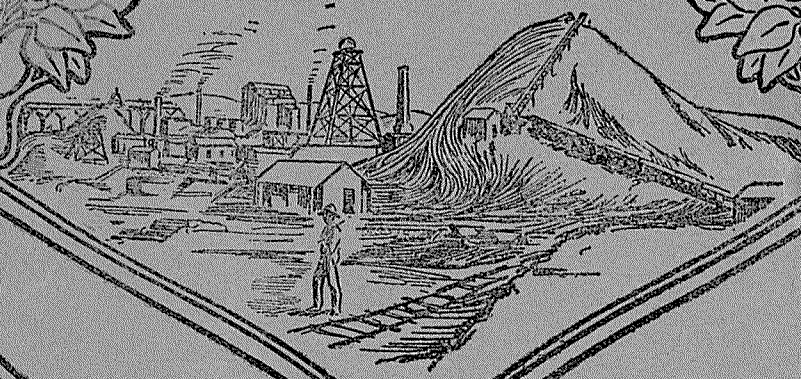
REPORT
OF THE
DEPARTMENT OF MINES
FOR THE YEAR
WESTERN · 1944 · AUSTRALIA



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

1945.

WESTERN AUSTRALIA.

REPORT

of the

Department of Mines

FOR THE YEAR

1944

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ANNUAL REPORT OF THE DEPARTMENT OF MINES, WESTERN AUSTRALIA, 1944.

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STATE OF WESTERN AUSTRALIA.

Report of the Department of Mines for the State of Western Australia for the Year 1944.

To the Hon. Minister for Mines.

Sir,—I have the honour to submit the Annual Report of the Department for the year 1944, together with reports from the officers controlling Sub-Departments and comparative tables furnishing statistics relative to the Mining Industry.

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

Department of Mines,
Perth, March 31st, 1945.

Division I.

The Hon. Minister for Mines,—

I have the honour to submit, for your information, a report on the Mining Industry for the year 1944.

The estimated value of the mineral output of the State for the year was £2,818,248 (calculating gold at £4 4s. 11.45d. per fine ounce); a decrease in value of £193,956 compared with the amended figure for the preceding twelve months. The estimated value of the premium paid to gold producers amounted to £A2,919,432, bringing the gross value of all minerals up to £A5,737,680, a decrease of £A663,913 compared with the 1943 production.

There were increases in quantities and values of alunite, arsenic, bentonite, bismuth, coal, copper, dolomite, glauconite, gypsum, phosphatic guano, pyrites, red ochre, silver, talc, tantalite, tin and tungsten (wolfram and scheelite). There was an increase in quantity of asbestos, but a decrease in value. There were decreases in quantities and values of antimony, beryl, diatomaceous earth, glass sand, graphite, iron ore, lead ore, soapstone and vermiculite. There were decreases in quantity but increases in value of clays, felspar and mica.

The estimated value of gold received at the Perth branch of the Royal Mint and exported in gold-bearing material was £A4,899,997 (and equalled 85.43 per cent. of all minerals. (See footnote to Table 1, (a), Part II.)

Other minerals realised:—Coal, £583,076; pyrites, £68,340; arsenic, £48,384; tungsten ores, £21,420; silver, £15,807; alunite, £14,229; phosphatic guano, £12,183; asbestos, £10,855; felspar, £10,531; beryl, £11,956; red ochre, £7,707; gypsum, £3,722; glauconite, £3,600; clays, £1,726; antimony, £1,482; mica, £1,279; soapstone, £828; dolomite, £794; vermiculite, £738; bentonite, £660; copper, £367; and glass sand, £204. Figures for tantalite, tin and tin-tantalite are incomplete, owing to realisation values not yet having been received. The amounts so far realised and which have been included in the total mineral production for the year are tantalite, £12,916; tin, £2,351; and tin-tantalite (estimated on tin content only), £2,045.

Dividends paid by mining companies amounted to £814,715, being an increase of £184,669 when compared with the amended figure for the previous year. (See Table 6, Part II.)

To the end of 1944, the total amount distributed by gold mining companies in dividends was £41,284,664. To the same date, the value of the mineral production amounted to £230,924,485 of which the gold production accounted for £211,321,534, based on normal values; but premiums on sale of gold during years 1920-24 and since 1930, increased the total value of gold and mineral productions by £60,126,047.

GOLD.

The quantity of gold reported as being received at the Perth Branch of the Royal Mint (464,439.76 fine ounces), together with that contained in bullion, concentrates and other gold bearing materials exported for treatment (1,824.99 fine ounces) totalled 466,264.75 fine ounces, and failed to equal that of 1943 by 80,210.67 fine ounces. (Vide Table 1 (a) of Part II.)

On the other hand, the total gold yield for the year, reported directly to the Department, by the producers, was 472,588.23 fine ounces, which was a decrease of 59,159.24 fine ounces, in comparison with the previous year's figures. (Vide Table 3, of Part II.)

The non-collation of the two totals, mentioned above, is principally due to the fact that the gold reported as being received at the Mint and exported for treatment, is not all necessarily produced during the calendar year under review, a certain quantity being in the transitory or near transitory stage from the producer at the end of the year. Then again, unfortunately, a small percentage of the production is not reported to the Department, despite a strict surveillance. For these and other reasons, the former total is accepted as the official production of the State, whilst the latter is utilised in tracing the gold back to its source. The calculated average value per ton of ore treated in the State as a whole, increased from 22.036 shillings per ton in 1943, to 22.604 shillings per ton in 1944, calculating at the rate of £4 4s. 11.45d. per fine ounce, but the averaged premium obtained for gold during the twelve months (147.40 per cent.) would more than double this estimate. For the East Coolgardie Goldfield (which produced approximately 59.177 per cent. of

the State's reported yield of gold), the calculated average value of the ore treated increased from 24.799 shillings per ton to 24.835 shillings per ton. The estimates for the East Murchison (Wiluna Gold Mines), Mount Margaret (Sons of Gwalia), and Dundas Goldfields, (Norseman Gold Mines and Central Norseman Gold Corporation) were 10.210s. (11.312s.); 31.165s. (31.045s.); 28.687s. (25.365s.) respectively; 1943 figures are shown in parentheses.

The tonnage of ore reported to have been treated in 1944, viz., 1,777,128 tons was 2,514,581 tons less than the record tonnage in 1940. Decreased tonnages were reported from the various goldfields as follows:—Kimberley, 455; Pilbara, 1,301; Ashburton, 35; Peak Hill, 198; East Murchison, 121,017; Murchison, 30,330; Yalgoo, 973; Mount Margaret, 3,657; North Coolgardie, 7,084; Broad Arrow, 16,119; East Coolgardie, 43,278; Coolgardie, 8,103; Yilgarn, 18,030; Dundas, 23,544; and Phillips River, 21. An increase of 261 tons was reported from the North-East Coolgardie Goldfield.

MINING GENERALLY—GOLD.

The gold yield for 1944 is again below that of the preceding year, a state of affairs likely to continue while the war lasts.

Taking into account that it was the fifth year of war, that manpower restrictions had not been in any way removed, and that stores, plant and spare parts were more difficult than ever to obtain, the output was remarkably high.

Great difficulty has been experienced regarding stores and the supply of sufficient quantities of items such as copper sulphate, quicksilver and cyanide, is a matter still causing much worry. The Agricultural Industry has been allotted first priority in regard to copper sulphate, while shipping difficulties have affected the importation of the latter two items which come from abroad.

Great delay is also experienced in obtaining machinery replacements, because of the industry's low priority and manpower and shipping difficulties.

During the year, several more of our larger mines were forced to close because of war-time conditions, the main ones being Yellowdine Gold Development Limited, Consolidated Gold Mines of Coolgardie, Limited (Tindals) and Ora Banda Amalgamated, No Liability.

These and other employing mines which had to close earlier in the war period for similar reasons, are being maintained by Government funds in such a state as will enable them to re-open with the minimum of delay once sufficient manpower is again offering. The amount of expenditure incurred on such maintenance during the year totalled £48,697 11s. 4d. The work being done includes care of machinery, underground safety measures, unwatering operations and general repairs.

The great improvement in the war position during the year, had the effect of encouraging interest by some companies in prospective new mines and exploratory work, including diamond drilling, was commenced towards the end of the year in several districts.

While the Allied nations have not given any indication since the Bretton Woods Conference of the likely post-war position in regard to gold, there is a noticeable air of optimism amongst mining men generally.

GOLD TAX.

The total gold tax collections from Western Australia since the Act came into force in 1939 until 31/12/1944, amounts to £3,155,515 6s. 4d. made up as follows:—

	£	s.	d.
Total to 31/12/1940	926,907	15	1
Year ended 31/12/1941	869,990	17	10
Year ended 31/12/1942	616,879	4	9
Year ended 31/12/1943	394,335	9	2
Year ended 31/12/1944	347,401	19	6
	3,155,515	6	4

The amounts refunded to prospectors and low grade producers over the same period totals £592,640 11s. 5d.

The industry has thus contributed considerably to the Nation's war effort financially, as well as with manpower and machinery.

MINERALS.

During the year, the output of strategic minerals for the war effort continued, and large supplies of beryl, tantalite, arsenic, wolfram, pyrites, phosphate, alunite, ochre and coal were raised.

In the case of the three first mentioned minerals, this State was one of the few Allied countries able to supply quantities of high-grade material quickly and our contribution was a highly valued one.

A wide variety of other minerals was also forthcoming, as is shown in Table 1.

Considerable progress was made during the year by the two companies operating on the Blue Asbestos deposits in the Hamersley Range. Treatment plants have been erected at each project and considerable development work undertaken. Fibre of a high standard is being obtained and it is hoped that an industry of considerable future importance to this part of the State is now being established.

COAL.

The output of coal for 1944 exceeded the 1943 figure by over 26,000 tons, mainly as a result of the operations of the Stockton Open-cut.

Because of the many new industries requiring power and fuel and because of the shortage of other fuels, this additional coal was badly needed.

The Department undertook exploratory operations at the Eradu Coal deposit during the year and sunk two shafts in an endeavour to contact the seam. Owing to an extraordinarily heavy influx of water, operations had to be temporarily abandoned. It is now proposed to drive on an outcrop a few miles from the shafts.

During the year, Australian Iron and Steel, Limited, commenced operations on the iron deposit at Cockatoo Island, Yampi Sound. The company is proceeding with the erection of necessary plant and buildings to enable production of ore on a considerable scale.

MINING DEVELOPMENT ACT.

The expenditure incurred in rendering assistance to mine owners and the industry generally under the provisions of this Act totalled £9,553 3s. 10d., and in the preceding year £6,240 12s. 8d.

PART II.—MINERALS.

TABLE 1.—*Quantity and Value of Minerals, other than Gold and Silver, produced and/or exported during Years* 1943 *and* 1944.

