79	...	...	23·79	561·93	417·71	...
		<i>From Goldfields generally:—</i>											
		Sundry Parcels treated at:											
		Associated Northern Cyanide Plant ... ..	...	...	...	1,971·20	958·85	...	...	...	2,573·40	1,324·32
		Black Flag Cyanide Plant ... ..	...	...	...	448·17	...	...	...	...	1,318·03	...
		Golden Arrow Cyanide Plant ... ..	...	...	...	453·33	...	...	...	...	502·94	...
		Mitchell's Cyanide Plant ... ..	...	...	...	222·69	...	...	...	...	274·77	...
		Pearce's Cyanide Plant ... ..	...	...	...	183·11	...	...	...	...	183·11	...
		Peat's Cyanide Plant ... ..	...	...	...	8·35	...	...	...	...	8·35	...
		State Battery, Ora Banda ... ..	...	...	...	1,171·65	...	...	...	72·05	*9,951·66	...
		Various Works ... ..	...	...	...	...	...	2,275·66	1·24	16,854·02	*35,591·05	278·85
		Reported by Banks and Gold Dealers	225·74	16·98	19·43	19·93	...	9,219·87	69·21	38·43	31·56	...	
		Totals	234·72	458·48	32,629·46	18,888·81	958·85	21,166·37	22,564·78	1,022,191·82	584,800·94	3,510·66	

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North-East Coolgardie Goldfield.

KANOWNA DISTRICT.

Gindalbie	Voided leases	19·94	43,613·28	39,438·75	38·31
		Sundry claims ... ..	...	2·33	654·50	383·21	...	...	678·05	2,314·27	1,884·85	...
Gordon	1532x	Sirdar ... ..	...	...	198·75	97·02	...	...	...	198·75	97·02	...
		Voided leases ... ..	...	...	...	...	...	...	589·88	48,580·78	16,437·38	...
		Sundry claims ... ..	...	...	111·25	34·04	...	...	177·38	1,085·70	997·01	...
Kalpini ... ..	...	Voided leases ... ..	...	...	...	...	...	...	38·73	13,463·50	6,739·57	07
		Sundry claims ... ..	...	...	101·50	33·82	...	24·70	247·59	1,142·25	846·88	...
Kanowna	(1530x)	Golden Crown ... ..	...	...	6·45	18·25	...	...	...	6·96	28·70	...
	(1520x)	Golden Feather ... ..	...	...	39·75	29·39	...	...	...	39·75	29·39	...
	(1521x)	Golden Feather East ... ..	...	...	606·05	186·05	...	...	...	1,601·05	499·48	...
	(1495x), etc.	Golden Valley (W.A.), G.M. Co., N.L. ... ..	...	...	353·25	89·33	...	...	...	364·00	91·38	...
	(1474x), etc.	Red Hill Leases ... ..	...	...	51·75	7·72	...	...	...	396·00	108·42	...

	(1518x)	Robinson	...	...	...	29.75	8.00	...	...	...	63.75	23.48	...
		Voided leases	...	...	...	...	...	...	24.94	4,508.74	682,168.59	379,245.54	2,482.24
		Sundry claims	...	...	...	738.50	175.43	...	92.88	1,998.42	19,608.97	9,923.57	1.50
Mulgarrie	...	Voided leases and sundry claims	...	...	...	...	...	...	...	1,229.92	8,145.51	4,821.78	...
Six-Mile	...	Voided leases	...	...	...	...	...	...	...	1,595.63	559.00	767.72	...
		Sundry claims	...	...	...	63.50	15.20	...	...	31.44	347.25	161.84	...
<i>From District generally:—</i>														
Sundry Parcels treated at:														
		Carlson's Cyanide Plant	...	...	...	...	360.59	...	...	...	...	1,561.58	...
		Beavis Cyanide Plant	...	...	...	...	38.73	...	...	...	...	38.73	...
		Job's Cyanide Plant	...	...	...	...	219.35	...	...	...	...	366.18	...
		Hall's Cyanide Plant	...	...	...	...	18.32	...	...	...	...	54.91	...
		North White Feather Cyanide Plant	...	...	...	...	24.13	...	...	...	...	59.90	...
		Various Works	...	...	...	...	...	...	330.42	867.52	158,919.05	149,179.54	...
		Reported by Banks and Gold Dealers	...	...	210.84	...	2.90	...	105,130.53	33.11	.50	96.25	...
		Totals	210.84	2.33	2,955.00	1,741.48	...	105,603.47	12,016.35	982,618.91	613,499.85	2,522.12

KURNALPI DISTRICT.

Jubilee	444K	Evelyn Gladys	...	...	...	69.00	15.32	...	...	...	69.00	15.32	...
		Voided leases	...	...	...	...	...	...	...	145.13	1,821.25	1,408.51	...
		Sundry claims	...	...	...	132.25	53.06	...	25.57	13.52	983.50	450.27	...
Kurnalpi	445K (443K)	Lady Mary	...	...	...	90.00	25.33	...	...	...	90.00	25.33	...
		Old Harriet	...	...	...	...	7.27	...	...	...	976.50	1,093.27	...
		Voided leases	...	...	...	...	...	...	371.18	3,100.64	2,925.01	2,778.07	6.27
		Sundry claims	...	...	...	2.49	167.01	...	303.36	322.90	3,504.61	1,764.46	...
Mulgabbie	...	Voided leases and sundry claims	...	...	...	...	...	...	6.50	2,679.12	348.95	8,422.63	4.95
<i>From District generally:—</i>														
Sundry Parcels treated at Various Works														
		Reported by Banks and Gold Dealers	26.75	11,849.92	67.08	...	101.50	382.73	...
		Totals	26.75	2.49	458.26	181.22	...	12,556.53	6,328.39	10,820.32	16,342.94	11.22

East Coolgardie Goldfield.

EAST COOLGARDIE DISTRICT.

Binduii	5802E	Bell of Kalgoorlie	...	...	...	70.00	7.71	...	...	...	70.00	7.71	...
		Voided leases	...	...	...	...	...	...	...	...	334.10	224.30	...
		Sundry claims	...	...	...	10.59	519.25	103.97	...	11.88	3,347.77	1,189.42	...
Boorara	(5722E) 5486E	Golden Ridge	...	...	...	37.25	17.67	...	...	...	69.25	33.00	...
		Olympian	...	...	...	57.25	85.26	...	...	...	303.25	304.23	...
		Voided leases	...	...	...	...	...	...	...	459.07	306,796.82	171,798.97	408.36
		Sundry claims	...	...	...	140.75	32.62	...	.49	73.77	1,808.57	1,179.52	...

TABLE II.—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 1936.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.
Boulder	5630E	Argennum	...	...	82.50	16.64	...	...	...	82.50	16.64	...
	5465E	Birthday Gift	...	...	217.00	75.06	...	...	...	4,404.64	1,190.15	...
	5691E, (24E), etc.	Blue Gap leases	...	...	...	...	...	...	...	6,172.50	1,947.26	...
	24E, etc.	Prior to transfer to present holders	...	...	...	...	...	2.10	...	78,345.50	39,654.53	...
	5474E	Boulder Brown Hill	...	...	135.25	38.27	...	...	...	1,442.64	499.77	...
	5690E, (66E)	Boulder Perseverance, Ltd.	...	...	97,752.03	34,392.21	5,153.46	...	...	902,471.97	485,949.72	126,001.40
	66E	Prior to transfer to present holders	...	...	...	...	...	...	3,306,942.88	1,841,159.00	203,821.43	...
	5473E	Brophy's Great Boulder	...	...	...	...	...	...	...	28.00	8.01	...
	5409E, etc.	Brownhill leases	...	...	692.87	103.86	...	1.00	...	3,802.47	4,456.68	...
	5556E	Brown Hill Extended	...	...	...	...	...	...	...	68.50	12.00	...
	5759E	Forty-five East	...	...	209.50	115.10	...	...	...	261.25	125.20	...
	5472E	Golden Key	...	...	55.75	15.10	...	18.27	5.65	147.25	78.73	...
	5507E	Golden Mile	...	...	...	...	...	...	...	17.25	3.74	...
	5521E, etc.	Golden Mile Block 45, N.L.	...	...	329.00	57.83	...	...	...	329.00	57.83	...
	5488E, etc.	Golden Mile Croesus Consolidated G.M., N.L.	...	...	...	...	...	...	...	229.00	116.57	...
	5488E	Prior to transfer to present holders	...	...	...	...	...	1.69	...	381.00	213.88	...
	5692E, (49E)	Gold Mines of Kalgoorlie, Ltd.	...	...	22,520.00	16,709.34	2,319.96	...	...	28,486.95	18,607.20	2,551.24
	49E	Prior to transfer to present holders	...	...	...	...	...	542.13	...	431,944.28	517,789.54	4,844.50
	5697E, (16E)	Great Boulder Proprietary G.Ms., Ltd.	...	...	166,755.00	72,901.30	9,062.21	...	...	4,968,122.36	3,947,944.17	482,293.59
	5466E, etc.	Imperial Gold Mines, Ltd.	...	...	655.50	222.64	...	1.45	...	1,566.50	614.09	...
	5517E, etc.	Iron King leases	...	...	...	...	...	...	...	32.50	4.65	...
	5345E, etc.	Kalgoorlie Enterprise Mines, Ltd.	...	...	2,548.00	1,030.94	...	...	...	4,904.97	1,805.83	...
	5345E, etc.	Prior to transfer to present holders	...	...	...	...	...	...	...	15,320.68	8,957.01	...
	5708E, (15E), etc.	Lake View & Star, Ltd.	...	...	524,988.00	174,409.09	2,926.13	...	...	2,635,575.55	1,068,523.05	78,290.72
		Prior to transfer to present holders	...	...	...	...	...	8.49	...	15,791,843.88	9,149,047.13	1,348,055.82
	5159E, etc.	Lake View South (G.M.K.), Ltd.	...	...	...	...	...	...	...	4,906.88	3,254.90	...
	5513E, etc.	Lake View South Extended, N.L.	...	...	320.50	67.47	...	...	...	656.50	176.67	...
	5469E	New Kalgoorlie, N.L.	...	...	127.00	332.26	...	...	...	375.50	976.85	2.00
	5232E, 5502E	North Boulder (Kalgoorlie) G.M., N.L.	...	...	2,125.92	1,720.46	...	...	...	2,679.84	2,051.84	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	1,950.82	1,328.88	...
	5700E, (22E), etc.	North Kalgurli (1912), Ltd.	...	15.74	147,197.20	45,430.41	3,640.80	...	15.74	538,456.34	204,052.30	6,641.52
	(22E), (34E), etc.	Prior to transfer to present holders	...	...	...	...	...	43.99	...	4,018,436.01	2,815,911.21	97,625.03
	5434E	North Kalgoorlie Central Gold, N.L.	...	...	227.00	35.58	...	...	...	1,510.25	365.23	...
	5434E	(Hillside)	...	...	...	...	...	...	...	675.05	158.46	...
	5429E, etc.	North Kalgurli United Mines, Ltd.	...	...	836.00	180.09	...	...	...	1,740.76	319.41	...
	5429E, (946E), etc.	Prior to transfer to present holders	...	...	...	...	...	...	...	131.74	76.74	...
	5539E	Oroya East	...	...	...	...	...	...	...	59.25	4.54	...
	5456E	Paringa Extended	...	...	3,035.47	1,234.57	...	...	...	4,527.40	1,886.25	...
	5480E, etc.	Paringa Junction, Ltd.	...	...	126.00	18.85	...	...	...	126.00	18.85	...
	5480E	(Croesus Oversight)	...	...	...	...	...	...	...	302.75	44.78	...