Description of Minerals.	1943.		1944.		Increase or Decrease for Year compared with 1943.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.	£A.	Tons.	£A.	Tons.	£A.
Alunite (Potash)	*Nil*	*Nil*	943·20	14,229	+ 943·20	+ 14,229
Antimonial (Concentrates)	1,475·94	52,913	*15·60	1,482	— 1,460·34	— 51,431
Arsenic	2,283·00	47,943	2,304·00	48,384	+ 21·00	+ 441
Asbestos (Anthophyllite)	8·68	87	23·00	226	+ 14·32	+ 139
Asbestos (Chrysotile)	52·85	2,798	12·04	656	— 40·81	— 2,142
Asbestos (Crocidolite)	181·55	10,090	273·49	9,973	+ 91·94	— 117
Bentonite	159·03	337	290·90	660	+ 131·87	+ 323
Beryl (exported)	515·56	14,764	390·15	†11,956	— 125·41	— 2,808
	lbs.		lbs.		lbs.	
Bismuth	560·00	137	1,466·00	482	+ 906·00	+ 345
	tons.		tons.		tons.	
Clays	2,111·75	1,387	1,615·50	1,726	— 496·25	+ 339
Coal	531,546·38	489,721	558,322·11	583,076	+ 26,775·73	+ 93,355
Copper Ore	·33	33	†46·01	367	...	+ 334
Diatomaceous Earth	40·00	640	*Nil*	*Nil*	— 40·00	— 640
Dolomite	*Nil*	*Nil*	158·51	795	+ 158·51	+ 795
Felspar	2,313·50	6,924	1,958·50	10,531	— 355·00	+ 3,607
Glass Sand	340·30	304	157·50	204	— 182·80	— 100
Glauconite	98·00	2,450	144·00	3,600	+ 46·00	+ 1,150
Graphite	11·00	55	*Nil*	*Nil*	— 11·00	— 55
Gypsum	935·30	880	3,604·45	3,722	+ 2,669·15	+ 2,842
Iron Ore	84·35	128	*Nil*	*Nil*	— 84·35	— 128
Lead Ore	1,250·00	1,100	*Nil*	*Nil*	— 1,250·00	— 1,100
	lbs.		lbs.		lbs.	
Mica	13,907·75	715	8,367·50	1,279	— 5,540·25	+ 564
	tons.		tons.		tons.	
Phosphatic Guano	42·00	21	2,215·00	12,183	+ 2,173·00	+ 12,162
Pyrites	10,189·00	19,078	23,702·00	68,340	+ 13,513·00	+ 49,262
Red Ochre	397·35	3,866	945·00	7,707	+ 547·65	+ 3,841
Soapstone	*Nil*	*Nil*	262·00	828	+ 262·00	+ 828
Talc	72·55	170	*Nil*	*Nil*	— 72·55	— 170
Tantalite (exported)	11·60	11,833	10·20	†12,916	— 1·40	+ 1,083
Tin (exported)	11·21	2,315	10·77	†2,351	— ·44	+ 36
Tin-Tantalum	*Nil*	*Nil*	20·16	†2,045	+ 20·16	+ 2,045
	units.		units.		units.	
Tungsten Ores (Scheelite) (exported) ...	492·00	2,664	3,899·73	21,420	+ 3,407·73	+ 18,756
Tunsten Ores (Wolfram) (exported) ...	14·00	80	*Nil*	*Nil*	— 14·00	— 80
	tons.		tons.		tons.	
Vermiculite	362·80	2,117	123·00	738	— 239·80	— 1,379
	...	675,550	...	821,876	...	146,326

‡ TABLE 1 (a).—*Quantity and Value of Gold and Silver exported and minted during Years* 1943 *and* 1944

	Fine ozs.	£A.	Fine ozs.	£A.	Fine ozs.	£A.
Gold (exported and minted)	546,475·42	5,710,668	466,274·75	4,899,997	— 80,200·67	— 810,671
Silver (exported)	118,802·92	15,375	123,198·97	15,807	+ 4,396·05	+ 432
Total	...	5,726,043	...	4,915,804	...	— 810,239

* Antimonial Content. † Incomplete. ‡ Included in the Value of Gold shown are the following estimated premiums :—1943, £A3,389,389 ; 1944, £A2,919,432.

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.
INFORMATION NOT AVAILABLE UNDER WAR CONDITIONS.			

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 yield of Gold per ton of ore treated.

Goldfield.	Reported Yield.		Percentage for each Goldfield.		Average Value per ton of Ore Treated. (Gold at £4 4s. 11·45d. per fine oz.)	
	1943.	1944.	1943.	1944.	1943.	1944.
	fine ozs.	fine ozs.	%	%	shillings.	shillings.
1. Kimberley	326	199	·061	·042	60·949	...
2. Pilbara	15,759	14,702	2·964	3·111	79·117	79·953
3. Ashburton	45	18	·008	·004	108·338	...
4. Gascoyne	...	...	...	...	...	...
5. Peak Hill	480	565	·090	·119	*100·912	232·004
6. East Murchison	81,190	58,743	15·268	12·431	11·312	10·210
7. Murchison	25,336	18,267	4·765	3·865	30·409	38·348
8. Yalgoo	1,288	926	·242	·196	40·221	45·003
9. Mt. Margaret	28,773	27,543	5·411	5·828	31·045	31·165
10. North Coolgardie	8,412	5,451	1·582	1·153	51·301	67·600
11. Broad Arrow	6,455	2,361	1·214	·499	30·683	113·702
12. North-East Coolgardie	705	465	·133	·098	*201·136	74·833
13. East Coolgardie	291,896	279,660	54·894	59·177	24·799	24·835
14. Coolgardie	15,244	14,720	2·867	3·115	20·466	22·663
15. Yilgarn	14,961	10,818	2·813	2·289	33·118	45·148
16. Dundas	40,737	38,125	7·661	8·068	25·365	28·687
17. Phillips River	57	16	·011	·003	*180·420	226·666
18. Outside Proclaimed Goldfield ...	84	9	·016	·002	...	...
Totals and Averages	531,748	472,588	100·000	100·000	22·036	22·604

* Principally from Sands.

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

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

TABLE 4.

Average Quantities of Gold Ore raised and treated, and Gold produced therefrom, per man employed on the several Goldfields of the State, during 1943, *and* 1944.

Goldfield.	1943.				1944.			
	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	151·67	75·83	108·75	54·38	...	...	99·60	49·80
2. Pilbara	423·27	114·40	393·97	106·48	300·57	101·49	282·73	95·47
3. Ashburton	11·67	4·38	14·87	5·58	...	...	17·50	5·83
4. Gascoyne	...	...	...	...	...	...	...	...
5. Peak Hill	40·40	17·57	47·96	20·85	20·65	8·60	56·52	23·54
6. East Murchison	1,487·94	812·32	198·02	108·11	1,362·22	736·50	163·63	88·47
7. Murchison	409·36	209·52	146·45	74·96	291·29	149·40	131·42	67·40
8. Yalgoo	136·09	71·62	64·40	33·89	194·33	79·50	102·89	42·09
9. Mt. Margaret	414·61	214·65	151·43	78·40	395·37	212·20	144·96	77·80
10. North Coolgardie	217·78	96·79	131·44	58·42	149·00	59·60	118·50	47·40
11. Broad Arrow	372·56	173·62	134·49	62·67	65·37	28·00	87·44	37·48
12. North-East Coolgardie ...	42·54	17·51	100·65	41·45	62·00	25·36	51·66	21·13
13. East Coolgardie	933·26	476·18	272·29	138·93	882·19	463·07	257·75	135·30
14. Coolgardie	430·69	206·90	103·70	49·82	525·80	255·60	140·19	68·15
15. Yilgarn	254·28	136·16	99·08	53·05	199·67	103·91	106·06	55·19
16. Dundas	580·89	284·39	173·35	84·87	535·37	281·70	180·69	95·07
17. Phillips River	9·00	3·00	19·10	6·37	...	1·20	...	3·19
18. Outside Proclaimed Goldfields	...	...	41·77	10·44	...	...	9·48	3·16
Total Averages ...	791·60	403·82	205·22	104·70	756·87	387·68	201·27	103·10

COMPARATIVE STATISTICAL DIAGRAMS
SHOWING
OUTPUT AND VALUE OF GOLD AND OTHER MINERALS
LANDS LEASED FOR GOLD MINING IN WESTERN AUSTRALIA
AND THE GOLD PRODUCTION OF AUSTRALASIA FOR THE YEAR 1944

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

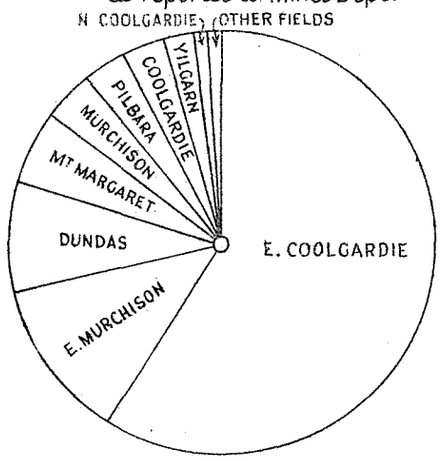


FIG.2 Gold produced from various Goldfields as given by the Export and Mint Returns.

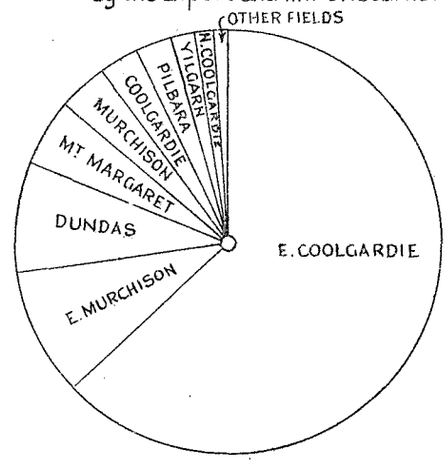


FIG.3 Value of Gold and other Minerals.

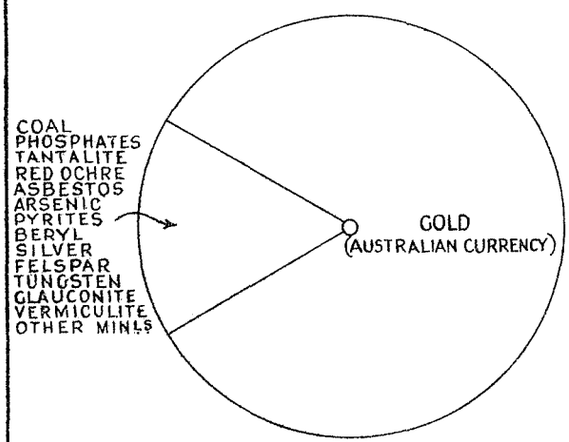


FIG.4 Value of Minerals other than Gold.

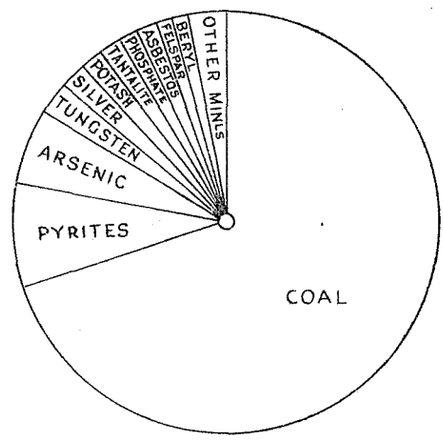


FIG.5 Areas of land leased for Gold mining on various Goldfields.

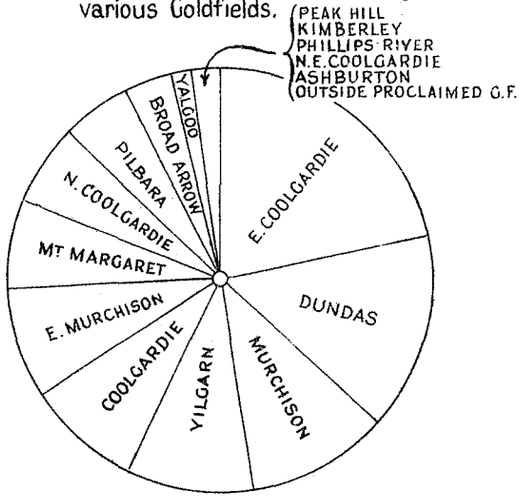


FIG.6 Output of Gold in the States of Australia and the Dominion of New Zealand.