	5782E, (392E)	Paringa Mining and Exploration Co., Ltd.	...	...	5,397.48	2,157.69	...	...	...	7,456.84	2,998.33	...
	392E ...	Prior to transfer to present holders	...	...	...	...	...	...	...	43,936.56	20,493.38	...
	1208E, (3643E), etc.	South Kalgurli Consolidated, Ltd.	...	...	45,308.00	14,802.16	...	...	...	1,725,162.25	764,746.48	15,071.52
	(3643E), 1208E, etc.	Prior to transfer to present holders	...	...	...	...	...	...	...	1,344,254.70	531,792.77	17,722.97
	5552E ...	Trafalgar ...	...	...	...	...	...	...	...	12.00	2.40	...
		Voided leases ...	...	...	...	...	...	109.90	11,996.56	617,557.95	471,281.96	6.83
		Sundry claims ...	...	24	272.25	52.54	...	24.58	201.30	9,294.74	3,937.66	...
Cutter's Luck ...		do. ...	...	...	61.75	9.43	...	...	113.31	415.40	195.80	...
Feysville ...		Voided leases ...	...	...	...	...	...	...	110.93	561.30	394.24	...
		Sundry claims ...	...	6.42	...	21.73	...	...	149.42	791.76	546.42	...
Hampton Plains ...	P.P.L. 9 ...	Celebration G.M., N.L.	...	...	17,613.00	1,953.83	...	...	...	39,730.75	11,415.30	...
	P.P.L. 252 ...	Mount Martin ...	...	...	572.75	122.07	...	...	...	13,217.00	5,260.32	...
	P.P.L. 279 ...	Mutooroo ...	...	...	1,186.00	233.87	...	...	...	1,186.00	233.87	...
	P.P.L. 277 ...	New Hope ...	...	...	8,335.00	1,650.48	...	...	...	15,532.25	3,696.49	...
	P.P.L. 1 ...	White Hope ...	...	...	...	...	...	...	...	29,850.53	12,487.14	...
		Voided leases ...	...	...	...	...	...	4,565.62	203.94	49,092.69	20,871.27	69.60
		Sundry claims and leases ...	...	10.55	2,668.25	471.57	...	2.68	24.25	30,902.10	6,185.55	...
Kalgoorlie ...	5455E ...	Argument ...	...	19.85	166.50	49.88	...	...	24.91	1,394.97	560.96	...
	5735E ...	Bonnie Lass ...	...	...	91.50	22.80	...	...	...	91.50	22.80	...
	5449E, 5460E, etc.	Broken Hill Proprietary Co., Ltd.	...	...	19,316.00	8,169.16	...	...	...	62,718.76	25,814.51	...
	5460E ...	(Kalgoorlie Star) ...	...	...	...	...	...	...	...	145.75	75.36	...
	5531E ...	Cassidy's Hill ...	...	...	...	...	...	...	79	243.50	18.27	...
	5564E, etc.	Charity leases ...	...	...	...	...	...	...	33	127.75	26.23	...
	5568E ...	Concord ...	...	...	...	...	...	...	...	36.00	5.90	...
	5719E, 5720E ...	Fair Play & Golden Group, N.L.	...	...	360.50	57.98	...	...	...	360.50	57.98	...
	5510E ...	Golden Dream ...	...	...	205.00	64.87	...	...	...	361.74	103.34	...
	5724E ...	Golden Hole ...	...	...	65.00	17.89	...	...	2.36	79.75	31.15	...
	5737E ...	Golden Mile Channel ...	...	...	686.50	48.23	...	...	...	867.25	65.46	...
	5512E ...	Golden Mile North ...	...	...	193.50	62.41	...	...	...	306.25	71.91	...
	5739E ...	Golden Star ...	...	...	406.50	52.67	...	...	...	503.50	60.49	...
	5554E ...	Good Hope ...	...	1.54	12.25	6.00	...	...	1.54	181.50	38.80	...
	5684E ...	Green Goddess ...	...	...	26.75	8.18	...	...	...	26.75	8.18	...
	5519E ...	Hannan's Enterprise ...	...	...	63.00	14.75	...	...	...	362.00	79.80	...
	4547E, 4548E, etc.	Hannan's Hill Amalgamated, Ltd.	...	...	...	...	...	...	...	189.75	103.21	...
	4547E, 4548E ...	Prior to transfer to present holders	...	...	...	...	...	...	5.72	47,525.85	13,719.48	...
	(5785E) ...	Hidden Secret East ...	...	...	10.75	2.27	...	...	...	10.75	2.27	...
	(5748E) ...	Hidden Secret North ...	...	...	9.75	7.11	...	...	...	9.75	7.11	...
	5665E, etc.	Jolly Bill leases ...	...	...	10.25	1.77	...	...	...	10.25	1.77	...
	5625E ...	Kapai ...	...	...	...	...	...	...	...	281.00	65.75	...
	5530E, etc.	Kapai North leases ...	...	...	13.75	2.58	...	...	...	120.75	21.63	...
	5528E ...	Kiora ...	...	5.61	37.25	26.77	...	...	18.97	53.50	37.07	...
	5549E ...	Maritana Hill ...	...	...	131.25	14.04	...	...	...	381.50	42.12	...
	5437E, 5736E ...	North End Extended leases ...	...	27.19	14.00	20.16	...	...	266.83	84.30	239.47	...
	5468E ...	Phar Lap ...	...	...	12.25	13.14	...	...	...	269.50	223.88	...
	5415E ...	Return ...	...	...	168.50	16.69	...	...	22	2,040.25	308.71	...
	(5776E) ...	Sons of Gwalia, Kalgoorlie ...	...	...	14.75	4.83	...	...	...	14.75	4.83	...
	5716E ...	Two S's ...	...	...	11.00	5.10	...	...	...	24.25	7.57	...
		Voided leases ...	...	...	...	...	...	242.48	9,508.36	958,352.73	395,929.65	44,017.12
		Sundry claims ...	...	9.50	322.25	46.61	...	232.41	823.50	55,039.89	22,135.66	...

TABLE II.—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 1936.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.
Wombola ...	5740E ...	Big Bull ...	...	...	44.75	224.75	...	...	...	83.75	403.59	...
	5688E ...	Caledonian ...	...	...	86.00	97.50	...	...	...	148.50	175.99	...
	5798E ...	Capitol ...	...	...	49.25	25.90	...	...	...	49.25	25.90	...
	5497E ...	Daisy ...	...	...	117.75	310.96	...	...	...	372.75	1,097.59	...
	5689E ...	Haoma ...	...	...	229.25	284.10	...	...	...	339.50	633.82	...
	5500E ...	Happy-go-lucky ...	...	...	83.50	11.92	...	...	...	406.25	447.45	...
	5637E ...	Hoffman ...	...	...	60.00	17.09	...	...	...	1,154.00	364.61	...
	5623E ...	Inve ness ...	...	...	139.25	65.16	...	...	80	248.00	121.38	...
	5616E ...	Leslie ...	...	...	167.00	313.30	...	...	...	251.50	648.58	...
	5829E ...	Lurgan ...	...	...	33.50	22.80	...	...	...	33.50	22.80	...
	5778E ...	Marconi ...	...	...	75.25	33.13	...	...	...	93.75	80.28	...
	5741E ...	Maria ...	...	...	12.50	5.88	...	...	...	25.00	18.29	...
	5726E ...	Mayflower ...	...	...	231.50	58.27	...	...	...	566.50	140.45	...
	5493E ...	Milano ...	...	...	712.00	987.62	...	...	...	1,055.00	2,372.02	...
	5734E ...	M.L.S. ...	...	...	233.50	123.01	...	...	...	455.25	281.58	...
	5457E ...	Mt. Monger ...	...	...	...	...	...	...	116.50	10.00	16.96	...
	4766E ...	Pericles G.M., Ltd. ...	...	...	...	...	...	...	358.11	4,221.53	19,127.56	...
	5645E ...	Three Effs ...	...	...	62.00	48.43	...	...	...	62.13	49.61	...
	5795E ...	Transvaal ...	...	...	43.00	34.96	...	...	...	43.00	34.96	...
	5796E ...	Twenty Grand ...	...	...	77.50	73.89	...	...	...	77.50	73.89	...
	5765E ...	Venezia ...	...	...	46.50	42.06	...	...	...	46.50	42.06	...
	5525E ...	Xmas Flat ...	...	...	35.25	27.36	...	...	...	202.25	235.67	...
		Voided leases ...	...	...	...	...	...	...	1,872.31	10,177.50	13,945.46	...
		Sundry claims ...	...	15.57	1,330.25	700.78	...	...	261.42	10,168.13	9,426.79	...
District generally	...	Sundry claims ...	...	...	...	...	...	11,014.57	465.61	5,440.46	2,541.10	...
		<i>From District generally:—</i>										
		Sundry Parcels treated at:										
		Curnow & Broadbent's Cyanide Plant ...	...	...	...	108.99	...	...	...	...	108.99	...
		Golden Horseshoe Cyanide Plant ...	...	...	...	9,380.17	7,577.20	...	...	...	107,168.22	60,970.68
		Gold Recovery Syndicate Cyanide Plant ...	...	...	...	1,547.28	...	...	...	...	3,410.37	...
		Lakeside Treatment Works ...	...	...	...	245.15	152.56	...	...	...	974.54	840.37
		Return Battery Cyanide Plant ...	...	...	...	...	...	...	...	...	114.37	...
		State Battery, Kalgoorlie ...	...	...	...	2,660.25	...	...	...	...	8,985.13	...
		Various Works ...	...	...	...	...	...	384.36	64.70	40,673.27	* 255,351.31	12,604.81
		Reported by Banks and Gold Dealers ...	300.98	5.32	...	134.94	...	15,203.01	9,138.95	43.50	812.17	...
		Totals ...	300.98	128.12	1,079,393.02	397,151.21	30,832.42	31,842.36	36,854.61	382,098.09	230,398.30	2,501,839.51

BULONG DISTRICT.

Balagundi	...	...	Voided leases	...	...	...	...	...	...	2,408.98	1,110.68	1,473.73	12.92
			Sundry claims	...	1.76	51.25	17.84	...	3.51	270.54	635.01	450.84	...	
Bulong	...	1278Y, (1277Y)	Good Hope Leases	...	1.80	847.75	228.97	...	...	1.80	2,953.25	652.68	...
		(1285Y)	Lake Consols	...	...	26.00	15.50	...	...	...	150.00	105.45	...
		1293Y	Queen Margaret Central	...	...	11.50	1.03	...	...	...	11.50	1.03	...
			Voided leases	...	...	...	...	...	107.54	8,433.70	100,886.05	84,263.22	...
			Sundry claims	...	39.13	387.90	210.87	...	1,655.03	1,317.81	9,793.93	16,432.91	...	
Majestic	...	...	Voided leases	...	...	...	...	...	19.45	63.91	1,317.94	647.62	...
			Sundry claims	...	...	90.75	23.73	...	42.88	150.39	1,638.55	884.95	...
Morelands	...	...	Sundry claims	...	...	14.00	3.90	...	...	.13	159.00	53.31	...
Mt. Monger	...	...	Voided leases and sundry claims	...	...	...	...	...	215.60	2,771.39	1,816.90	1,564.58	...
Randalls	...	...	Voided leases	...	...	...	...	...	...	60.04	31,853.29	10,654.49	...
			Sundry claims	...	...	288.25	51.17	...	20.45	2.69	3,057.56	781.89	...
Taurus	...	...	Voided leases	...	...	...	...	...	2.06	3.70	1,697.60	891.34	...
			Sundry claims	...	.05	170.50	68.77	...	112.69	51.88	1,098.75	757.41	...
Trans Find	...	Loc. 41, 309	Dawn of Hope	...	...	178.00	62.12	...	...	...	201.00	71.89	...
			Voided leases	...	...	...	...	...	...	...	961.92	862.66	...
			Sundry claims	...	...	118.00	47.28	...	...	5.93	627.00	296.23	...
			<i>From District generally :-</i>											
			Sundry Parcels treated at :											
			Davis Cyanide Plant	...	...	...	2.27	...	...	...	...	2.27	...
			Thompson's Cyanide Plant	...	...	...	120.13	...	...	...	...	455.52	...
			Various Works	...	...	...	...	...	...	...	6,102.15	5,848.25	...
			Reported by Banks and Gold Dealers	...	52.04	...	2.42	...	24,933.27	61.70	...	4.01	...	
			Totals	...	52.04	42.74	2,183.91	856.00	...	27,112.48	15,604.59	166,072.09	127,156.28	12.92

Coolgardie Goldfield.

COOLGARDIE DISTRICT.

Bonnievale	...	(5469)	Jenny Wren G.M.	...	...	16.00	29.38	...	...	...	56.00	121.28	...
		4600	Kunanalling Gold, N.L.	...	...	110.00	287.76	...	...	...	614.50	1,099.21	11.63
		4600	(Melva Maie)	...	...	...	...	...	...	...	1,269.00	2,747.60	...
		5522	Lucky Hit	...	...	212.00	85.00	...	...	...	212.00	85.00	...
		5518	Nightingale	...	...	24.00	10.95	...	...	...	24.00	10.95	...
		5326, 5327	Saunders Mt. Burgess G.Ms.	...	...	...	...	...	...	...	80.00	11.34	...
		(5460)	Star of the East	...	...	9.50	3.21	...	...	...	66.50	40.30	...
		5507	Vale of Coolgardie	...	...	107.00	7.65	...	...	...	107.00	7.65	...
		5321	Westralia Extended	...	...	11.00	2.53	...	...	...	56.50	15.94	...
			Voided leases	...	...	...	...	...	...	25.00	350,921.84	188,105.81	...
			Sundry claims	...	...	306.50	135.87	...	...	153.28	4,725.73	4,028.72	...
Bulla Bulling	...	...	Voided leases	...	...	...	...	...	...	...	776.81	668.19	...
			Sundry claims	...	...	184.50	34.07	...	5.21	15.98	1,129.76	481.40	...

TABLE II.—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 1936.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.
Burbanks ...	(5479) ...	Bell Bird ...	...	...	20.00	11.25	...	...	...	20.00	11.25	...
	5417 ...	Bernard Frank ...	...	...	13.00	1.75	...	...	...	13.00	1.75	...
	5545 ...	Boshter ...	...	...	40.00	16.88	...	...	...	40.00	16.88	...
	5529 ...	Cheapside ...	...	...	57.00	16.44	...	...	...	57.00	16.44	...
	5524 ...	Coronation ...	...	...	55.00	10.83	...	...	...	55.00	10.83	...
	5320 ...	Golden Arch ...	...	...	171.00	37.08	...	...	10.15	419.35	142.15	...
	5473 ...	Grosmont ...	...	...	393.00	128.36	...	...	...	560.00	168.20	...
	5382 ...	Ivan ...	...	...	79.00	111.11	...	...	...	94.00	150.07	...
	5489 ...	Lady Robinson South ...	...	...	8.00	5.48	...	...	...	8.00	5.48	...
	5263 ...	Lord Bobs ...	...	...	429.00	80.21	...	...	8.59	1,123.00	467.51	...
	5432 ...	Main Stay ...	1.54	1.10	120.00	33.01	...	1.54	1.10	262.00	103.25	...
	5443 ...	New Gift ...	...	...	65.00	27.28	...	...	...	65.00	27.28	...
	5503 ...	Royal Standard ...	...	...	280.00	83.95	...	...	...	280.00	83.95	...
	5250 ...	Vice Regal ...	...	1.91	248.50	72.01	...	...	1.91	1,311.00	551.33	...
		Voided leases ...	...	...	...	...	...	13.36	352.33	408,671.36	302,098.43	521.06
		Sundry claims ...	...	2.56	764.00	315.10	...	51.42	429.97	11,161.85	7,594.69	...
Cave Rocks ...	5553 ...	Blue Spec ...	...	...	100.00	13.75	...	...	...	100.00	13.75	...
		Voided leases ...	...	...	...	...	...	...	...	132.00	28.04	...
		Sundry claims ...	...	...	432.00	70.84	...	...	...	2,026.50	414.52	...
Coolgardie ...	5309 ...	Bayley's Boronia ...	...	...	...	...	...	...	...	31.00	8.52	...
	5239 ...	Bayley's Reward ...	...	...	...	...	...	...	2.74	106.50	225.15	...
	5508 ...	Booloroo ...	...	...	136.00	14.61	...	...	...	136.00	14.61	...
	5285 ...	Boronia ...	...	...	9.00	5.07	...	...	...	21.00	13.62	...
	5297, etc.	Consolidated Gold Mines of Coolgardie, Ltd.	...	...	75.00	22.92	...	...	...	75.00	22.92	...
	5297, etc.	Prior to transfer to present holders	...	...	405.00	79.13	...	...	4.55	1,946.35	547.45	3.22
	5391 ...	Coolgardie Brilliant Extended ...	...	...	...	...	...	...	...	36.00	5.40	...
	(5282), etc.	Coolgardie Brilliant, N.L.	...	...	150.00	4.85	...	...	...	1,004.50	73.69	...
	5390 ...	Garden Gully ...	...	...	23.00	2.47	...	...	...	91.00	10.08	...
	5468 ...	Golden Queen ...	...	...	167.00	180.13	...	...	...	167.00	180.13	...
	(5513) ...	Golden Ridge ...	...	...	49.00	11.99	...	...	...	49.00	11.99	...
	(5463) ...	Great Coolgardie ...	...	...	10.00	11.93	...	...	...	31.00	58.99	...
	5218 ...	Great Western ...	...	...	11.00	17.99	...	...	...	99.30	613.20	...
	5494 ...	Juno ...	...	...	191.00	43.32	...	...	...	212.00	54.61	...
	5465 ...	Keystone ...	...	...	67.00	10.43	...	...	...	107.50	15.77	...
	5403 ...	King Solomon Gold Mine ...	...	...	...	...	...	...	...	56.50	9.04	...
	5277 ...	Lady Theresa ...	...	...	20.00	38.37	...	...	...	192.00	178.65	...
	5384 ...	Lindsay's Gold Mine ...	...	...	72.00	20.83	...	...	...	116.00	45.82	...
	5269 ...	Master Key G.M. ...	...	...	51.00	5.97	...	...	...	238.50	41.86	...

	(5388) ...	May Moon ...			32.00	3.12				134.00	17.51	
	(5449) ...	Nelson Gold Mine ...			22.00	4.67				102.00	15.75	
	5256 ...	New Coolgardie ...								30.06	4.13	
	5225 ...	Queen Extended ...			105.15	25.22			63.83	633.15	286.15	
	5407 ...	Rose Hill United ...								52.00	5.85	
		Voided leases ...						1,299.02	4,506.75	561,907.48	322,717.98	.96
		Sundry claims ...	29.08	22.26	1,145.40	441.74		187.73	2,233.53	53,484.78	20,969.23	
Eundynie ...	5509 ...	Brilliant ...			57.50	27.59				57.50	27.59	
	5287 ...	Eundynie ...		3.22	441.00	269.23		.92	10.85	642.25	878.17	
		Voided leases ...								29,892.45	14,994.04	1.75
		Sundry claims ...		10.18	66.40	17.74			10.18	531.19	284.34	
Gibraltar ...	5217 ...	Lloyd George ...			30.00	15.39			14.69	2,296.88	2,131.25	
		Voided leases ...							15.28	31,849.75	16,424.07	
		Sundry claims ...		2.21	122.00	19.43			50.76	2,401.20	1,094.99	
Gnarlbine ...	5485 ...	Great Gnarlbine ...		1.00	115.50	46.10			1.00	127.50	64.55	
		Voided leases and sundry claims ...							15.84	2,463.35	1,372.66	
Hampton Plains ...	P.P.L. 1 ...	Consolidated Gold Areas ...			70.00	22.10				70.00	22.10	
	P.P.L. 119 ...	Golden Eagle ...			92.00	60.18			7.63	1,072.09	1,668.15	
		Voided leases ...							403.05	8,518.25	7,798.76	
		Sundry claims and leases ...			78.00	21.62			3.60	674.25	211.36	
Higginsville ...	5444 ...	Daughter of Erin ...			373.00	291.53				464.25	416.39	
	5496 ...	Sons of Erin ...			721.00	120.66				721.00	120.66	
	5272 ...	Sugar Gum ...			543.00	94.77				664.50	119.79	
	5293 ...	Two Boys ...			982.00	757.08				3,705.00	1,807.18	
		Voided leases ...							287.26	32,578.00	14,939.51	134.79
		Sundry claims ...			299.25	115.55			40.82	2,486.43	1,343.26	
Larkinville ...	5236 ...	Ground Lark ...			139.11	318.00			3.87	1,467.91	2,707.14	
		Voided leases and sundry claims ...						22.77	59.38	186.00	239.17	
Logan's Find ...	5200 ...	Perseverance ...								468.06	379.16	
	5324, etc. ...	Spargo's Reward G.M.L. (1935), N.L. ...								522.00	199.98	
		Voided leases ...								53.50	31.41	
		Sundry claims ...		2.00	61.50	46.35			9.41	897.00	466.18	
Londonderry ...	5402 ...	Christmas Box ...			678.00	617.93			1.37	1,460.00	1,572.23	
		Voided leases ...							46.25	27,231.85	18,654.09	
		Sundry claims ...		-19	86.50	62.63			6.97	2,736.17	2,013.14	
Mungari ...		Voided leases and sundry claims ...						1.77	125.53	1,399.26	615.57	
Paris ...	5311 ...	Lister's G.M. ...			567.00	185.38				1,741.00	882.92	
	5514 ...	Paris ...			47.00	15.96				47.00	15.96	
	5530 ...	Paris Extended ...			56.00	24.30				56.00	24.30	
	5500 ...	Saltbush ...			113.00	24.16				113.00	24.16	
		Voided leases ...							4.30			
		Sundry claims ...			95.50	16.58				1,941.25	480.01	
Red Hill ...		Voided leases ...							1,541.48	40,797.40	31,070.65	
		Sundry claims ...	3.31		230.00	43.59		4.43	85.26	1,164.77	611.82	
Ryan's Find ...		Voided leases ...								54.16	151.69	
		Sundry claims ...			14.00	2.02			.44	101.69	228.66	