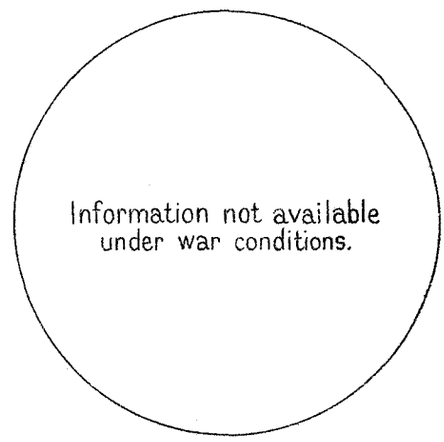


DIAGRAM OF GOLD OUTPUT

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

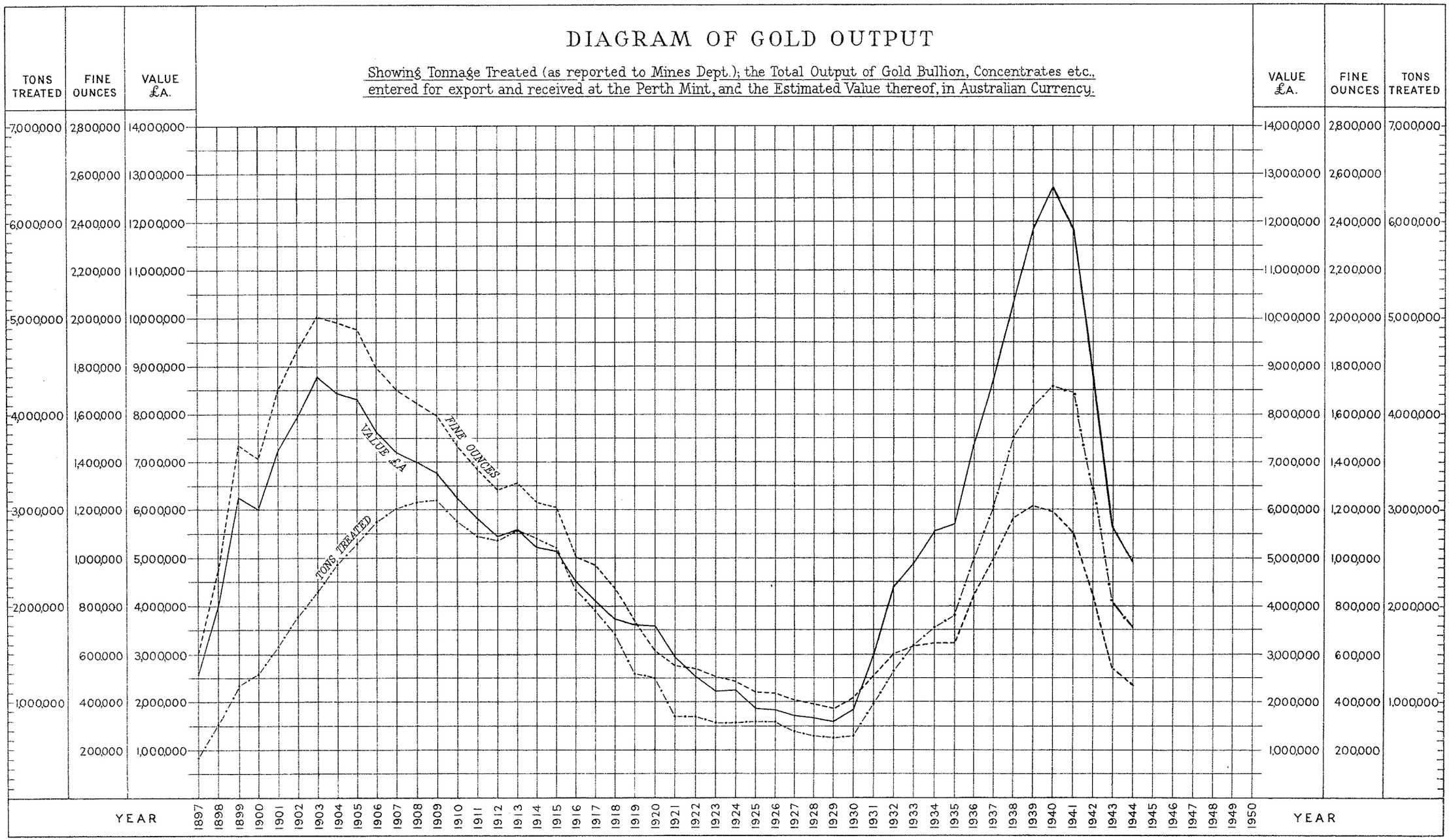


TABLE 5.

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.

State.	Output of Gold.	Value.	Percentage of Total.	
			Output of Commonwealth.	Output of Australasia.
INFORMATION NOT AVAILABLE UNDER WAR CONDITIONS.				

TABLE 6.

Dividends, etc., paid by Western Australian Mining Companies during 1944, *and the 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.	Dividends Paid.	
		1944.	Grand Total to end of 1944.
		£	£
Pilbara	Various Companies	...	26,513
Peak Hill	do. do.	...	199,305
East Murchison	do. do.	...	1,914,053
Murchison	Hill 50 Gold Mine, N.L.	18,750	156,251
	Various Companies	...	(*e*) 2,714,945
Mt. Margaret	Sons of Gwalia, Limited	16,250	1,916,613
	Western Mining Corporation, Ltd.	97,450	164,997
	Various Companies	...	777,047
North Coolgardie	First Hit (1934) G.M's., N.L.	4,661	97,880
	Various Companies	...	614,671
Broad Arrow	do. do.	...	92,500
North-East Coolgardie	do. do.	...	129,493
East Coolgardie	Boulder Perseverance, Ltd.	11,241	(*a*) 2,395,301
	Golden Horseshoe (New) Ltd.	13,750	(*b*) 3,996,250
	Gold Mines of Kalgoorlie, Ltd.	30,500	297,375
	Great Boulder Proprietary Ltd.	62,500	(*e*) 6,785,963
	Kalgoorlie Enterprise Mines, Ltd.	22,000	232,375
	Lake View & Star, Ltd.	350,000	(*c*) 3,339,500
	North Kalgurli (1912), Ltd.	37,500	827,500
	Paringa Mining and Exploration Co., Ltd.	14,488	179,223
	South Kalgurli Consolidated, Ltd.	15,625	(*d*) 1,091,567
	Various Companies	...	10,754,854
Coolgardie	do. do.	...	388,770
Yilgarn	do. do.	...	1,205,556
Dundas	Central Norseman Gold Corporation	120,000	200,000
	Various Companies	...	786,162
	Totals	814,715	41,284,664

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

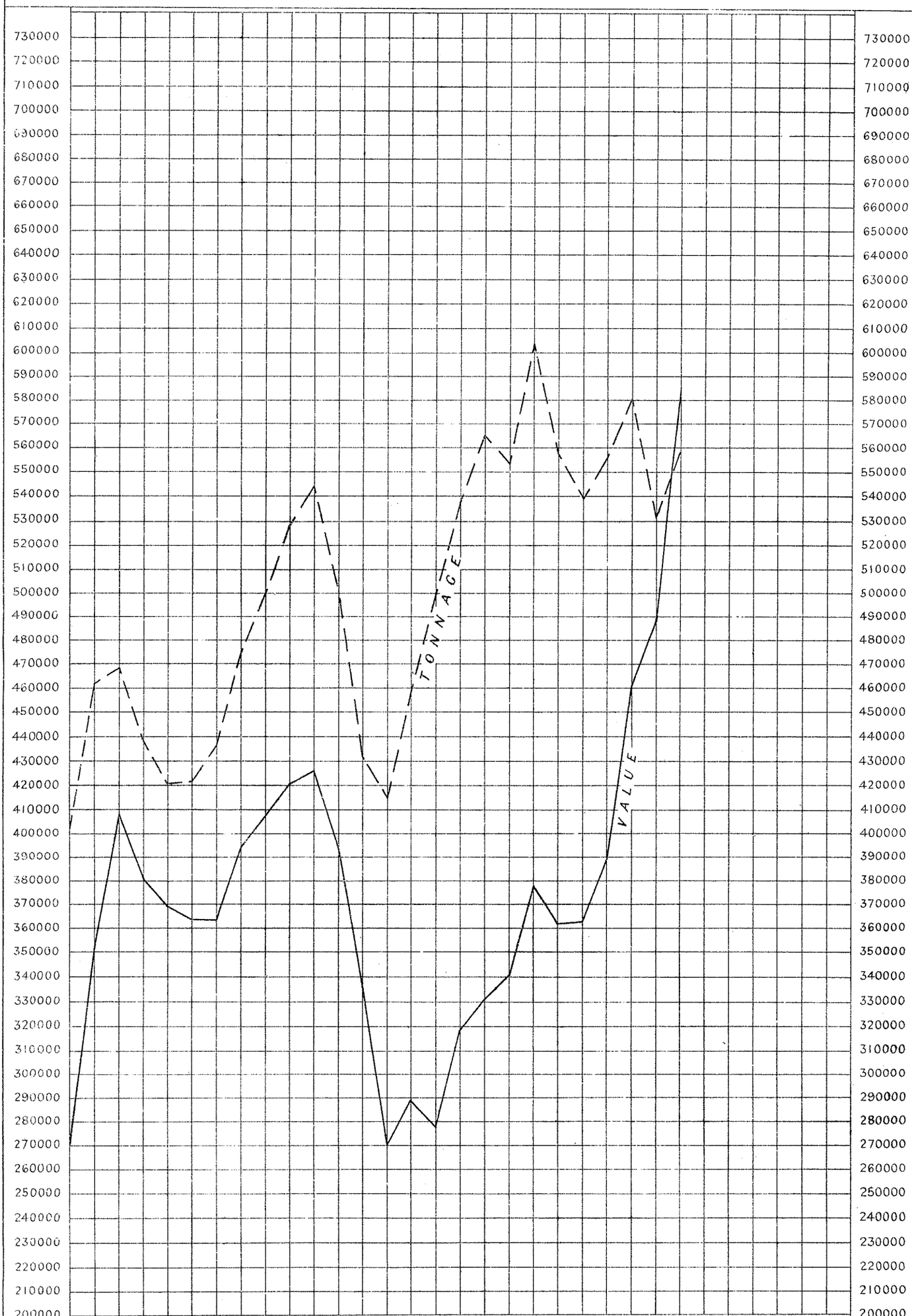
TABLE 7.

Quantity and Value of Minerals, other than Gold and Silver, reported to the Mines Department during 1944.

Goldfield, District or Mineral Field.	1944.		Increase or Decrease as compared with 1943.	
	Quantity.	Value.	Quantity.	Value.
	tons.	£A.	tons.	£A.
ALUNITE (Potash)	943·20	14,229	+ 943·20	+ 14,229
ANTIMONY—				
East Murchison (Wiluna)	12·00	1,230	— 1,459·00	— 51,372
Pilbara (Nullagine)	3·60	252	— 1·34	— 59
ARSENIC—				
East Murchison (Wiluna)	2,304·00	48,384	+ 21·00	+ 441
ASBESTOS (Anthophyllite)—				
Outside Proclaimed Goldfield	23·00	226	+ 14·32	+ 139
ASBESTOS (Crocidolite)—				
Outside Proclaimed Goldfield	273·49	9,974	+ 91·94	— 116
ASBESTOS (Chrysotile)—				
Pilbara	2·00	200	— 16·00	— 654
Outside Proclaimed Goldfield	10·04	456	— 24·81	— 1,489
BENTONITE—				
Outside Proclaimed Goldfield	290·90	660	+ 131·87	+ 323
BERYL—				
Coolgardie	28·71	861	+ 28·71	+ 861
Murchison (Cue)	21·53	659	+ 21·53	+ 659
Pilbara	302·11	9,055	— 174·64	— 4,505
Outside Proclaimed Goldfield	37·80	1,381	+ 1·01	+ 177
BISMUTH—	lbs.		lbs.	
Outside Proclaimed Goldfield	1,466·00	482	+ 906·00	+ 345
CLAYS—	tons.		tons.	
Outside Proclaimed Goldfield	1,615·50	1,726	— 496·25	+ 339
COAL—				
Collie	558,322·11	583,076	+ 26,775·73	+ 93,355
COPPER ORE—				
Phillips River	1·21	130	+ 1·21	+ 130
East Murchison (Lawlers)	7·30	31	+ 6·90	— 2
East Murchison (Black Range)	19·50	117	+ 19·50	+ 117
East Murchison (Wiluna)	...	*35	...	+ 35
Murchison (Meekatharra)	18·00	54	+ 18·00	+ 54
DIATOMACEOUS EARTH—				
Outside Proclaimed Goldfield	*Nil*	*Nil*	— 40·00	— 640
DOLOMITE—				
Outside Proclaimed Goldfield	158·51	795	+ 158·51	+ 795
FELSPAR—				
Coolgardie	1,881·00	10,376	— 408·00	+ 3,509
Outside Proclaimed Goldfield	77·50	155	+ 53·00	+ 98
GRASS SAND—				
Outside Proclaimed Goldfield	157·50	204	— 182·80	— 100
GLAUCONITE—				
Outside Proclaimed Goldfield	144·00	3,600	+ 46·00	+ 1,150
GRAPHITE—				
Outside Proclaimed Goldfield	*Nil*	*Nil*	— 11·00	— 55
GYPSUM—				
Outside Proclaimed Goldfield	3,604·45	3,722	+ 2,669·15	+ 2,842
IRON ORE—				
Outside Proclaimed Goldfield	*Nil*	*Nil*	— 84·35	— 128
LEAD ORE—				
Northampton	*Nil*	*Nil*	— 1,250·00	— 1,100