TABLE II.—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 1936.					TOTAL PRODUCTION.					
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	
St. Ives	5195, 4732 ...	Clifton leases ... ..	...	...	410.00	250.54	...	...	...	1,784.25	654.43	...
	5195, 4732 ...	Prior to transfer to present holders	...	...	...	...	...	...	...	7,244.40	3,565.36	...
	(5450)	Grand Slam ... ..	...	...	50.25	7.98	...	...	...	50.25	7.98	...
	5406	Idough ... ..	...	...	625.50	145.88	...	...	42.04	838.75	201.47	...
	4720, etc. ...	Ives Reward Gold Mines, N.L.	...	...	1,181.75	297.92	...	...	...	19,511.66	6,078.54	...
	4720, etc. ...	(Lake View Reward leases)	...	...	...	...	...	...	...	883.25	544.64	...
	5487	Victory ... ..	...	...	36.00	11.12	...	...	...	169.00	26.40	...
		Voided leases	54.63	47.84	5,105.00	3,584.42	...
	Sundry claims ... ..	...	...	47.25	14.14	...	...	211.25	944.85	3,921.56	1,381.31	...
Wannaway	5506	Argyle ... ..	...	...	25.00	4.73	...	...	...	25.00	4.73	...
	(5490)	Edna ... ..	...	...	17.25	44.84	...	...	...	29.15	94.88	...
	(5394)	Golden Wonder ... ..	...	...	15.25	13.11	...	...	...	105.05	89.25	...
		Voided leases ... ..	...	...	...	...	...	...	19.10	1,447.40	771.54	...
		Sundry claims ... ..	...	104.28	124.00	60.69	...	...	167.10	684.17	960.75	...
Widgiemooltha ...	5294	Aussie ... ..	...	...	38.00	8.53	...	...	151.90	142.05	227.37	...
	5332	Banquet ... ..	...	20.74	78.00	85.66	...	...	20.74	218.00	171.15	...
	5319	Imperial ... ..	...	...	261.50	47.11	...	...	...	1,917.50	397.19	...
		Voided leases	9.42	928.82	10,952.85	8,261.68	17
		Sundry claims	8.43	20.59	585.50	192.45	...	44.60	352.32	11,607.91	5,348.89	...
		From District generally :—
		Sundry Parcels treated at :
		State Battery, Coolgardie	80.00	1,997.77	771.01	*24,057.74	9.65
	State Battery, St. Ives	...	...	...	...	...	...	...	...	60.50	*1,920.03	...
	Imperial Battery	...	...	...	129.22	...	...	...	...	26.00	*310.13	...
	Seahill's Cyanide Plant	...	...	...	12.17	...	...	...	...	...	16.05	...
	Parry's Cyanide Plant	...	...	...	181.14	...	...	...	...	...	269.85	...
	Collins & Frank Cyanide Plant	...	...	...	54.78	...	...	...	...	...	54.78	...
	A. Collins Cyanide Plant	...	...	...	460.07	...	...	...	...	...	597.25	...
	C. B. Frank Cyanide Plant	...	...	...	4.59	...	...	...	...	...	4.59	...
	H. H. Frank Cyanide Plant	...	...	...	34.72	...	...	...	...	...	34.72	...
	L. Stuck Cyanide Plant	...	...	...	30.01	...	...	...	...	...	30.01	...
	Widgiemooltha Cyanide Plant	...	...	...	116.55	...	...	...	...	...	367.26	...
	Crudace & Stewart Cyanide Plant	...	...	...	13.24	...	...	...	...	...	13.24	...
	S. Green's Cyanide Plant	...	...	...	2.68	...	...	...	...	...	2.68	...

Ives Reward Cyanide Plant ... ..	...	...	...	...	...	...	...	...	...	...	479.05	...
Various Works ... ..	...	...	...	...	...	...	7.75	...	3,811.11	*18,617.37	223.06	...
Reported by Banks and Gold Dealers	279.02	23.53	...	11.56	...	13,454.20	684.51	38.25	52.44	...	...	...
Totals	321.38	215.77	16,649.06	10,045.58	...	15,370.02	13,914.15	1,682,496.25	1,060,763.52	906.29	...	...

KUNANALLING DISTRICT.

Carbine	(955s)	Abundance North ... ..	...	...	26.00	12.03	...	...	...	26.00	12.03	...
	(922s)	Bower Bird ... ..	...	...	203.00	40.58	...	...	...	203.00	40.58	...
	(33s), 970s	Carbine ... ..	...	...	...	...	...	...	9,037.00	4,764.34	...	...
	33s, 970s, etc.	(Carbine leases)	...	...	...	...	...	687.98	51,991.86	39,862.25	...	...
	917s	Homeward Bound ... ..	...	...	801.00	135.48	...	...	1,342.50	223.46	...	...
	(940s)	Kookaburra ... ..	...	...	84.00	6.99	...	...	84.00	6.99	...	...
	935s	Providence ... ..	...	...	599.00	110.22	...	...	707.50	134.38	...	...
	923s	Wattle Bird ... ..	...	...	423.00	58.70	...	...	423.00	58.70	...	...
		Voided leases ... ..	...	...	...	...	...	...	3,347.00	3,233.60	...	...
		Sundry claims	12.14	...	604.00	230.29	...	136.08	89.66	2,541.18	1,172.84	...
Chadwin	958s	Argosy ... ..	...	...	17.00	38.71	...	...	...	321.00	355.25	...
	(937s)	Resolute ... ..	...	...	63.00	117.75	...	...	...	143.00	299.94	2.50
		Voided leases ... ..	...	...	...	...	...	...	...	1,257.80	2,170.14	...
		Sundry claims ... ..	...	...	252.50	92.57	...	6.31	38.25	2,384.50	1,750.61	...
Dunnsville		Voided leases ... ..	...	...	...	...	...	...	181.12	17,407.10	7,982.23	...
		Sundry claims ... ..	...	7.42	140.50	92.19	...	2.82	178.93	1,252.70	1,002.48	...
Jourdie Hills		Voided leases ... ..	...	...	...	...	...	...	18.00	28,009.74	19,401.09	28.45
		Sundry claims ... ..	...	...	188.50	70.82	...	1.86	37.52	1,411.25	718.57	...
Kintore	973s	Florence Bell ... ..	...	...	10.00	7.86	...	...	...	10.00	7.86	...
	902s	New Haven ... ..	...	...	223.00	109.95	...	...	...	698.75	296.41	...
	(956s)	Newminister... ..	...	...	107.00	43.61	...	...	...	227.00	102.68	...
		Voided leases ... ..	...	...	...	...	...	6.66	143.66	44,174.14	31,882.70	...
		Sundry claims	11.61	39.96	111.10	69.57	...	111.91	90.13	2,072.63	1,711.34	...
Kundana		Voided leases and sundry claims	...	...	...	...	...	...	...	503.50	77.86	...
Kunanalling	(942s)	Catterwood Extended ... ..	...	...	12.00	4.06	...	...	...	138.50	39.39	...
	928s	Gouldbourn ... ..	...	...	...	...	...	...	...	169.00	44.93	...
	914s	Kioro ... ..	...	...	3,205.00	1,164.16	...	...	...	3,789.00	1,294.74	...
	919s, etc.	Kunanalling Gold, N.L. ... ..	...	...	2,617.00	2,308.03	...	...	...	3,590.50	3,449.60	...
	919s, etc.	Prior to transfer to present holders	...	...	...	...	...	...	...	690.00	850.41	12.78
	913s	New Australia ... ..	...	...	1,352.00	633.65	8.86	...	...	2,946.19	1,730.36	8.86
	977s	Peter Pan ... ..	...	...	32.00	55.32	...	...	...	32.00	55.32	...
	934s	Premier Gold Mine	35.36	...	...	...	...	43.95	...	...	...	...
	645s	Star of Fremantle ... ..	...	...	...	...	...	32.67	...	5,625.50	4,253.88	...
	945s	Sydney Mint ... ..	...	...	276.00	89.94	...	...	...	301.00	119.27	...
		Voided leases ... ..	...	...	...	...	...	...	1,712.20	99,696.97	81,130.39	18.84
		Sundry claims ... ..	...	60.93	203.58	183.13	...	211.68	756.98	11,221.16	7,970.11	...
		<i>From District generally:—</i>										
		Sundry Parcels treated at:										
		Various Works ... ..	...	...	...	...	...	42.23	...	1,771.26	4,966.13	...
		Reported by Banks and Gold Dealers	23.06	...	...	...	...	643.16	7.93	...	2.38	...
Totals			82.17	108.31	11,550.18	5,695.61	8.86	1,239.33	3,942.36	299,547.23	223,180.24	71.43

TABLE II.—Production of Gold and Silver from all sources, etc.—continued.

Yilgarn Goldfield.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1936.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.
Blackbourne	...	Voided leases and sundry claims	...	...	...	...	...	1,568.00	408.12	...
Bullfinch	3700	Bullfinch North	...	...	.06	5.78	...	.06	5.78	...
	3345	Copperhead	...	...	110.00	18.98	...	4,281.32	1,297.14	...
	3378	Copperhead Deeps	...	...	3,491.50	1,534.86	...	6,162.50	2,459.34	...
	3337, 3458	Easter Gift leases	...	...	...	...	...	157.00	43.61	...
	3337, 3458	Prior to transfer to present holders	...	...	...	...	48.03	3,594.26	1,169.82	...
	3400	Frances May	...	5.68	2,493.00	584.48	7.74	6,422.00	2,658.49	...		
	3397	Goldfinch	...	6.73	1,092.03	560.22	6.73	3,144.53	1,640.03	...		
	3753	Lady Agnes	...	...	61.00	39.36	...	106.00	71.95	...
	3812	Little Hill	...	...	8.00	18.80	...	8.00	18.80	...
	(3697)	Mistletoe	...	...	114.00	60.59	...	369.00	173.74	...
	3825	Mistletoe	...	...	90.00	48.33	...	90.00	48.33	...
	3709	Peter Pan	...	...	24.00	34.38	...	35.00	50.80	...
	10PP	Reynold's Find	...	...	31.00	36.95	...	280.25	208.91	...
	3350	Rising Sun	...	...	734.03	583.11	...	5,753.53	3,599.64	...
	3661	Rising Sun Deeps	...	...	287.00	58.71	...	287.00	58.71	...
	3838	Star of Hope	...	...	12.00	5.43	...	12.00	5.43	...
	3451	Volcano	...	...	60.00	113.57	...	5.34	275.00	361.11
		Voided leases	...	...	...	...	3.57	481,302.26	179,248.59	27,833.41
		Sundry claims	...	.26	392.05	286.03	7.48	5,175.50	3,034.08	...
Corinthian	(3774)	Birthday Gift	...	...	10.00	1.40	...	10.00	1.40	...
	3398	Corinthian	...	...	1,590.00	548.65	...	4,957.75	1,719.48	...
	3425	Corinthian North	...	...	510.00	82.47	...	1,985.00	998.07	...
	3415	Deliverance	...	...	317.10	538.80	...	849.10	1,564.15	...
		Voided leases	...	...	...	...	...	134,508.00	29,324.83	...
		Sundry claims	...	.68	38.50	41.56	...	68	925.85	504.26
Ennuin	3787	Morning Glory	...	...	52.00	116.97	...	52.00	116.97	...
		Voided leases	...	...	...	...	...	471.56	666.38	...
		Sundry claims	...	...	275.00	189.24	...	9.39	1,152.60	858.60
Forrestonia	...	Voided leases and sundry claims	...	...	...	...	...	1,512.00	413.10	...
Golden Valley	3763	Great Willow	...	...	175.00	136.52	...	215.00	160.84	...
	3811	Kathleen	...	...	60.00	20.61	...	60.00	20.61	...
	(3509)	Manxman	...	...	27.00	15.98	...	98.00	114.64	...
	3768	North Radio No. 1	...	...	84.00	209.00	...	106.00	222.09	...
	3822	Queen Marie	...	...	65.00	62.58	...	65.00	62.58	...
	(3744)	Radio Deeps North	...	...	85.00	45.15	...	119.00	71.33	...