DIAGRAM OF COAL OUTPUT

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



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

TABLE 7—*continued.*

Quantity and Value of Minerals, other than Gold and Silver, reported to the Mines Department during 1944—*continued.*

Goldfield District or Mineral Field.	1944.		Increase or Decrease as compared with 1943.	
	Quantity.	Value.	Quantity.	Value.
MICA—	lbs.	£A.	lbs.	£A.
Outside Proclaimed Goldfield	8,367·50	1,279	— 5,540·25	+ 564
PHOSPHATIC GUANO—	tons.		tons.	
Outside Proclaimed Goldfield	2,215·00	12,183	+ 2,173·00	+ 12,162
PYRITES—				
Dundas	23,702·00	68,340	+ 13,513·00	+ 49,262
RED OCHRE—				
Murchison (Cue)	74·00	563	+ 74·00	+ 563
East Coolgardie	20·00	80	+ 4·65	+ 34
Outside Proclaimed Goldfield	851·00	7,064	+ 469·00	+ 3,244
SOAPSTONE—				
Greenbushes	262·00	828	+ 262·00	+ 828
TALC—				
East Coolgardie	*Nil*	*Nil*	— 72·55	— 170
TANTALITE—				
Greenbushes	*Nil*	*Nil*	— 10·73	— 11,054
Pilbara	10·20	12,916	+ 9·33	+ 12,137
TIN—				
East Murchison (Lawlers)	*Nil*	*Nil*	— 0·14	— 53
Greenbushes	0·90	176	— 4·97	— 921
Kimberley	*Nil*	*Nil*	— 0·60	— 143
Pilbara	9·87	2,175	+ 5·27	+ 1,153
TIN-TANTALUM—				
Greenbushes	20·16	†2,045	+ 20·16	+ 2,045
TUNGSTEN (Scheelite)	units.		units.	
Murchison (Cue)	11·00	59	+ 11·00	+ 59
Coolgardie	16·00	90	— 265·00	— 1,450
Dundas	*Nil*	*Nil*	— 2·00	— 9
North Coolgardie (Menzies)	*Nil*	*Nil*	— 7·00	— 24
Yalgoo	*Nil*	*Nil*	— 194·00	— 1,050
Yilgarn	3,873·00	21,271	+ 3,865·00	+ 21,230
TUNGSTEN (Wolfram)—				
Yalgoo	*Nil*	*Nil*	— 14·00	— 80
VERMICULITE—	tons.		tons.	
Yilgarn	*Nil*	*Nil*	— 20·00	— 60
Outside Proclaimed Goldfield	123·00	738	— 219·80	— 1,319

* Quantity of ore not reported. † Tin content value only.

TABLE 8.

Quantity of Coal raised during 1943 *and* 1944, *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	1943	531,546	489,721	188	650	818	634
	1944	**558,322**	**583,076**	**207**	**673**	**830**	**634**

The quantity and value of coal raised during the year 1944 showed an increase amounting to 26,776 tons and £93,355 respectively. The average number of men employed during the year increased by 42, but the number of tons raised per man employed remained the same.

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

TABLE 9.

Total Number and Acreage of Leases, Mineral Claims, and Prospecting Areas held for Mining on 31st December, 1943 and 1944.

	1943.		1944.	
	No.	Acreage.	No.	Acreage.
Gold Mining Leases on Crown Land	1,263	21,167	1,302	21,743
Gold Mining Leases on Private Property	3	72	3	72
Mineral Leases on Crown Land	167	38,436	175	38,474
Mineral Claims	133	7,927	149	8,291
Prospecting Areas	*343	5,737	†386	6,453
Totals	1,909	73,339	2,015	75,033

* Includes 47 Prospecting Areas for Minerals of a total area of 1,193 acres.

† Includes 50 Prospecting Areas for Minerals of a total area of 1,277 acres.

PART IV.—MEN EMPLOYED.

TABLE 10.

Average number of Men reported as engaged in Mining during 1943 *and* 1944.

Goldfield.	District.	Reef or Lode.		Alluvial.		Total.	
		1943.	1944.	1943.	1944.	1943.	1944.
Kimberley	...	6	4	...	...	6	4
Pilbara	Marble Bar	111	104	...	...	111	104
	Nullagine	37	50	...	...	37	50
Ashburton	...	8	3	...	...	8	3
Gascoyne	...	...	...	...	...	...	...
Peak Hill	...	23	24	...	...	23	24
East Murchison	Lawlers	94	78	...	...	94	78
	Wiluna	641	571	...	...	641	571
	Black Range	16	15	...	...	16	15
Murchison	Cue	107	86	...	...	107	86
	Meekatharra	90	74	...	...	90	74
	Day Dawn	21	20	...	...	21	20
	Mt. Magnet	120	91	...	...	120	91
Yalgoo	...	38	22	...	...	38	22
Mt. Margaret	Mt. Morgans	63	64	...	...	63	64
	Mt. Malcolm	263	244	...	...	263	244
	Mt. Margaret	41	46	...	...	41	46
North Coolgardie	Menzies	84	74	2	3	86	77
	Ularring	26	23	1	1	27	24
	Niagara	10	9	...	...	10	9
	Yerilla	20	9	1	1	21	10
Broad Arrow	...	98	63	5	5	103	68
North-East Coolgardie	Kanowna	9	15	1	2	10	17
	Kurnalpi	6	7	1	1	7	8
East Coolgardie	East Coolgardie	2,076	2,056	17	16	2,093	2,072
	Bulong	7	11	1	1	8	12
Coolgardie	Coolgardie	289	200	2	...	291	200
	Kunanalling	15	16	...	...	15	16
Yilgarn	...	282	196	...	...	282	196
Dundas	...	430	401	...	...	430	401
Phillips River	...	9	5	...	...	9	5
State Generally	...	8	3	...	...	8	3
Total—Gold Mining		5,048	4,584	31	30	5,079	4,614
MINERALS OTHER THAN GOLD.							
Alunite	...	69	77	...	...	69	77
Arsenic	...	23	22	...	...	23	22
Asbestos	...	56	102	...	...	56	102
Bentonite	...	1	1	...	...	1	1
Beryl	...	21	25	...	...	21	25
Bismuth	...	1	1	...	...	1	1
Clays	...	5	7	...	...	5	7
Coal	...	838	880	...	...	838	880
Copper Ore	...	1	1	...	...	1	1
Dolomite	...	...	2	...	...	...	2
Felspar	...	9	8	...	...	9	8
Glass Sand	...	1	1	...	...	1	1
Glauconite	...	2	2	...	...	2	2
Gypsum	...	2	8	...	...	2	8
Iron Ore	...	2	...	...	...	2	...
Lead	...	2	...	...	...	2	...
Mica	...	25	30	...	...	25	30
Phosphatic Guano	...	...	27	...	...	...	27
Pyrites	...	33	40	...	...	33	40
Red Ochre	...	3	2	...	...	3	2
Soapstone	...	...	1	...	...	...	1
Talc	...	1	...	...	...	1	...
Tantalite	...	30	48	...	...	30	48
Tin	...	7	5	...	...	7	5
Tin-Tantalum	...	...	13	...	...	...	13
Tungsten Ore (Scheelite)	...	14	11	...	...	14	11
Tungsten Ore (Wolfram)	...	1	...	...	...	1	...
Vermiculite	...	1	2	...	...	1	2
Total—Other Minerals		1,148	1,316	...	...	1,148	1,316
GRAND TOTAL		6,196	5,900	31	30	6,227	5,930

PART V.—ACCIDENTS.

TABLE 11.

MEN EMPLOYED IN MINES KILLED AND INJURED IN MINING ACCIDENTS DURING 1943 AND 1944.

A.—According to Locality of Accident.

Goldfield.	Killed.		Injured.		Total Killed and Injured.	
	1943.	1944.	1943.	1944.	1943.	1944.
1. Kimberley	...	...	...	...	...	...
2. West Kimberley	...	...	...	...	...	...
3. Pilbara	2	...	7	11	9	11
4. West Pilbara	...	...	...	...	...	...
5. Ashburton	...	...	...	...	...	...
6. Gascoyne	...	...	...	...	...	...
7. Peak Hill	...	...	...	...	...	...
8. East Murchison	1	2	99	78	100	80
9. Murchison	1	...	14	16	15	16
10. Yalgoo	...	...	...	...	...	...
11. Mount Margaret	...	...	31	20	31	20
12. North Coolgardie	...	...	...	10	...	10
13. North-East Coolgardie	...	...	...	...	...	...
14. Broad Arrow	1	...	...	...	1	...
15. East Coolgardie	5	4	372	338	377	342
16. Coolgardie	1	...	24	10	25	10
17. Yilgarn	...	...	17	12	17	12
18. Dundas	2	1	71	78	73	79
19. Phillips River	...	...	...	...	...	...
MINING DISTRICTS—						
Northampton	1	...	...	...	1	...
Greenbushes	...	...	...	...	...	...
Collie	1	1	291	242	292	243
South-West	...	1	8	2	8	3
Totals	15	9	934	817	949	826

From the above table it will be seen that the number of fatal accidents for the year 1944 was 9, as against 15 in 1943. The number injured showed a decrease of 117. In the report of the State Mining Engineer, published in Division II of this report, these accidents are classified according to their causes.

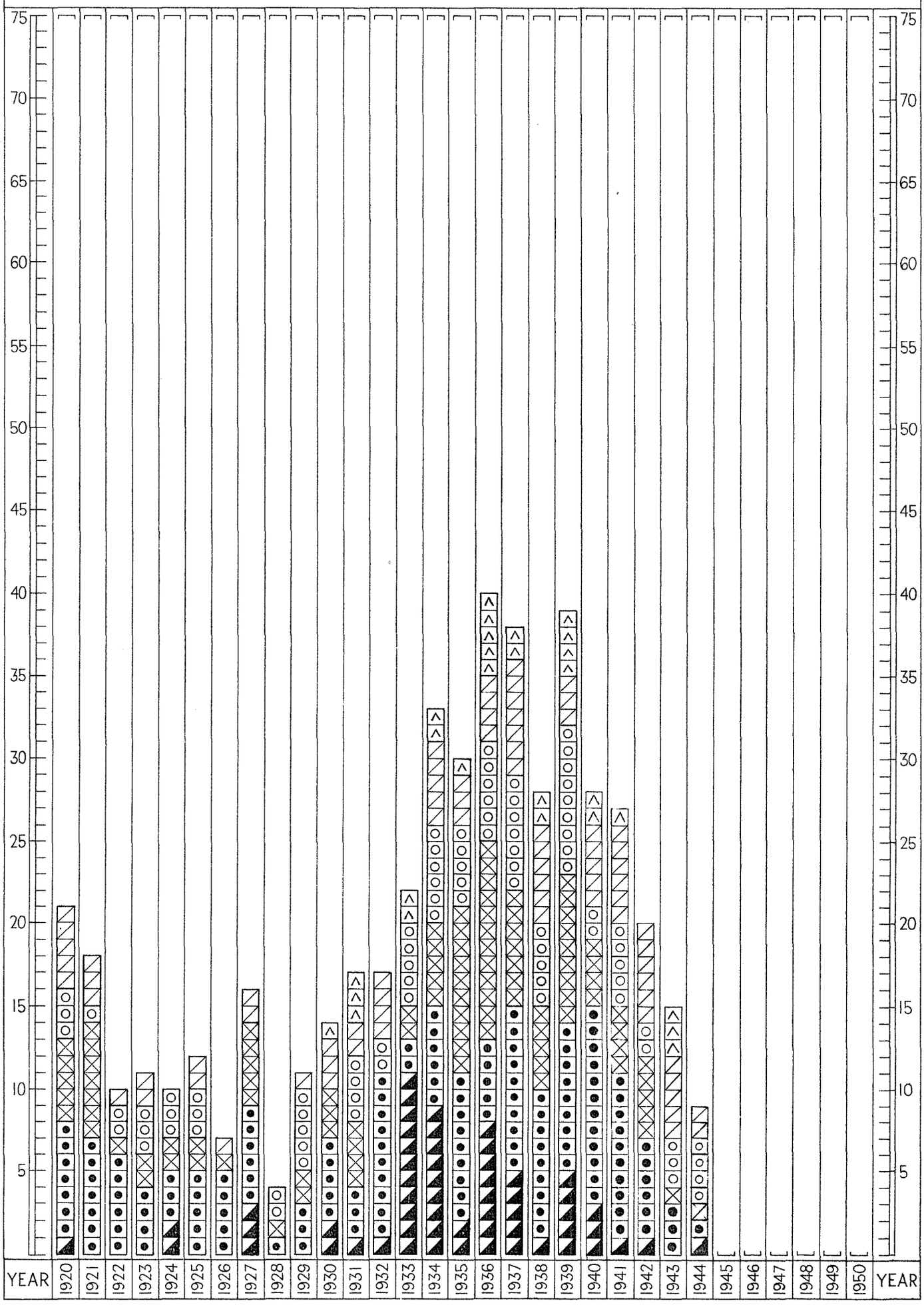
B.—According to Causes of Accidents.

Cause.	1943.		1944.		Comparison with 1943.	
	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.
1. Explosives	...	14*	1	5	+ 1	— 9
2. Falls of Ground	3	72†	1§	55	— 2	— 17
3. In Shafts	1	12	1	11	...	— 1
4. Miscellaneous Underground ...	3	628	4	548	+ 1	— 80
5. Surface	5	203‡	2	195‖	— 3	— 8
6. Fumes	3	5	...	3	— 3	— 2
Totals	15	934	9	817	— 6	— 117

* Includes 1 serious in Quarries. † Includes 1 serious in Quarries. ‡ Includes 6 serious in Quarries.
§ Includes 1 fatal in Quarries. ‖ Includes 2 serious in Quarries.

DIAGRAM OF ACCIDENTS

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



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

PART VI.—STATE AID TO MINING.

(A) *State Batteries.*

1. The number of State Batteries existing at the end of the year was 23 with three leased. From inception to the end of 1944, gold and tin to the value of £12,374,019.74, including gold premium estimated at £3,065,772.337, have been received from State plants; 2,630,692.94 tons of auriferous ore have been treated and have produced £9,213,792.244 plus estimated premium of £3,065,772.337 and 81,810.5 tons of tin ore produced tin to the value of £93,882.96 and residues to the value of £572.2.

2. During the year, 18,261.75 tons of ore were crushed for 14,289.5 ounces of bullion estimated to contain 12,103.1 fine ounces of gold equal to 13 dwts. 6.1 grains per ton. The average value of tailings produced was 5 dwts. 4 grains, making the average head value of 18 dwts. 10.1 grains.

The estimated value of gold produced was 12,103.1 ounces by amalgamation and 3,482.58 ounces from tailings treatment, a total of 15,585.68 ounces, valued at £A152,670.471.

3. The working expenditure for all plants for the year was £37,876 10s. and the revenue £22,025 17s. 4d., which shows a loss of £15,850 12s. 8d. on the year's operations.

4. The capital expenditure since inception of the scheme has been £542,203 19s. 11d.; £406,069 14s. 1d. from the General Loan Fund, £93,726 4s. 5d. from Consolidated Revenue, £28,621 13s. 5d. from Assistance to Gold Mining Industry and £13,786 8s. from Commonwealth Assistance to Metalliferous Mining.

5. Head Office expenditure, including insurance under the Workers' Compensation Act, and Pay Roll Tax was £4,276 10s. 3d. as against £5,123 6s. 8d. for 1943.

The working expenditure from inception to the end of the year exceeds revenue by £98,508 9s. 7d.

(B) *Geological Survey.*

The work of the Geological Survey during the year 1944 is represented by the following reports which are published in the Annual Progress Report of the Geological Survey for that year:—

A Kyanite Deposit near Yanmah, Nelson District, S.W. Division.

Notes on the Structural Feature of the Blue Spec Gold-Antimony Mine, Middle Creek, Nullagine District, Pilbara Goldfield.

A Summary Report on the Principal Tantalum-Bearing Deposits of the Pilbara Goldfield, North-West Division.

Report on Quartz Crystal Deposits on P.A. 2096, Pilbara Goldfield, Kangan Station, North-West Division, Western Australia.

Report on Beryl and Tantalite occurrences on P.A. 2096 and 818H, Pilbara Goldfield, Kangan Station, North-West Division, W.A.

Report on The Donnelly River Graphite Deposits, Western Australia.

Report on the Munglinup Graphite Deposits, P.A. 802H, Munglinup River, Eucla Division, Western Australia.

Report on the Young River Vermiculite Deposits, Young River, Eucla Division, Western Australia.

Boring at Site of Proposed Repatriation Building (Reserve 8828).

Report on Yellowdine Gold Mine, Mt. Palmer, Yilgarn Goldfield.

Report on Red Ochre Deposits, M.L. 370H, Ophthalmia Range, Windell District, North-West Division.

Addendum to Report on Red Ochre Deposits, M.L. 370H, Ophthalmia Range, Windell District, North-West Division.

Report on Yinnietharra Mica Project, Lyons District, North-West Division.

Report on M.C. 291H for Beryl, Yinnietharra, North-West Division.

Beryl Deposit, Bidgemia Station, Lyons District, North-West Division.

Yandanooka Mica Deposit.

Report on Soapstone Deposit, approx. 7 miles E.S.E. of Moora, Melbourne District, South-West Division.

Report on Testing Foundations on Proposed Site for New Government Buildings, Reserve A↑1149, Government House Grounds, Perth.

Notes on an Inspection of Quartz Crystal Deposits, Goomalling, Morawa and Payne's Find.

Preliminary Report on Limestone Prospects—Commonwealth Land south of Fremantle.

Notes on Sampling Douro Road Limestone Quarry, South Fremantle.

During this period, the Geological Survey prepared a Bulletin on the Mica Deposits of this State, which was published as No. 2 of a series of Mineral Resources Bulletins, issued by the Central Office of the Mines Department.

Field officers of the Survey continue to provide much practical assistance to prospectors and miners in the course of their field work, and the Head Office of the Geological Survey continues to meet numerous requests for information concerning the mineral resources of the State.

(C) *Assistance Under Mining Development Act*, 1902.

The following statement shows the sums advanced during the year 1943 under this Act:—

	£	s.	d.
1. Advanced in aid of mining work and equipment of mines with machinery	7,135	1	11
2. Subsidies on stone crushed for the public, being amounts paid to owners of plants crushing at fixed rates	1,570	18	0
3. Providing means of transport, equipment and sustenance for prospectors	1,511	7	8
4. Other assistance granted from the vote during the year on various matters totalled	335	16	3
	£9,553	3	10

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

	£	s.	d.
1. Refund of Advances	191	6	1
2. Prospecting Refunds	462	17	10
3. Miscellaneous Refunds	Nil.		
	£654	3	11

PART VII.—INSPECTION OF MACHINERY.

The Chief Inspector of Machinery reports that the number of useful boilers registered at the end of the year totalled 5,064, against 4,963 for the preceding year, showing an increase after all adjustments of 101 boilers.

Of the total 5,064 useful boilers, 3,088 were out of use at the end of the year, 1,911 thorough and 215 working inspections were made and 1,905 certificates were issued.

Permanent condemnations totalled 13 and temporary condemnations 13. There was one conversion. Five boilers were transferred beyond the jurisdiction of the Act.

The total number of machinery groups registered was 18,213 against 17,527 for the previous year, showing an increase of 686.

Inspections made total 11,281 and 3,302 certificates were granted.

The total miles travelled for the year was 53,389 against 53,425 miles for the previous year, showing a decrease of 36 miles. The average miles travelled per inspection was 3.98 as against 3.86 miles per inspection for the previous year.

Two hundred and seventeen applications for engine-drivers' and boiler attendants' certificates were received and dealt with, and 192 certificates, all classes, were granted as follows:—

Winding Competency (including certificates issued under regulation 40 and section 60)	2
First Class Competency (including certificates issued under regulations 40 and 45, and sections 60 and 63)	5
Second Class Competency (including certificates issued under regulation 40 and section 60)	15
Third Class Competency (including certificates issued under regulations 40 and 45 and sections 60 and 63 of Act)	26
Locomotive Competency (including certificates issued under regulation 40 and section 60)	5
Traction Competency (including certificates issued under regulation 40 and section 60)	—
Internal Combustion Competency (including certificates issued under regulation 40 and section 60)	46
Crane and Hoist Competency (including certificates issued under regulation 40 and section 60)	6
Boiler Attendants' Competency (including certificates issued under regulation 40 and section 60)	70
Interim	—
Copies	13
Transfers	4
	192

The total revenue from all sources during the year was £7,894 18s. 2d. as against £8,243 16s. 11d. for the previous year, showing a decrease of £348 18s. 9d.

The total expenditure for the year was £8,293 19s. 10d. as against £8,043 12s. 3d. for the previous year, showing an increase of £250 7s. 7d.

PART VIII.—SCHOOL OF MINES.

(a) *Kalgoorlie.*—The individual enrolment for 1944, exclusive of Correspondence Course students reached a maximum of 383 compared with 305 in 1943, while Correspondence Course enrolments totalled 40, made up of 12 civilian and 28 service personnel.

During the year, five discharged service personnel were admitted for tuition under the Commonwealth Reconstruction Training Scheme, while 67 members of the R.A.A.F. took advantage of a special concession rate to attend the School.

Fourteen State School Students from the Senior Classes at the Kalgoorlie Central School were admitted free to a special elementary class in chemistry in an endeavour to promote in them an interest in science and to encourage them to continue technical training after leaving primary school.

In the Public Assay Branch of the School, 64 gold and metal and 75 mineral determinations were carried out for prospectors.

The Metallurgical Laboratory dealt with 16 new investigations into the treatment of ores and minerals and completed two others commenced in 1943. The items concerned were graphite, beach sand, gold and tin-tantalum minerals.

(b) *Wiluna,* (c) *Norseman.*—The individual enrolments at the beginning of the first term were 41 and 47 respectively. This showed a falling off in Wiluna as compared with 1943, but Norseman was unchanged.

PART IX.—MINER'S PHTHISIS ACT AND MINE WORKERS' RELIEF ACT.

In 1944, all Goldfields were visited with the exception of Ashburton, Gascoyne, Kimberley, Phillips River, Pilbara, West Kimberley and West Pilbara.

The number of examinations conducted were 4,468 compared with 4,298 for 1943.

STAFF.

Over 80 members of the staff still remain in the fighting services, and several in munitions factories.

During the year, Mr. R. C. Wilson, B.Sc. B.E. M. Inst. M.M., State Mining Engineer, commenced accrued leave prior to retirement. Mr. Wilson was appointed State Mining Engineer in 1934 and had rendered excellent service to the Department and the State. He has been succeeded by Mr. J. S. Foxall, B.E. M.I.E. (Aust). Mr. E. E. Brisbane, B.C.E. (Melb.) A.M.I.E. (Aust.) A.M. Inst. M.M., has been appointed Assistant State Mining Engineer, which post was previously occupied by Mr. Foxall.

Mr. W. Winzar, Senior Inspector of Mines, Kalgoorlie, an old and valued member of the Staff, died during the year and was succeeded by Mr. H. Verran.

Despite the difficult conditions prevailing, all members of the Staff loyally and efficiently carried on and can be assured that their efforts, particularly in regard to the production of strategic minerals, were of great value to the war effort.

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

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

Department of Mines,
Perth, 31st March, 1945.

Division II.

Report of the State Mining Engineer for the Year 1944.

The Under Secretary for Mines.

Sir,—I have the honour to submit, for the information of the Hon. the Minister for Mines, my report on this Branch of the Mines Department for the year 1944.