	3248, etc.	Radio Deeps leases		314.00	309.24				3,131.58	4,990.58	
	2994, etc.	Radio leases		792.00	1,942.83			2.70	10,991.30	31,179.64	7.43
		Voided leases						30.55	9,440.34	9,465.15	2.00
		Sundry claims	34.41	338.00	306.14		4.58	47.80	4,702.27	3,901.97	
Greenmount	3525	Transvaal North		28.00	3.53				129.00	31.57	
		Voided leases					45.99	21.62	124,803.64	31,527.40	944.50
		Sundry claims		27.00	2.17			4.27	1,239.58	439.82	
Holleton	3428	Holleton		190.25	52.70				809.25	312.25	
	3312, etc.	North End leases							38,210.50	11,660.54	
		Voided leases						9.33	524.50	396.16	31.79
		Sundry claims		256.00	48.06			3.75	2,699.05	692.66	
Hope's Hill	3419, (3439)	Coras Mine		403.50	49.06				955.00	211.63	
	3406	Hill View							78.00	25.51	
	3681	Hill View North		10.00	1.44				10.00	1.44	
	3414, 14PP	Pilot		2,005.00	356.08				7,170.00	1,440.71	
		Voided leases						74.78	130,784.05	35,918.55	1.00
		Sundry claims		298.50	56.22		5.04	31.49	3,374.02	1,119.34	
Kennyville	3667	Battler Gold Mine		1,178.00	342.57				1,562.00	387.19	
	3766	Golden Arrow		126.00	35.67				136.00	38.27	
	3432	Leviathan Amalgamated G.Ms., Ltd.		2,054.00	691.39				6,312.50	2,519.01	
	(3668)	Patronis		14.50	3.56				22.50	4.28	
		Voided leases						18.76	32,650.13	15,271.63	.59
		Sundry claims		787.50	122.93			5.06	6,627.50	1,881.62	
Koolyanobbing	3514	Chadwick's Reward		301.00	151.75				469.50	274.96	
	(3699)	Golden Friday		8.00	6.88				43.00	53.20	
	(3581)	Golden Wishbone		71.00	19.42				339.00	203.89	
		Voided leases							335.00	128.95	
		Sundry claims		46.00	9.66		.26		353.00	177.41	
Marvel Loch	3393	Bohemia		412.00	184.05				1,970.00	1,113.72	
	3675	Christmas Gift		202.50	470.58				324.50	533.97	
	3455	Comet		164.00	32.38	2.41			224.00	43.52	2.41
	13PP	Cricket		431.00	168.29				1,111.00	721.59	
	11PP	Edward's Reward		800.00	847.51				1,800.00	1,820.93	
	3515	Ellection		140.00	17.79				240.00	30.94	
	3512	Evelyn Molly		1,565.00	382.83				2,620.00	620.30	
	3541	Four Threes	.85	168.50	445.81			.85	266.50	591.23	
	3724	Frances Firness		463.00	495.28				643.00	766.16	
	3824	Ganymedes		90.00	95.89				90.00	95.89	
	(3472)	Gentle Annie		61.00	9.84				286.00	100.80	
	3683	Golden Cube		40.00	3.05				40.00	3.05	
	3707	Grand National		2,108.00	372.34				2,190.00	382.76	
	(3798)	Great Eastern		20.00	2.16				20.00	2.16	
	3565	Great Victoria Block S		20.00	2.04				20.00	2.04	
	3832	Ireland		54.00	6.35				54.00	6.35	
	3394	Iron Channel							1,185.00	197.25	
	3431	Jacoletti G.M. & Battery Co., Ltd.		656.00	132.03				996.00	169.64	
	3431	(Lenodo)							506.00	119.02	
	3542	Jacoletti South		336.00	41.43	.14			471.00	59.84	.14
	3828	Jester		54.00	21.81				54.00	21.81	
	3390	Just in Time							1,180.00	215.95	
	3718	Kurraiong		375.00	257.70				488.00	286.69	
	3434	Lady Gladys		521.00	300.40				1,331.00	555.14	

TABLE II.—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 1936.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.
Marvel Loch—contd.	33PP ...	Lady Luck ...	...	...	35.00	7.06	...	...	...	35.00	7.06	...
	24PP ...	Lady Mary ...	...	...	44.00	37.48	...	...	...	209.00	111.11	...
	3413 ...	Marvel Loch ...	...	...	214.00	59.83	...	...	...	609.00	139.23	...
	3423, etc.	Marvel Loch Gold Development, N.L.	...	...	33,008.00	5,012.09	254.86	...	...	33,008.00	5,012.09	254.86
	3423, etc. (3685) ...	Prior to transfer to present holders	...	...	...	...	...	...	...	1,185.00	215.67	...
	3837 ...	Marvel Loch North ...	...	...	142.00	31.58	...	...	...	240.00	47.12	...
	3459 ...	Maydo ...	...	...	44.00	18.69	...	...	...	44.00	18.69	...
	3835 ...	May Queen ...	...	...	529.00	2,019.00	...	...	...	1,285.00	3,966.40	...
	(3764) ...	Mountain King ...	...	...	20.00	19.33	...	...	...	20.00	19.33	...
	3791 ...	Mountain Queen ...	...	...	112.00	23.44	...	...	...	202.00	29.35	...
	3491 ...	Mountain Queen South ...	...	...	380.00	112.82	...	...	...	380.00	112.82	...
	3456 ...	New Democrat ...	...	...	...	...	...	...	...	62.00	18.10	...
	3492 ...	Newry ...	...	...	...	...	...	...	...	70.00	15.46	...
	(3639) ...	Outsider ...	...	...	65.00	11.06	...	...	...	235.00	75.30	...
	(3632) ...	Outsider No. 2 ...	...	...	30.00	10.97	...	...	...	159.50	57.92	...
	3468 ...	Prince ...	...	...	10.00	2.57	...	...	...	10.00	2.57	...
	3690 ...	Prince George ...	...	...	...	...	...	...	...	1,409.00	117.84	...
	3382 ...	Pro Patria Gold Mines, Ltd.	...	...	88.00	16.64	...	...	...	88.00	16.64	...
	12PP ...	Salvation ...	...	...	265.00	60.73	...	...	...	1,039.00	991.20	...
	3816 ...	Sunshine ...	...	...	995.00	404.20	...	...	...	2,201.00	1,024.46	...
	3404 ...	Watsonia ...	...	...	101.00	35.67	...	...	...	101.00	35.67	...
	3404 ...	Yilgarn G.M., N.L.	...	...	372.00	260.90	15.85	...	...	1,705.30	1,099.98	87.29
		(Banker) ...	...	...	...	...	...	...	...	25.00	20.11	...
		Voided leases ...	...	...	...	...	...	...	...	108.46	479,008.86	141,443.56
		Sundry claims ...	...	...	3.15	1,384.50	462.81	...	...	11.16	106.70	23,097.29
			...	...	...	...	...	...	...	...	...	10,382.86
Mt. Jackson	(3592) ...	Allen's Find ...	...	...	55.00	20.17	...	...	...	305.00	133.00	...
	3773 ...	Bullseye ...	...	...	318.00	53.73	...	...	...	318.00	53.73	...
	(3786) ...	Bullshhead ...	...	...	102.00	15.75	...	...	...	102.00	15.75	...
	3449 ...	Die Hardy ...	...	...	94.50	80.11	...	...	...	288.00	229.13	...
	(3698) ...	Dolly Pot Hill ...	...	...	30.25	47.35	...	...	...	49.25	58.52	...
	3820 ...	Hazel Merle ...	...	...	111.00	37.27	...	...	...	111.00	37.27	...
	3418, 3478	Mt. Jackson Gold Mines, N.L.	...	...	1,969.00	2,024.95	...	...	...	3,320.00	4,043.27	...
	3418 ...	(Clamps Central) ...	...	...	...	...	...	...	...	40.00	182.57	...
	3756 ...	Mt. Jackson South ...	...	...	23.00	11.71	...	...	...	23.00	11.71	...
	3821 ...	Mt. Jumbo ...	...	...	471.00	216.73	...	...	...	471.00	216.73	...
	(3448) ...	Mt. King Enterprise ...	...	...	33.00	8.80	...	...	...	243.00	140.63	...
	3804 ...	North Yilgarn ...	...	...	558.00	201.50	...	...	...	558.00	201.50	...
		Voided leases ...	...	...	...	...	...	...	...	114.88	38,270.03	28,246.23
		Sundry claims ...	...	...	1,581.50	455.60	...	...	...	6.44	52.46	6,184.10
			...	...	...	...	...	...	...	...	...	3,104.09
			...	...	...	...	...	...	...	...	...	2,305.28
			...	...	...	...	...	...	...	...	...	.74

Mt. Palmer	(3655)	Bryant			15.25	7.90				15.25	7.90	
	3544, etc.	Yellowdine Gold Development, Ltd.			27,050.00	12,841.75				27,050.00	12,841.75	
	3546, etc.	Prior to transfer to present holders								1,564.65	2,540.71	
		Voided leases								52.00	15.00	
		Sundry claims	182.37	7.50	26.00	6.13		1,585.62	7.50	246.75	313.95	
Mt. Rankin	3555	No Trumps			305.50	78.96				705.50	131.36	
		Voided leases and sundry claims						3.84	5.20	981.00	236.67	
Parker's Range	3716	Black Cat			58.00	156.06				73.00	190.21	
	3801	Blue Hills			50.00	10.65				50.00	10.65	
	3520	Centenary			64.00	34.13				236.00	74.25	
	3823	Cinderella			174.00	34.07				174.00	34.07	
	3411	Constance Una			76.00	246.53				306.25	489.04	
	3401	Dulcie Jean			7.00	9.10				355.50	323.50	
	3460	Fortuna Lease			94.00	22.61				494.00	97.59	
	(3523)	Garibaldi			82.00	97.96				82.00	97.96	
	3779	Janetta								35.00	79.07	
	3827	L.S.D.			238.00	44.50				238.00	44.50	
	(3757)	Miner's Dream			33.00	85.98				33.00	85.98	
	(3717)	Monita			39.00	43.35				39.00	43.35	
	3671	Mundy Hills			98.00	27.86				292.00	70.85	
	3702	New Hope								209.00	48.91	
	3452	Pomeranian			279.00	157.01				1,085.00	637.09	
	2801	Scots Greys			140.00	33.59				1,668.00	598.29	
	3384	Snowdrop			12.00	7.91				67.00	41.02	
	3815	Spring Hill No. 5			299.00	52.35				299.00	52.35	
	3813	Spring Hill No. 6			440.00	124.03	.45			440.00	124.03	.45
	3814	Spring Hill No. 7			13.00	9.75				13.00	9.75	
3818	Triumph			55.00	12.23				55.00	12.23		
3540	White Horseshoe			70.00	21.45				85.00	30.78		
	Voided leases								105.14	35,912.25	19,707.28	
	Sundry claims		.50	3.63	1,204.50	308.45	.04	5.39	6.15	5,853.75	3,034.88	.04
Southern Cross	3568	Nil Desperandum			154.00	42.23				154.00	42.23	
	3473	Queen Ann			485.00	70.36				723.00	127.50	
	574H	Southern Cross United Mines, Ltd.			287.50	71.07				287.50	71.07	
	(3784)	Sunrise			121.00	28.01				121.00	28.01	
	3802	Tarcoola			39.00	10.36				39.00	10.36	
	3637	Tarcoola North			46.00	8.59				71.00	18.42	
	3444, 3526	Yellowdine Options, N.L.			4,743.25	816.12				5,224.25	912.83	
	3444	(Three Boys)								398.50	224.35	
		Voided leases						2.90	248.85	434,268.18	212,364.47	364.41
	Sundry claims		.99	317.50	33.38		19.94	638.62	6,050.61	2,102.44		
Westonia	3308	(Consolidated)								3,987.00	2,844.48	
	3447	(Edna Central)								105.00	22.78	
	3556	Contemptible			44.00	35.80				56.50	45.59	
	3710	De Valra			9.50	6.18				9.50	6.18	
	(3513)	Hopeful			69.00	28.10				299.00	135.94	
	3388	Les Trois			298.25	82.74				468.25	153.92	
	3367	Princess Royal G.M. Co., N.L.								19,490.00	13,279.35	
	(3571)	Recovery			40.00	18.98				40.00	18.98	
	3797	Westonia			124.50	35.93				124.50	35.93	
		Voided leases							4.06	424,056.74	300,453.52	21.78
	Sundry claims			72.50	24.51		9.51	60.40	3,215.35	2,207.75		

TABLE II.—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 1936.					TOTAL PRODUCTION.					
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	
		<i>From Goldfield generally:—</i>											
		Sundry Parcels treated at:											
		Butcher Bird Cyanide Plant ... ..	...	...	...	231·00	...	...	...	...	1,636·41	...	...
		Copperhead Cyanide Plant ... ..	...	...	...	2,086·13	...	...	...	...	7,002·01	...	...
		Dulcie Jean Cyanide Plant ... ..	...	...	...	21·01	...	...	...	...	59·11	...	...
		Golden Arrow Cyanide Plant ... ..	...	...	...	29·18	...	...	...	...	29·18	...	...
		Howlett's Battery and Cyanide Plant ... ..	...	...	...	1,309·98	...	...	...	110·00	*6,848·56	...	...
		Jacoletti G.M. and Cyanide Plant ... ..	...	...	...	...	...	...	...	...	87·33	...	...
		Leviathan Cyanide Plant ... ..	...	...	...	420·24	...	...	...	...	790·50	...	...
		Mt. Jackson Cyanide Plant ... ..	...	...	...	266·03	...	...	...	...	627·90	...	...
		North End Cyanide Plant ... ..	...	...	...	918·90	...	...	...	...	1,817·53	...	...
		Passmore's Cyanide Plant ... ..	...	...	...	131·54	...	...	...	...	305·79	...	...
		Pilot Cyanide Plant ... ..	...	...	...	532·65	...	...	...	...	2,044·65	...	...
		Radio Deeps Cyanide Plant ... ..	...	...	...	239·74	...	...	...	...	353·31	...	...
		Scots Greys Cyanide Plant ... ..	...	...	...	141·57	...	...	...	...	555·77	...	...
		Southern Cross Cyanide Plant ... ..	...	...	...	170·66	...	...	...	...	170·66	...	...
		Sunshine Cyanide Plant ... ..	...	...	...	110·47	...	...	...	...	110·47	...	...
		Triumph Cyanide Plant ... ..	...	...	...	62·23	...	...	...	...	62·23	...	...
		Westonia Cyanide Plant ... ..	...	...	...	200·25	...	...	...	...	1,834·66	...	...
		Various Works ... ..	...	...	...	...	...	...	...	156·78	*45,694·81	...	36·54
		Reported by Banks and Gold Dealers	45·21	51	...	...	...	...	277·35	51·85	...	4·89	...
		Totals	228·08	66·89	111,175·52	49,238·16	273·75	1,985·96	1,870·05	2,646,998·17	1,244,919·34	32,665·69	

Dundas Goldfield.

Buldanian ... ..	...	Voided leases ... ..	...	...	...	...	...	3·02	846·05	708·99	...
		Sundry claims ... ..	...	...	14·75	10·23	...	36·53	767·52	712·57	...
Dundas	1436	Edwards Norseman ... ..	...	...	21·75	17·92	...	...	65·75	70·59	...
		Voided leases ... ..	...	...	...	...	...	...	4,543·23	2,208·48	...
		Sundry claims ... ..	...	2·14	80·75	49·55	...	389·82	801·00	374·30	...
Norseman	1488	Abbotshall ... ..	...	...	234·50	41·59	...	...	234·50	41·59	...
	(1334)	Abbotshall ... ..	...	...	84·25	23·61	...	...	1,189·00	292·70	...
	1319, etc.	Central Norseman Gold Corporation, N.L. ... ..	...	...	20,303·00	5,840·21	16,485·38	...	20,303·00	5,840·21	16,485·38
	1319, etc.	Prior to transfer to present holders ... ..	...	...	93·50	38·97	...	...	16,382·71	13,939·02	2,049·45
	1490	Commercial ... ..	...	...	34·50	8·73	...	...	34·50	8·73	...
	1452	Cumberland Central ... ..	...	...	89·00	22·23	...	...	173·75	54·54	...
	1462	Cumberland Central West ... ..	...	...	98·75	33·37	...	...	118·00	36·75	...

	1482 ...	Grand View ...	...	...	102.00	10.63	...	...	...	102.00	10.63	...
	(1424) ...	Iron King North ...	...	...	12.50	5.68	...	...	...	12.50	5.68	...
	1453 ...	Lady Evelyn ...	...	...	23.00	6.00	...	...	...	53.00	13.46	...
	1364 ...	Lady Mary ...	...	...	99.00	15.45	...	...	...	99.00	15.45	...
	1401 ...	Lady Mary Deeps No. 2 ...	...	...	...	...	...	...	...	135.00	27.55	...
	1347, etc.	Lady Miller G.Ms., Ltd.	...	...	181.87	68.85	...	...	...	824.87	130.14	...
	1347, etc.	Prior to transfer to present holders	...	...	...	...	...	...	...	805.00	216.37	...
	1315, etc.	Norseman Gold Mines, N.L.	...	...	67,860.00	22,440.40	20,646.00	...	...	128,114.00	49,891.15	34,111.54
	1315, 1481	Prior to transfer to present holders	...	...	73.00	7.94	...	...	...	2,539.00	606.32	...
	1428 ...	Norseman Lake View ...	...	...	27.25	8.93	...	5.08	...	71.25	14.14	...
	1382, etc.	Northern Goldfields Dev. Synd., N.L.	...	...	412.00	744.74	...	...	...	523.25	1,022.08	...
	1382 ...	(Bluebird) ...	...	...	...	...	...	...	...	128.00	119.82	...
	1427 ...	Northern Star Extended ...	...	...	...	...	...	...	...	31.00	6.80	...
	1317, 1405	O.K. Gold Mines, N.L.	...	...	168.50	49.73	...	...	8.34	4,686.25	3,865.96	...
	1422, 1468	Onkaparinga leases ...	...	...	176.75	343.26	...	...	...	321.75	908.57	...
	1466 ...	Oreb ...	...	...	84.50	63.93	...	...	...	84.50	63.93	...
	1460 ...	Red, White and Blue ...	...	...	117.75	63.06	...	...	...	117.75	63.06	...
		Voided leases ...	...	...	...	...	...	4.23	10,458.38	874,729.97	577,905.56	34,959.70
		Sundry claims ...	...	7.16	1,095.00	334.09	...	1,013.97	3,216.01	35,361.41	17,600.21	.59
Peninsula ...	1477 ...	Day Dawn Extended ...	...	...	49.00	12.83	...	...	...	49.00	12.83	...
	1463 ...	Peninsula ...	...	...	20.00	18.58	...	...	...	20.00	18.58	...
		Voided leases ...	...	...	...	...	...	...	17.61	7,807.14	4,833.88	...
		Sundry claims ...	...	...	47.00	5.73	...	...	...	116.75	37.16	...
	<i>From Goldfield generally:—</i>											
	Sundry Parcels treated at:											
		Hockey & Mitchell's Cyanide Plant ...	...	...	...	45.24	1.47	...	...	...	46.65	21.68
		Princess Royal Cyanide Plant ...	...	...	...	405.29	286.20	...	...	...	450.83	305.51
		State Battery, Norseman ...	...	...	...	381.82	...	...	...	405.39	*16,169.77	885.41
		Various Works ...	...	...	...	...	...	...	54.52	483.14	*11,123.46	657.20
		Reported by Banks and Gold Dealers ...	1.01	...	...	2.03	...	1,074.87	36.28	47.50	11.43	...
		Totals ...	1.01	9.30	91,603.87	31,120.62	37,419.05	2,098.15	14,220.51	1,103,127.43	709,479.94	89,476.46

Phillips River Goldfield.

Hatter's Hill ...	(243) ...	King George ...	...	...	50.00	59.36	...	...	...	50.00	59.36	...
	244 ...	Sunday Gift... ..	...	...	81.00	84.13	...	...	...	81.00	84.13	...
		Voided leases ...	...	...	...	...	...	...	4.38	1,251.55	957.01	...
		Sundry claims ...	...	...	531.50	329.17	...	74.91	21.69	2,890.60	1,737.12	...
Kundip ...	211 ...	Gem Restored ...	...	...	167.50	67.59	...	...	...	916.50	297.56	...
	M.L. 370 ...	North Harbour View ...	...	...	...	...	...	...	...	35.27	†22.16	...
		Voided leases ...	...	...	...	...	113.28	556.17	69,609.31	56,327.68	3,797.24	...
		Sundry claims ...	...	...	174.50	34.06	...	88.62	72.84	3,146.88	1,215.85	15.45
Mt. Desmond ...		Voided leases and sundry claims	...	...	...	...	...	...	1.40	9.00	†3,938.27	†6,942.60
Ravensthorpe ...	212 ...	Bridgetown ...	...	...	73.00	20.34	...	...	...	231.00	63.63	...
	234 ...	Bullrush G.M. Co., N.L.	...	...	93.99	53.61	...	...	...	123.99	102.20	...
	213 ...	Charmaine ...	...	...	71.00	43.54	...	...	...	208.00	88.84	...
	(11PP) ...	Deo Juvante ...	...	...	118.00	45.37	...	...	...	118.00	45.37	...
	(9PP) ...	James Henry ...	...	...	76.00	18.07	...	...	...	76.00	18.07	...
	245 ...	Jim Dunn ...	...	...	180.00	39.88	...	...	...	180.00	39.88	...
	(12PP) ...	May Bell ...	...	...	14.00	1.38	...	...	...	14.00	1.38	...