STAFF.

Mr. R. C. Wilson, State Mining Engineer since 1934, commenced his long service leave in July, prior to retirement. Mr. Wilson's services have been retained by the Commonwealth Government as Chairman of the Western Australian Coal Committee, which functions as the State branch of the Commonwealth Coal Commission.

Mr. J. S. Foxall was appointed State Mining Engineer to fill the vacant position and Mr. E. E. Brisbane was appointed Assistant State Mining Engineer. Both of these officers are carrying out the respective duties in an acting capacity until the completion of Mr. Wilson's leave.

It is with great regret that the death of Senior Inspector Winzar is recorded. He had almost reached the age of retirement after many years of useful service.

Inspector Brisbane and Inspector Olive were released from military service and returned to the Kalgoorlie office.

Inspector Verran has been appointed Senior Inspector of Mines in succession to the late Senior Inspector Winzar.

At an election for Workmen's Inspectors of Mines, all existing Workmen's Inspectors were re-elected, but Mr. W. E. Boyce, of Cue, subsequently resigned on account of ill-health.

ACCIDENTS.

Fatal and serious accidents on mines and quarries reported to the Department for the year are shown below. Corresponding figures for 1943 are shown in brackets.

There were 9 (15) fatal and 817 (934) serious accidents, including 2 (2) fatal and 244 (262) serious on coal mines and quarries.

Of the fatal accidents 7 (12) occurred in gold mines, 1 (1) in coal mines and 1 (0) in quarries.

The total number of serious accidents reported from gold mines was 573 (635). The average number of men employed in such mines was 4,584 (5,079). The average accident rate per 1,000 men employed on gold mines was thus 1·53 (2·36) for fatal and 125·00 (125·02) for serious accidents.

On the coal mines the number of serious accidents was 242 (291), while the average number of men employed was 880 (839). The average accident rate was therefore 1·14 (1·19) fatal and 275·00 (346·84) serious accidents per 1,000 men employed.

TABLE A.

SERIOUS ACCIDENTS—1944.

Goldfield	Major Injuries—Exclusive of Fatal.																					
	Fractures.											Amputations.						Loss of Eye.	Serious Internal.	Hernia.	Dislocations.	Other Major.	Total Major.
	Head.	Shoulder.	Arm.	Hand.	Spine.	Rib.	Pelvis.	Thigh.	Leg.	Ankle.	Foot.	Arm.	Hand.	Finger.	Leg.	Foot.	Toe.						
East Coolgardie	....	....	2	3	....	4	1	....	....	....	2	....	....	3	....	....	....	....	....	1	1	....	17
Yilgarn	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Coolgardie	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1
Dundas	....	....	....	1	....	1	....	....	1	....	....	....	....	5	....	....	....	....	1	1	....	....	10
Mt. Margaret	....	....	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1	....	3
North Coolgardie	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1	....	2
East Murchison	....	1	....	1	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	1	....	1	6
Murchison	....	....	....	2	....	2	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	5
Pilbara	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	3
South-West Mining District	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Collie Coalfield	....	1	2	1	....	6	1	....	2	....	2	....	....	2	....	....	....	....	....	6	3	10	36
Total	....	3	4	9	....	15	2	....	5	....	4	....	....	12	....	....	....	....	1	10	6	13	84

Goldfield.	Minor Injuries.												
	Fractures.		Head.	Eyes.	Shoulder.	Arm.	Hand.	Back.	Rib.	Leg.	Foot.	Other Minor.	Total Minor.
	Finger.	Toe.											
East Coolgardie	6	3	6	14	9	17	105	48	9	47	39	18	321
Yilgarn	1	....	1	....	....	1	4	....	....	3	....	1	11
Coolgardie	1	....	2	....	....	....	2	....	....	2	....	2	9
Dundas	....	2	6	5	2	8	8	12	3	15	6	1	68
Mt. Margaret	2	4	1	....	....	1	....	4	....	2	2	1	17
North Coolgardie	....	....	....	....	....	....	....	2	....	1	2	3	8
East Murchison	4	1	....	7	....	5	19	10	1	8	7	10	72
Murchison	1	....	....	1	1	....	5	1	....	2	....	....	11
Pilbara	....	....	....	1	....	....	3	....	1	....	3	....	8
South-West Mining District	....	....	....	....	....	....	1	1	....	....	....	....	2
Collie Coalfield	6	4	9	11	13	10	52	17	3	17	24	40	206
Total	21	14	25	39	25	42	199	95	17	97	83	76	733

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

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

TABLE B.

	1940.	1941.	1942.	1943.	1944.
Fatal accidents to men engaged in mining (exclusive of quarries) ...	28	27	20	15	8
Total number of men engaged in mining (average)	15,500	14,021	9,100	6,227	5,930
Accident death rate per 1,000 men engaged in mining	1·81	1·93	2·23	2·41	1·35
Fatal accidents at quarries	...	...	...	...	1

FATAL ACCIDENTS.

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

Name and Occupation.	Date.	Mine.	Details and Remarks.
		Surface. (2).	
Spence, George Hislop (Bench Hand)	16–2–44	Lake View and Star Mine	Was working at a saw bench and was struck in the stomach by a piece of timber. Two days later he died in hospital of internal injuries. There was no witness to the accident but it is probable that the piece of timber contacted the saw while it was not down on the bench and that it was "thrown" by the saw.
Matthees, Herman (Reagent Mixer)	22–6–44	Wiluna Gold Mines, Ltd.	He was seen to fall through an opening in a platform above a surge tank. One of the planks covering the opening fell into the tank at the same time. The tank was being emptied to allow a stay to be repaired and Matthees fell on to the revolving rakes. It is thought that he removed the boards covering the opening to assist in the repairs.
		Miscellaneous Underground (4).	
Del Grande, Giovanni Vito (Miner)	22–7–44	Bulletin Gold Mine, Wiluna Gold Mines, Limited	Was struck by a fall of ground while standing on a bench in an underhand stope. He had taken off his safety belt to fetch a pipe bar and was knocked over the bench into the ore chute. The chute had to be emptied before the body was recovered.
Thompson, James Schofield (Deputy)	12–7–44	Proprietary Coal Mine	Owing to a broken coupling, several skips ran off the line. During operations to bring them back a prop was knocked out and struck Thompson on the head. He sustained a compound fracture of the skull and died in hospital a month later.
Bilas, Mijo (Braceman) ...	25–10–44	Great Boulder Pty. Gold Mines Ltd.	Went on to a platform serving as a control chute when the bearer supporting it broke and he fell down the pass. There was no witness to the accident. The jury recommended that a stronger bearer be used. In addition to this a safety belt has been provided.
White, Thomas Walter James (Timberman)	21–11–44	Boulder Perseverance Gold Mine	White and another miner were engaged in hanging ladders in a winze. A ladder was lowered to him and he disconnected it from the hoisting rope. His mate heard the noise of the ladder falling some time later. It was later found that White had fallen with it a distance of about 90 feet. He was dead when found.
		Falls of Earth (1).	
Hadwiger, William Robert (Power Shovel Driver)	16–11–44	Red Hill Clay Pit ...	This man was the driver of a ⅜ cubic yard diesel shovel. While he was using the shovel to load a truck a large piece of clay weighing about 50 tons fell out of the face. It pivoted about its lower extremity and fell against the cabin of the machine, killing the driver instantly. No danger was anticipated. The unusual type of fall was due to the irregular shape of the quarry face.
		Explosives (1).	
Tait, William (Machine Miner)	9–10–44	Lake View and Star Mine, Chaffers Shaft	Was killed by an explosion. He was working alone at the time and the cause of the explosion is not known.
		In Shafts (1).	
Sweet-Baseden, Robert (Skipman)	8–7–44	Iron King Pyrites Mine, Norseman Gold Mines N.L.	Baseden was riding alone in a skip ascending the Red, White and Blue Shaft, which is an underlay shaft at about 40° with the horizontal. His body was found in the skip when it reached the surface and investigation showed that his head had struck a chute in the shaft. He was killed instantly.

Table C shows the total number of fatal and serious accidents that were reported during the year classified according to the gold or mineral field on which they occurred and also according to their causes.

Table 11, showing fatal and serious accidents and the districts in which they occurred is forwarded herewith for inclusion in your Annual Report, together with a diagram showing fatal accidents year by year according to their causes.

TABLE C.

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

	Explosives.		Falls of Ground.		In Shafts.		Fumes.		Miscellaneous Underground.		Surface.		Total.	
	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.
1. East Coolgardie ...	1	...	...	10	...	6	...	1	2	242	1	79	4	338
2. Mt. Margaret ...	...	...	...	2	...	4	...	1	...	10	...	3	...	20
3. Coolgardie	...	2	...	...	...	...	...	...	...	3	...	5	...	10
4. North Coolgardie ...	...	...	...	...	...	...	...	...	...	5	...	5	...	10
5. North-East Coolgardie	...	...	...	...	...	...	...	...	...	...	...	...	...	...
6. Broad Arrow ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
7. Dundas	...	1	...	8	1	...	...	...	...	50	...	19	1	78
8. Yilgarn	...	...	...	...	...	...	...	...	...	8	...	4	...	12
9. Murchison	...	...	...	...	...	...	...	...	...	6	...	10	...	16
10. East Murchison ...	...	...	...	6	...	1	...	...	1	46	1	25	2	78
11. Peak Hill	...	...	...	...	...	...	...	...	...	...	...	...	...	...
12. Yalgoo	...	...	...	...	...	...	...	...	...	...	...	...	...	...
13. Northampton ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
14. Greenbushes ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
15. South-West ...	...	...	1	...	...	...	...	...	...	...	...	2	1	2
16. Phillips River ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
17. Collie	...	2	...	29	...	...	...	...	1	172	...	39	1	242
18. Pilbara	...	...	...	...	...	...	...	1	...	6	...	4	...	11
19. West Pilbara ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
20. Ashburton	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Totals for 1944 ...	1	5	1	55	1	11	...	3	4	548	2	195	9	817
Totals for 1943 ...	...	14	3	72	1	12	3	5	3	628	5	203	15	934

WINDING MACHINERY ACCIDENTS.

There were seven accidents involving winding machinery. Five of these were overwinds and two were skip derailments. Brief details are as follows:—

Skip Derailments.

(1) The cause of the accident is not known. It is surmised that a piece of wood fell on to the rail. Only minor damage resulted.

(2) A skip was derailed by a large stone on the track. No serious damage was caused.

Overwinds.

(1) Driver had valve motion lever in the wrong position. No damage was caused.

(2) Throttle valve jammed and cage was lowered out of control. The grippers acted after the cage had fallen 30 feet to the 1,700 plat. Two men were working from the bonnet. One escaped serious injury. The other had his hand crushed by the shackle.

(3) The engine was started with the reversing lever in the wrong position.

(4) The driver lowered a cage for 2,000 level after gearing for 1,600 level. The detaching gear operated.

(5) The driver states that electric power did not cut off. When the electrical gear was tested it was found to be in order.

PROSECUTIONS.

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

The manager of a mine was prosecuted for breach of regulation 2 in that he did not arrange for some person to visit a man working alone.

The manager of a mine and the miner concerned were prosecuted for offences related to a fuming accident. The manager was prosecuted under General Rule 49a (Regulation 4) for allowing a tap, other than the master tap at the brace, to be used on the air line in a winze. The miner was prosecuted under section 52 for working in those conditions.

The manager of a mine was prosecuted for not supplying ventilating air to a development face as required by General Rule 49 (Regulation 4).

EXEMPTIONS.

In accordance with the provisions of section 34, subsection 4 of the Mines Regulation Act, 1906-38, 20 certificates were issued, exempting the holders from the operation of subsection 1 (b) of the same section, as compared with 14 during 1943.

SUNDAY LABOUR.

Eighty-four permits to work on Sunday were issued under section 54 (4) of the Coal Mines Regulation Act, 1902-1926, to various mines in the Collie Coalfield.

ADMINISTRATION.

(Amendments of Acts.)

The Mining Act, 1904-1937.

Definition under section 157. Gazetted 10/3/44.
Regulation 55 amended. Gazetted 10/3/44.
Regulation 218 amended. Gazetted 11/8/44.