TABLE II.—Production of Gold and Silver from all sources, etc.—continued.

PHILLIPS RIVER GOLDFIELD—continued.

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1936.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240lbs.).	Fine ozs.	Fine ozs.
Ravensthorpe—cont.	(240)	South Charmaine ... ..	...	...	22·00	8·06	...	...	...	22·00	8·06	...
	1PP	Westeria ... ..	...	...	226·00	82·44	...	...	...	226·00	82·44	...
		Voided leases ... ..	...	...	...	...	...	...	141·80	21,933·76	† 25,149·50	† 4,384·07
		Sundry claims ... ..	...	...	781·33	234·41	...	163·96	6·60	5,096·57	2,522·78	20·65
West River ... ..	...	Voided leases and sundry claims	...	...	...	...	...	...	...	† 13·63	† 34·50	
		<i>From Goldfield generally:—</i>										
		Sundry Parcels treated at:										
		Floater Cyanide Plant ... ..	...	...	...	56·39	...	...	...	...	114·02	...
		Kings Cyanide Plant ... ..	...	...	...	2·87	...	...	...	...	187·91	...
		Maori Queen Cyanide Plant ... ..	...	...	...	64·01	...	...	...	...	64·01	...
		Various Works ... ..	...	...	...	...	...	...	...	...	1,036·31	493·66
		Reported by Banks and Gold Dealers	2·08	1·00	...	...	...	154·94	11·47	...	...	...
		Totals	2·08	1·00	2,659·82	1,244·68	...	595·71	816·35	106,219·43	94,177·17	15,688·17

† Includes gold and silver obtained from smelting copper ore.

Outside Proclaimed Goldfield.

Burracoppin	5PP	Benbur ... ..	...	...	19·25	19·16	...	...	...	427·60	522·45	...
	13PP	Christmas Gift ... ..	...	...	13·25	23·31	...	...	...	218·00	153·52	...
		Sundry claims ... ..	...	...	7·75	8·17	...	...	...	364·25	203·74	...
Donnybrook ... ..	...	Voided leases and sundry claims	...	...	...	...	...	23·24	37·83	1,682·80	828·47	15·18
Little Wongan ... ..	...	Sundry claims ... ..	...	...	80·75	6·39	...	...	...	80·75	6·39	...
Jimperding ... ..	...	Voided leases and sundry claims	1·10	...	...	...	...	240·67	·37	64·10	18·51	...
Late West Pilbara	56H, etc.	Weeriana G.Ms. ... ..	...	...	...	...	...	...	...	224·00	75·93	...
		Voided leases ... ..	...	...	...	...	...	177·74	93·21	18,902·11	21,620·82	1,234·54
		Sundry claims ... ..	...	...	...	...	...	32·95	88·97	420·60	489·94	96·53
		Reported by Banks and Gold Dealers	24·25	3·87	...	15·49	...	5,964·69	148·65	37·00	161·55	...
Sussex ... ..	...	Sundry claims ... ..	...	...	...	...	...	1·89	...	...	...

<i>From State generally :—</i>														
Sundry Parcels treated at:														
Fremantle Smelter	...	...	...	...	69·35	86·25	...	...	...	...	1,476·97	737·74
Various Works	...	...	...	...	...	...	...	...	27·00	...	6,796·27	30,394·19
Sundry specimens	...	...	...	...	...	...	4·24	56·85	...	...	...	...
Reported by Banks and Gold Dealers	...	...	...	...	30·60	33·69	2·50	...	497·90	463·39	103·62	59·99
Totals	55·95	37·56	121·00	144·37	86·25	6,943·32	889·27	22,448·21	32,458·18	32,538·17

TABLE III.

RETURN SHOWING TOTAL PRODUCTION REPORTED TO THE MINES DEPARTMENT, AND RESPECTIVE DISTRICTS AND GOLDFIELDS FROM WHENCE DERIVED.

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 ...	...	...	...	...	...	...	...	5,527·96	...	17,818·25	14,352·06	19,880·02	...
Pilbara ...	Marble Bar ...	14,070·43	4,181·23	119,369·18	162,830·20	181,081·86	653·91	} 22,162·12	} 4,715·50	} 165,812·47	} 239,940·87	} 266,818·49	} 682·58
	Nullagine ...	8,091·69	534·27	46,443·29	77,110·67	85,736·63	28·67						
Ashburton ...	...	...	...	...	...	...	...	8,940·35	332·23	537·00	326·20	9,598·78	7,793·32
Gascoyne ...	...	...	...	...	...	...	...	572·32	41·57	387·00	517·29	1,131·18	...
Peak Hill ...	...	...	...	...	...	...	...	} 2,708·94	} 4,880·11	} 579,120·18	} 279,256·04	} 286,845·09	} 2,288·21
East Murchison ...	Lawlers ...	6,523·45	2,251·91	1,656,871·33	725,905·86	734,681·22	25,782·88						
	Wiluna ...	166·81	957·23	3,092,170·07	908,536·88	909,660·92	450·03	} 8,296·01	} 20,198·67	} 6,046,484·13	} 2,460,892·08	} 2,489,386·76	} 42,932·63
	Black Range ...	1,605·75	16,989·53	1,297,442·73	826,449·34	845,044·62	16,699·72						
Murchison ...	Cue ...	2,859·99	6,242·34	607,544·38	440,765·95	449,868·28	4,732·80	} 20,612·01	} 48,532·27	} 5,363,147·92	} 3,420,673·98	} 3,489,818·26	} 180,146·32
	Meekatharra ...	12,910·74	15,012·46	2,027,908·10	1,198,392·76	1,226,315·96	5,028·90						
	Day Dawn ...	2,685·15	10,430·73	1,992,409·50	1,316,278·04	1,329,393·92	169,210·44						
	Mt. Magnet ...	2,156·13	16,846·74	735,285·94	465,237·23	484,240·10	1,174·18	} 1,668·71	} 2,418·69	} 324,008·25	} 213,314·39	} 217,401·79	} 1,250·41
Yalgoo ...	...	...	...	...	...	...	...
Mt. Margaret ...	Mt. Morgans ...	2,556·92	8,532·16	1,159,734·96	652,232·47	663,321·55	5,780·87	} 9,702·29	} 29,606·52	} 7,735,495·30	} 3,793,830·84	} 3,833,139·65	} 184,485·86
	Mt. Malcolm ...	3,407·34	12,856·24	4,738,081·88	2,232,913·47	2,249,277·05	121,657·69						
	Mt. Margaret ...	3,738·03	8,218·12	1,837,678·46	908,684·90	920,641·05	57,047·30	} 4,361·85	} 12,278·28	} 2,676,629·18	} 2,013,482·06	} 2,030,122·09	} 31,954·67
North Coolgardie ...	Menzies ...	1,438·28	5,568·30	1,306,437·06	1,080,273·52	1,087,280·10	20,007·37						
	Ularring ...	56·53	1,294·97	310,506·32	305,694·55	307,046·05	5,973·05						
	Niagara ...	1,646·30	1,706·23	910,095·72	506,265·68	509,618·21	5,603·42						
	Yerilla ...	1,220·74	3,708·68	149,590·08	121,248·31	126,177·73	370·83	} 21,166·37	} 22,564·78	} 1,022,191·82	} 584,800·94	} 628,532·09	} 3,510·66
Broad Arrow ...	...	...	...	...	...	...	...
N.E. Coolgardie ...	Kanowna ...	105,603·47	12,016·35	982,618·91	613,499·85	731,119·67	2,522·12	} 118,160·00	} 18,344·74	} 993,439·23	} 629,842·79	} 766,347·53	} 2,533·34
	Kurnalpi ...	12,556·53	6,328·39	10,820·32	16,342·94	35,227·86	11·22						
East Coolgardie ...	East Coolgardie ...	31,842·36	36,854·61	38,209,809·20	23,039,830·63	23,108,527·60	2,501,839·51	} 58,954·84	} 52,459·20	} 38,375,881·29	} 23,166,986·91	} 23,278,400·95	} 2,501,852·43
	Bulong ...	27,112·48	15,604·59	166,072·09	127,156·28	169,873·35	12·92						
Coolgardie ...	Coolgardie ...	15,370·02	13,914·15	1,682,496·25	1,060,763·52	1,090,047·69	906·29	} 16,609·35	} 17,856·51	} 1,982,043·48	} 1,283,943·76	} 1,318,409·62	} 977·72
	Kunanalling ...	1,239·33	3,942·36	299,547·23	223,180·24	228,361·93	71·43						
Yilgarn ...	...	...	...	...	...	...	...	1,985·96	1,870·05	2,646,998·17	1,244,919·34	1,248,775·35	32,665·69
Dundas ...	...	...	...	...	...	...	...	2,098·15	14,220·51	1,103,127·43	709,479·94	725,798·60	89,476·46
Phillips River ...	...	...	...	...	...	...	...	595·71	816·35	106,219·43	94,177·17	95,589·23	15,688·17
State generally ...	...	...	...	...	...	...	...	6,943·32	889·27	22,448·21	32,458·18	40,290·77	32,538·17
		...	...	...	...	...	...	311,066·26	252,025·15	69,161,788·74	40,183,194·84	40,746,286·25	3,130,776·64

* By product in the treatment of auriferous ore, with exception of yield from Ashburton and State generally.