The Mines Regulation Act, 1906-38.

Schedule.

(1) New regulation 2B.
(2) New General Rule 49A.
(3) New General Rule 53. Gazetted 10/3/44.

Regulation 17. Districts specified. Gazetted 13/10/44.
Regulation 17 amended. Gazetted 3/11/44.
Regulation 7 amended. Gazetted 17/11/44.

The Coal Mines Regulation Act, 1902-1926.

Regulation 60 amended. Gazetted 3/11/44.

VENTILATION.

Inspector Lloyd's report on his work as Ventilation Officer is quoted in full hereunder:—

During the year the general ventilation of the mines was found to be satisfactory where mechanical ventilation is in use, and in those mines relying on natural ventilation, apart from rectifying faults in the harnessing of the air currents by installation of doors, brattices and stoppings, the conditions were also fairly satisfactory.

Owing to the continuance of the war, great difficulty is being experienced in obtaining venturi cloths, and where recourse has been made to using galvanised iron piping or disused cyanide drums, the problem of obtaining the services of tinsmiths has been most acute, owing to manpower regulations.

Temperatures in working places with one or two exceptions, were found to be good, and in those places where high readings were recorded, remedial action was taken immediately.

Dust sampling surveys were again carried out for portion of the year only, due to the fact I was called upon to carry out general inspection duties.

Accidents from fumes, as reported to this office for the year were as follows:—

	Serious.	Minor.
East Coolgardie Goldfield ..	1	10
Dundas Goldfield	Nil	2
	1	12

The serious accident recorded was the result of an injury to the finger sustained by the man who was fumed. The finger became septic and he was absent from work for 14 days.

Fuming accidents coming within the category of minor were in the majority, slight, and the employee did not seek medical advice.

Where the employee was admitted to hospital, invariably he returned to work after two days. In the meantime statements were obtained and the working place visited.

In the early part of the year, an investigation was carried out in the wheat bins and silo at Geraldton in connection with occupational dust in wheat workings. The investigation extended over a period of six days, which included dust sampling of wheat dust and diatomaceous earth, the latter having been scattered over the surface of the wheat for the purpose of destroying the wheat weevil.

Ventilation problems in these places and on ship were also investigated, recommendations made, and drawings prepared to accompany the report.

In response to complaints of dust in the Metallurgical Laboratory, School of Mines, Kalgoorlie, a dust survey was carried out and as a result, recommendations were made for the crushing and sampling portions of the building to be housed separately, by the erection of walls and the installation of a dust exhausting unit outside the building. Drawings and estimates were also prepared.

DUST SAMPLING.

Summary of Samples taken during 1944.

Month.	Level.		Development.		Stoping.		Number of Places showing count of 1,000 p.p.c.c.		
	No.	Average Count.	No.	Average Count.	No.	Average Count.	Level.	Development.	Stope.
January	...	...	...	...	...	...	...	...	...
February	...	...	...	...	...	...	...	...	...
March	...	...	...	...	...	...	...	...	...
April	...	...	...	...	...	...	...	...	...
May	9	117	2	190	3	346	...	3	...
June	...	...	...	...	...	...	...	...	...
July	2	467	4	254	...	...	1	...	...
August	2	91	11	117	14	209	2	...	1
September	5	180	10	174	9	241	...	1	...
October	...	...	...	...	...	...	...	...	...
November	...	...	...	...	...	...	...	...	...
December	...	...	...	...	...	...	...	...	...
	17	162	28	157	26	112	Total 8		

GOLD MINING.

The industry has declined again this year, but the rapid slump of 1942 and 1943 has been arrested. The ore treated for the year was 1,777,128 tons and the gold won was 472,588 ounces. The average number of men employed was 4,614. This represents about 90 per cent. of the 1943 production.

The average grade was 5·32 dwt. per ton, a little above the grade of 5·185 dwt. per ton for the previous year.

The tonnage treated and gold won per man were 387·7 tons and 103·2 ounces, which are a little less than the corresponding figures, 403·8 tons and 104·7 ounces for 1943.

The number of mines producing 5,000 ounces and over has fallen from 21 in 1943 to 17 for this year.

State batteries treated 18,261 tons of ore and produced 15,596 ounces of gold. This indicates a decline similar to that of mining generally, the figures for 1943 being 19,074 tons of ore for 18,591 ounces.

Table G shows the output and yield of the principal mines of the State. Nearly all mines have maintained their tonnage at or near the 1943 level. Eight mines have produced more gold than in the previous year.

Two mines, formerly consistent producers, Yellowdine Gold Development, Limited, and Ora Banda Amalgamated, were closed down during the year.

Among smaller mines, the following are worthy of note:—

	Tons.	Ounces.	Dwt. per ton.
Boomerang	126	986	156.5
Carnation	398	177	8.9
Edwards Reward ..	1,280	621	9.7
Fenian	339	226	13.3
Haoma	862	528	12.25
Lister	920	537	11.7
Mountain View ..	1,481	2,723	36.8
Phar Lap	697	341	9.8
Premier	410	212	10.3
Radio	695	822	23.7

Table D shows the production statistics for each year since 1929.

TABLE D.

Gold Production Statistics.

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

Note.—In this table the figures given are those reported to the Department by the various producers.

OPERATIONS OF THE PRINCIPAL MINES.

EAST COOLGARDIE GOLDFIELD.

The total ore treated on this field during 1943 was 957,174 tons and the gold won was 279,660 ounces, giving an average return of 5·8 dwt. per ton. The average number of men employed was 2,067.

There is a small reduction on last year's figures.

About half the ore treated and gold produced in the State comes from the East Coolgardie Goldfield.

The principal mines are:—

Lake View and Star, Limited, which treated 278,171 tons for a return of 90,990 ounces, the average yield being 6·54 dwt. per ton. Both the tonnage treated and the gold returned are a little greater than for 1943, while the grade is slightly lower.

The supply to the mill has been maintained by concentrating underground operations to areas that yield the maximum tonnage per shift worked. Productive work below 2,400 level has been stopped and no sand filled stopes were operated. As a result of this policy more than half the ore came from the eastern group.

Development work was greater than for the preceding year. On the western leases the work was directed to areas that would yield the maximum tonnage for the work done and produced a substantial increase in ore reserves. Exploratory work on the eastern leases has discovered two new shoots of ore in the Lake View Mine.

Great Boulder Pty. Gold Mines, Limited.—The grade of ore increased from 4·47 dwt. per ton in 1943 to 5·22 dwt. per ton in 1944. On this account 248,313 tons treated, although slightly less than the 1943 tonnage, produced a little more gold, the figures for the two years being 63,302 and 64,878 ounces. Developments have been satisfactory. A new ore body has been located at the 700 level Main Shaft. The use of classified tailings for stope filling has been extended and eight stopes are now worked by this method.

South Kalgurli Consolidated, Limited, treated 56,885 tons for 15,603 ounces, an average return of 5·51 dwt. per ton. There is a slight decline from last year's figures of 63,065 tons for 19,135 ounces, averaging 6·07 dwt. per ton. Developments have exposed a nice shoot of ore on the 1,800 and 1,920 levels of the No. 2 Cross Lode and a small shoot of good grade in the Lake View ore channel.

Boulder Perseverance, Limited.—The amount of development work done increased in comparison with the amount done last year. The amount of ore broken and treated decreased. The grade also declined slightly. Production figures for 1944 are 75,987 tons treated for a return of 20,398 ounces averaging 5·37 dwt. per ton.

Kalgoorlie Enterprise, Limited.—Production and development were not up to last year's performance. The ore mined was 37,349 tons, which yielded 9,490 ounces, an average of 5·08 dwt. per ton. Classified tailings were used as filling in some stopes.

Gold Mines of Kalgoorlie, Limited.—In March the tonnage treated was increased from 6,000 tons per month to 8,000 tons per month, the extra 2,000 tons being obtained from the Australia East open cut. For the year the production was 98,544 tons, which yielded 22,969 ounces, an average of 4·66 dwt. per ton. A new ore body has been opened up on No. 9 level in the True Blue Lease. Development generally has yielded good results.

North Kalgurli (1912) *Limited.*—A vigorous development programme has given excellent returns. The majority of the work has been in payable ore and some high grade ore has been located.

This year has shown an improvement on the results of last year. The tonnage treated was 91,444 tons for a return of 27,443 ounces, averaging 6·00 dwt. per ton, as compared with 78,181 tons for 25,721 ounces averaging 6·58 dwt. per ton in 1943.

Paringa Mining and Exploration Company, Limited, has also increased its development as compared with last year. A big tonnage of 4 to 4·5 dwt. ore has been proved. Ore produced for the year was 67,295 tons and the gold obtained was 15,446 ounces, which is an average of 4·59 dwt. per ton.

Among the smaller mines the *Haoma* and the *Daisy* both at Mount Monger, have been the most successful.

COOLGARDIE GOLDFIELD.

The total production for this goldfield was 14,720 ounces, of which the Phoenix supplied 8,061 ounces and Tindals 2,267. The smaller mines have done well to produce 4,392 ounces.

Consolidated Gold Mines of Coolgardie, Limited, had another difficult year. The ore treated was 20,745 tons and the gold returned was 2,267 ounces, the average return being 2·18 dwt. per ton. The tonnage is only about two-thirds of last year's output and the grade is lower. A great deal of mechanical trouble has occurred in the plant.

Phoenix Gold Mines, Limited, improved on last year's figures by treating 28,507 tons for an average return of 5·6 dwt. per ton to produce 8,061 ounces. Development is proceeding on No. 13 level, but has not reached the ore shoot.

The Surprise Mine on the Hampton Plains area has been hampered by lack of labour. It is now being drilled by Australian Mines Management and Secretariate, Limited, who have an option on the property.

TABLE E.

Classification of Gold Output for 1944, *by Goldfields and Districts.*

Goldfield or District.	Unclassified, Sundry Claims, Alluvial, etc. (fine ozs.)	Under 100 ozs.		100–500 ozs.		500–1,000 ozs.		1,000–2,000 ozs.		2,000–3,000 ozs.		3,000–4,000 ozs.		4,000–5,000 ozs.		5,000–10,000 ozs.		10,000–20,000 ozs.		20,000–30,000 ozs.		30,000–40,000 ozs.		40,000–50,000 ozs.		50,000–100,000 ozs.	
		No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).
Kimberley Goldfield	199	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Ashburton Goldfield	18	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Pilbara Goldfield—																											
Marble Bar	84	13	387	2	460	....	....	....	....	....	....	....	....	....	....	....	....	1	13,125	....	....	....	....	....	....	....	....
Nullagine	198	7	239	1	208	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Peak Hill Goldfield	70	3	102	2	394	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
East Murchison Goldfield—																											
Lawlers	107	3	25	1	218	....	....	....	....	....	....	....	....	1	4,539	....	....	....	....	....	....	....	....	....	....	....	....
Wiluna	393	3	131	2	414	....	....	....	....	....	....	....	....	....	....	....	....	1	12,019	....	....	1	39,028	....	....	....	....
Black Range	14	2	163	3	1,178	1	512	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Murchison Goldfield—																											
Cue	255	4	65	4	1,403	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Meekatharra	184	6	170	4	1,057	1	769	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Day Dawn	60	3	50	....	....	....	....	....	....	1	2,723	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Mt. Magnet	421	9	221	5	1,319	....	....	....	....	....	....	....	....	....	....	1	9,571	....	....	....	....	....	....	....	....	....	....
Yalgoo Goldfield	10	12	459	3	457	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Mt. Margaret Goldfield—																											
Mt. Morgans	295	9	200	3	481	2	1,258	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Mt. Malcolm	59	1	72	6	828	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	22,657	....	....	....	....	....	....
Mt. Margaret	94	7	199	2	414	1	986	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
North Coolgardie Goldfield—																											
Menzies	211	6	198	2	263	....	....	....	....	....	....	....	....	1	4,315	....	....	....	....	....	....	....	....	....	....	....	....
Ularring	124	4	86	1	154	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Niagara	95	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Yerilla	2	1	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Broad Arrow Goldfield	167	7	308	3	783	....	....	1	1,103	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
North-East Coolgardie Goldfield—																											
Kanowna	88	2	43	1	318	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Kurnalpi	16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
East Coolgardie Goldfield—																											
East Coolgardie	830	17	504	6	1,291	1	533	....	....	....	....	....	....	....	....	2	18,674	2	31,049	3	70,809	....	....	....	....	2	155,868
Bulong	52	1	49	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Coolgardie Goldfield—																											
Coolgardie	513	11	220	5	983	3	2,114	....	....	1	2,267	....	....	....	....	1	8,061	....	....	....	....	....	....	....	....	....	....
Kunanalling	58	....	....	3	504	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Yilgarn Goldfield	54	15	477	8	1,241	2	1,442	2	3,332	....	....	....	....	1	4,271	....	....	....	....	....	....	....	....	....	....	....	....
Dundas Goldfield	....	9	383	5	1,230	....	....	....	....	....	....	....	....	....	....	1	6,837	....	....	1	29,675	....	....	....	....	....	....
Phillips River Goldfield	16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
State Generally	9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Totals	4,696	155	4,753	72	15,598	11	7,614	3	4,435	2	4,990	....	....	3	13,125	5	43,143	4	56,193	5	123,141	1	39,028	....	....	2	155,868

The new mine the *Barbara*, worked by Cash and Scahill about half a mile east of the Surprise, has developed very well. A return of 403 ounces was obtained by amalgamation from crushings totalling 302 tons.