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, 1936; 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 1936	22,422·06	8,632·81	31,054·87	147,302·43	187,102·87	334,405·30
1936	...	311·83	311·83	...	9,057·34	9,057·34
Total	22,422·06	8,944·64	31,366·70	147,302·43	196,160·21	343,462·64
	<i>a</i> WEST PILBARA.			ASHBURTON.		
Prior to 1936	4,351·11	26,760·61	31,111·72	4,104·96	2,550·19	6,655·15
1936	...	...	...	...	310·84	310·84
Total	4,351·11	26,760·61	31,111·72	4,104·96	2,861·03	6,965·99
	<i>b</i> GASCOYNE.			<i>c</i> PEAK HILL.		
Prior to 1936	304·55	968·96	1,272·61	41,102·62	191,574·95	232,677·57
1936	...	3·51	3·51	...	2,066·22	2,066·22
Total	304·55	971·57	1,276·12	41,102·62	193,641·17	234,743·79
	EAST MURCHISON.			MURCHISON.		
Prior to 1936	230,882·91	1,918,442·71	2,149,325·62	1,458,084·41	2,236,648·10	3,694,732·51
1936	356·66	109,468·76	109,825·42	27,695·60	38,658·81	66,354·41
Total	231,239·57	2,027,911·47	2,259,151·04	1,485,780·01	2,275,306·91	3,761,086·92
	<i>d</i> YALGOO.			<i>e</i> MT. MARGARET.		
Prior to 1936	11,528·21	135,337·70	146,865·91	611,459·14	3,054,569·82	3,666,028·96
1936	85·10	10,003·11	10,088·21	6,460·04	82,542·12	89,002·16
Total	11,613·31	145,340·81	156,954·12	617,919·18	3,137,111·94	3,755,031·12
	<i>f</i> NORTH COOLGARDIE.			<i>g</i> BROAD ARROW.		
Prior to 1936	262,388·44	1,780,723·79	2,043,112·23	121,985·78	271,616·30	393,602·08
1936	46·46	25,166·87	25,213·33	63·76	18,365·40	18,429·16
Total	262,434·90	1,805,890·66	2,068,325·56	122,049·54	289,981·70	412,031·24
	<i>f</i> NORTH-EAST COOLGARDIE.			<i>f</i> EAST COOLGARDIE.		
Prior to 1936	235,728·35	447,266·93	682,995·28	6,808,284·95	17,340,407·40	24,148,692·35
1936	17·15	1,773·68	1,790·83	14,649·91	389,729·73	404,379·64
Total	235,745·50	449,040·61	684,786·11	6,822,934·86	17,730,137·13	24,553,071·99
	<i>h</i> COOLGARDIE.			YILGARN.		
Prior to 1936	661,920·68	924,514·55	1,586,435·23	216,235·17	1,073,643·61	1,289,878·78
1936	93·85	20,409·24	20,503·09	109·76	44,212·10	44,321·86
Total	662,014·53	944,923·79	1,606,938·32	216,344·93	1,117,855·71	1,334,200·64
	<i>i</i> DUNDAS.			<i>j</i> PHILLIPS RIVER.		
Prior to 1936	113,946·22	668,940·32	782,886·54	40,195·24	50,601·67	90,796·91
1936	5,375·94	36,653·24	42,031·18	...	1,591·98	1,591·98
Total	119,322·16	705,593·56	824,917·72	40,195·24	52,193·65	92,388·89
	¶ DONNYBROOK.			STATE GENERALLY.		
Prior to 1936	282·21	557·53	839·74	18,287·84	27,036·09	45,323·93
1936	...	...	...	70·35	856·43	926·78
Total	282·21	557·53	839·74	18,358·19	27,892·52	46,250·71

a Prior to 1st May, 1893, included with Pilbara and abolished 12th July, 1929. *b* Prior to March, 1890, 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 State generally. ¶ 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.

Year.	Export.	Mint.	Total.
	fine ozs.	fine ozs.	fine ozs.
1886 to 1929	10,987,594·33	26,899,852·59	37,887,446·97
1930	1,753·09	* 415,765·00	417,518·09
1931	1,726·66	508,845·36	510,572·02
1932	3,887·07	601,674·33	605,561·40
1933	2,446·97	634,760·40	637,207·37
1934	3,520·40	647,817·95	651,338·35
1935	9,868·71	639,180·38	649,049·09
1936	55,024·58	791,183·21	846,207·79
Total	11,065,821·86	31,139,079·22	42,204,901·08

* Accumulated differences in calculations adjusted by addition of 1,148·88 fine ozs.

The estimated value of the above production (calculated prior to 1930 at £4·24773, 1930 at £4·2477 and subsequently at £4 4s. 11·45d. per fine ounce) amounted to £179,274,999 7s. 3d.; in addition premiums on sales of gold during 1920-1924 and 1930-1936 were received totalling approximately £17,037,284. The bonus paid under the Commonwealth "Gold Bounty Act, 1930," was £161,448, bringing the gross estimated value of gold won up to £A196,473,731.

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 1936, AND PREVIOUS YEARS.

Period.	BLACK TIN.											
	Pilbara Goldfield—Marble Bar District.				Greenbushes Mineral Field.				Total.			
	Quantity.			Value.	Quantity.			Value.	Quantity.			Value.
	Lode.	Stream.	Total.		Lode.	Stream.	Total.		Lode.	Stream.	Total.	
* Prior to 1935	tons.	tons.	tons.	£	tons.	tons.	tons.	£	tons.	tons.	tons.	£
1935	372.62	5,511.20	5,883.82	543,642	350.96	10,757.71	11,108.67	966,063	724.18	16,273.78	16,997.96	1,510,126
1936	.....	.....	.....	80	.....	17.32	17.32	2,360	.....	17.87	17.87	2,440
1936	.....	4.60	4.60	677	.....	21.85	21.85	2,784	.....	26.45	26.45	3,461
Total	372.62	5,516.35	5,888.97	544,399	350.96	10,796.88	11,147.84	971,207	724.18	16,318.10	17,042.28	1,516,027

* Includes 4.72 tons, value £360, the produce of Cue District, .15 tons value £15 the produce of Coolgardie District and .60 tons value £46 the produce of Yilgarn Goldfield.

Period.	TANTALITE.											
	Pilbara Goldfield—Marble Bar District.				Greenbushes Mineral Field.				Total.			
	Quantity.			Value.	Quantity.			Value.	Quantity.			Value.
	Lode.	Stream.	Total.		Lode.	Stream.	Total.		Lode.	Stream.	Total.	
Prior to 1935	tons.	tons.	tons.	£	tons.	tons.	tons.	£	tons.	tons.	tons.	£
1935	14.49	157.31	171.80	29,864	.....	3.94	3.94	2,009	14.49	161.25	175.74	31,873
1936	7.35	.....	7.35	2,859	.....	.....	.....	.....	7.35	.....	7.35	2,859
1936	11.00	3.36	14.36	7,120	.....	.....	.....	.....	11.00	3.36	14.36	7,120
Total	32.84	160.67	193.51	39,843	.....	3.94	3.94	2,009	32.84	164.61	197.45	41,852

Period.	COPPER ORE.													
	West Kimberley Goldfield.	Pilbara Goldfield.				West Pilbara Goldfield.	Ashburton Goldfield.	Peak Hill Goldfield.	East Murchison Goldfield.					
		Marble Bar District.		Nullagine District.					Lawlers District.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.		
Prior to 1935	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
1935	109	1,709	33	386	14	480	82,745	748,482	351	6,408	1,015	32,212	238	4,364
1936	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1936	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	109	1,709	33	386	14	480	82,745	748,482	351	6,408	1,015	32,212	238	4,364

Period.	COPPER ORE—continued.									
	Murchison Goldfield.		Yalgoo Goldfield.		Northampton Mineral field.		Yandanooka Mineral field.		Mt. Margaret Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Prior to 1935	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
1935	1,024	11,236	39	413	24,019	119,451	172	1,889	47,861	230,846
1936	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1936	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	1,024	11,236	39	413	24,019	119,451	172	1,889	47,861	230,846

TABLE VI.—Minerals other than Gold—continued.

Period.	COPPER ORE—continued.										GYPSUM.						COAL.	
	North Coolgardie Goldfield.		East Coolgardie Goldfield.		Phillips River Goldfield.		State generally.		Total.		Yilgarn Goldfield.		State generally.		Total.		Collie Mf.	
	Menzies District.		E. Coolgardie District.															
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Previous to 1935	6	51	51	330	95,727	588,115	19	249	253,423	1,746,621	6,243	6,243	35,319	51,037	41,562	57,280	11,616,727	7,777,630
1935	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	487	487	4,975	6,401	5,462	6,888	537,188	318,012
1936	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	455	455	6,206	7,114	6,661	7,569	565,075	331,506
Total	6	51	51	330	95,727	588,115	19	249	253,423	1,746,621	7,185	7,185	46,500	64,552	53,685	71,737	12,718,990	8,427,208

Period.	IRONSTONE.								LEAD ORE.							
	West Pilbara Goldfield.		E. Coolgardie Gf.		State generally.		Total.		West Pilbara.		Northampton Mf.		Total.			
	E. Coolgardie D.															
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.		
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£		
Previous to 1935	100	300	450	247	57,280	36,148	57,830	36,695	107	1,529	408,687	1,270,141	408,774	1,271,670		
1935	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1936	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,535	2,228	1,535	2,228
Total	100	300	450	247	57,280	36,148	57,830	36,695	107	1,529	410,202	1,272,369	410,309	1,273,898		

Period.	SILVER LEAD ORE.						TUNGSTEN ORES.											
	Pilbara Goldfield.		Ashburton Goldfield.		Total.		WOLFRAM.		SCHERLITE.									
	Marble Bar District.						State generally.		North Coolgardie Gf.		Broad Arrow Goldfield.		Coolgardie Gf.		Dundas Goldfield.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Previous to 1935	195	3,658	2,974	35,796	3,169	39,454	265.89	1,295	407	942	3	175	86	155	.4	10	496.4	1,282
1935	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1936	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	195	3,658	2,974	35,796	3,169	39,454	265.89	1,295	407	942	3	175	86	155	.4	10	496.4	1,282

Period.	FIRECLAY.		GADOLINITE.		ASBESTOS.									
	Collie Mf.		Pilbara Goldfield.		Pilbara Goldfield.		West Pilbara.		Total.					
	Marble Bar District.													
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Previous to 1935	1,051	738	1	112	1,160	53,633	848	20,036	2,013	73,866	141	2,889	141	2,889
1935	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1936	.....	.....	.....	.....	84	770	122	2,520	158	3,479	.....	.....	.....	.....
Total	1,051	738	1	112	1,194	54,403	1,111	25,445	*2,312	80,234	.....	.....	.....	.....

* Includes 2.35 tons, value £189, produced from Ashburton Goldfield, and 5 tons, value £197, produced from area outside any proclaimed gold or mineral field.

Period.	LIMESTONE.								DIAMONDS.		EMERALDS.		MAGNESITE.		ANTIMONY.		MANGANESE.	
	Murchison Goldfield.		Yilgarn Goldfield.		State generally.		Total.		Pilbara Goldfield.		Murchison Goldfield.		East Coolgardie Goldfield.		West Pilbara Goldfield.		Peak Hill Goldfield.	
	Cue District.								Nullagine District.		Cue District.		Bulong District.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	carats.	£	carats.	£	tons.	£	tons.	£	tons.	£
Previous to 1935	298	772	2,548	1,607	90,859	15,911	93,705	18,290	.....	24	18,373	1,609	825	1,053	21	491	77	436
1935	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
1936	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	298	772	2,548	1,607	90,859	15,911	93,705	18,290	.....	24	18,373	1,609	825	1,053	21	491	77	436

NOTE.—As the collection of Statistics of Minerals other than Gold commenced during 1899, the total production from the different localities can only be approximately estimated by the Customs Records.

TABLE VI.—*Minerals other than Gold*—continued.

Period.	*ARSENIC.		FELSPAR.		GLAUCONITE.	
	Wiluna District.		Coolgardie.		State generally.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£
Prior to 1935	4,932	88,766	1,049	1,973	775	3,875
1935	3,728	67,108	4,208	8,437	308	1,540
1936	3,470	62,460	2,840	5,680	219	1,095
Total	12,130	218,334	8,097	16,090	1,302	6,510

* By-product from ore treated by Wiluna Gold Mines, Ltd.