Three men employed on the *Lloyd George Mine* at Gibraltar have produced 140 tons of ore, which yielded 111 ounces. Recent development work has been disappointing.

Sands retreatment has been continued at the *Two Boys* at Higginsville.

The *Lister Mine* on the Paris group produced 920 tons for 537 ounces by amalgamation. Ore is won from a siliceous ore body 12 feet to 27 feet wide.

The *Premier* at Kunanalling worked throughout the year. A total of 410 tons of ore was crushed for a return of 212 ounces over the plates.

DUNDAS GOLDFIELD.

The principal mines in this goldfield are the Norseman Gold Mines and the Central Norseman. They contributed 36,506 ounces of the total of 38,125 ounces produced in the goldfield.

Norseman Gold Mines, Limited, operated at a reduced output to produce 38,980 tons, which yielded 6,837 ounces, an average return of 3·52 dwt. per ton. In 1943 the production was 58,215 tons for 11,734 ounces, which is equivalent to 4·03 dwt. per ton.

The mining of pyrites at the *Iron King* mine for the manufacture of superphosphate has been undertaken by the Norseman Gold Mines, Limited. Owing to the wartime necessity for the production of sulphur, pyrites mining has taken priority over gold mining, and this accounts to some extent for the reduced gold production.

Central Norseman Gold Corporation, N.L., has operated the *Phoenix* mine, producing 77,046 tons for 29,669 ounces, which is equivalent to 8·30 dwt. per ton. This ore contains a good deal of silver and 18,666 ounces of silver were also recovered. Considerable development has been carried out and the *Princess Royal* mine has been unwatered.

Among the smaller mines the *Bronzewing* and *Onkaparinga* in the Cumberland group and the *Second Try* in the Lady Mary group have been the most successful.

YILGARN GOLDFIELD.

Since the closure of the *Yellowdine Gold Development, Limited*, at Mount Palmer early this year, the only major producer in the field is the Edna May Amalgamated. The total gold produced was 10,818 ounces, of which the two principal mines contributed 6,268 ounces. The smaller mines, among which there are some consistent producers, were thus responsible for 4,550 ounces.

Edna May Amalgamated in the Westonia district produced 12,409 tons for a return of 4,271 ounces at an average of 6·88 dwt. per ton. This is a considerable improvement on last year's output, of 8,681 tons, which yielded 3,332 ounces, the average grade being 7.68 dwt. per ton.

Accumulated tailings have been treated for the recovery of tungsten concentrates by flotation. A gold concentrate is also produced.

The *Radio* at Bullfinch obtained 822 ounces of gold from 695 tons of ore. This mine has been a consistent producer of high grade ore and appears to have good prospects for some time to come.

Edward's Reward at Marvel Loch is the solidest of several other producers in this goldfield.

Gold amounting to 1,335 ounces was recovered from accumulated concentrates on the *Evanston* Mine.

NORTH COOLGARDIE GOLDFIELD.

The only mine to produce any considerable quantity of gold was the *First Hit* in the Menzies District, which did a little better than last year to produce 5,850 tons of ore, which yielded 4,315 ounces at an average grade of 14·75 dwt. per ton.

Smaller shows produced a total of 1,136 ounces, bringing the total for this goldfield up to 5,451 ounces.

MOUNT MARGARET GOLDFIELD.

This field produced 27,543 ounces for the year. The principal mine, the *Sons of Gwalia, Limited*, was responsible for 22,657 ounces, which was recovered from 72,653 tons of ore averaging 6·24 dwt. per ton.

Development work has been pushed ahead, but stope preparation has not kept pace with ore extraction. The principal difficulty has been the lack of skilled timbermen.

The *Puzzle* is the best of the smaller mines. It produced 370 ounces of gold from 212 tons of ore, the average grade being 35 dwt. per ton.

The Mount Margaret District recorded a production of 1,693 ounces, which is 619 ounces above 1943 production, principally due to 986 ounces from 126 tons at the *Boomerang*.

EAST MURCHISON GOLDFIELD.

With a production of 58,743 ounces, the field is second to the East Coolgardie Goldfield.

The *Wiluna Gold Mines, Limited*, treated 392,246 tons for a return of 39,028 ounces. In 1943 the corresponding figures were 479,069 tons for 52,377 ounces. The grade, which was 2·19 dwt. per ton in 1943, has fallen to 1·99 dwt. per ton. The future of this mine as a gold producer does not appear to be bright, but as it also produces arsenic and antimony, it may continue for some time as a source of these products.

Moonlight output fell to about 75 per cent. of that for 1943, the production being 75,375 tons for 12,019 ounces, giving an average grade of 3·19 dwt. per ton. No development or stope preparation was done and mining operations in the sulphide zone have now ceased.

The *Emu Gold Mines, Limited*, in the Lawlers district mined and treated 18,816 tons for a return of 4,539 ounces, which is an average of 4·82 dwt. per ton. Production was affected by shortage of labour and by mechanical difficulties in the plant.

MURCHISON GOLDFIELD.

Big Bell and *Triton* did not produce any ore. No underground work was done on Big Bell, but some development was done at Triton.

The principal producer was *Hill* 50 in the Mount Magnet District, which mined and treated 32,082 tons averaging 5.98 dwt. per ton, which returned 9,571 ounces. Last year's return of 10,054 ounces was obtained from 36,459 tons of an average grade of 5·52 dwt.

The mine was closed down to provide for a thorough overhaul of plant and normal development has been carried out. The return is therefore very satisfactory.

The total gold produced in this goldfield was 18,267 ounces. After deducting Hill 50 production, 8,213 ounces remain.

The Cue district produced 1,723 ounces, the principal contributors being *Hill View* with 417 ounces and *Winston* with 375 ounces.

Meekatharra district contributed 2,179 ounces, with *Phar Lap*, 341 ounces, as the most important of several small mines.

The rich *Mountain View* produced 2,723 ounces of the total of 2,833 ounces for the Day Dawn district.

PILBARA GOLDFIELD.

The *Comet Mine* in the Marble Bar district mined and treated 12,968 tons for 13,125 ounces at an average of 20·02 dwt. per ton. This compares favourably with the return for last year, which was 12,905 tons treated for 13,265 ounces, which is an average return of 20.56 dwt. per ton.

Development included 270 feet of shaft sinking, 226 feet of driving, 151 feet of crosscutting and 213 feet of rising and winzing.

TABLE F.

Classification of Gold Output, 1940–1944.

Range of Output.	1944.			1943.			1942.			1941.			1940.		
	No. of Producers.	Production.	Percentage of Total.	No. of Producers.	Production.	Percentage of Total.	No. of Producers.	Production.	Percentage of Total.	No. of Producers.	Production.	Percentage of Total.	No. of Producers.	Production.	Percentage of Total.
Fine ozs.		fine ozs.			fine ozs.			fine ozs.			fine ozs.			fine ozs.	
Over 100.000	...	...	...	...	...	...	1	127,149	15·0	1	170,550	15·4	1	165,894	14·4
50,000–100,000	2	155,870	33·0	3	202,875	38·1	2	146,795	17·4	4	279,155	25·2	3	237,863	20·7
40,000– 50,000	...	...	...	...	...	...	2	87,082	10·3	3	131,557	11·9	3	137,651	11·9
30,000– 40,000	1	39,030	8·3	...	...	...	4	134,164	15·8	1	38,145	3·5	3	101,711	8·8
20,000– 30,000	5	123,141	26·0	5	121,408	22·8	3	69,679	8·2	6	146,278	13·2	7	166,613	14·4
10,000– 20,000	4	56,193	12·0	8	115,886	21·8	7	101,217	12·0	8	107,847	9·8	5	72,370	6·2
5,000– 10,000	5	43,143	9·1	4	24,407	4·6	7	49,124	5·8	9	62,514	5·6	13	99,321	8·7
4,000– 5,000	3	13,125	2·8	2	8,329	1·6	4	19,032	2·3	3	12,796	1·2	2	8,850	0·8
3,000– 4,000	...	...	...	3	9,626	1·8	5	16,999	2·0	5	16,992	1·5	3	10,950	0·9
2,000– 3,000	2	4,990	1·0	1	2,276	0·4	4	9,692	1·2	5	11,018	1·0	4	9,137	0·8
1,000– 2,000	3	4,435	0·9	4	5,250	1·0	9	12,946	1·5	19	27,040	2·4	19	26,932	2·3
500– 1,000	11	7,614	1·6	14	9,635	1·8	27	18,253	2·2	35	24,906	2·3	42	30,418	2·6
100– 500	72	15,598	3·3	87	21,345	4·0	130	29,963	3·5	180	41,730	3·8	193	43,007	3·7
Under 100	155	4,753	1·0	193	5,127	1·0	330	10,569	1·2	396	13,193	1·2	433	15,550	1·4
Sundry Claims, P.A's., etc.	...	4,696	1·0	...	5,583	1·1	...	13,108	1·6	...	21,696	2·0	...	28,066	2·4
Total	263	472,588	100·0	324	531,747	100·0	535	845,772	100·0	675	1,105,477	100·0	731	1,154,843	100·0

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

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

Mine.	1944.			1943.			1942.			1941.			1940.		
	Tons treated.	Ounces Gold.	Dwt. per Ton.	Tons treated.	Ounces Gold.	Dwt. per Ton.	Tons treated.	Ounces Gold.	Dwt. per Ton.	Tons treated.	Ounces Gold.	Dwt. per Ton.	Tons treated.	Ounces Gold.	Dwt. per Ton.
1. Big Bell Mines, Limited	....	....	....	26,354	4,220	3·20	376,550	46,117	2·45	423,420	45,984	2·17	466,142	53,890	2·31
2. Blue Bird Gold Mines, N.L.	....	....	....	154	243	31·56	1,590	1,517	19·08	3,569	4,214	23·61	2,667	5,877	44·07
3. Boulder Perseverance, Limited	75,987	20,398	5·37	81,965	22,985	5·61	107,377	32,757	6·10	121,313	38,145	6·29	111,996	36,103	6·45
4. Burbidge Gold Mines, N.L.	....	....	....	4,350	411	1·89	29,920	2,634	1·76	45,115	5,107	2·26	....	....	....
5. Central Norseman Gold Corporation, N.L.	71,521	29,675	8·30	76,864	27,089	7·05	89,085	39,994	8·98	121,212	53,913	8·89	98,799	34,626	7·01
6. Comet Gold Mines, Limited	12,968	13,125	20·02	12,905	13,265	20·56	12,977	13,324	20·54	15,844	12,221	17·32	10,901	8,027	14·73
7. Consolidated Gold Areas	....	27	....	8,127	2,276	5·60	22,195	5,762	5·19	31,152	6,642	4·26	34,377	7,315	4·26
8. Consolidated Gold Mines of Coolgardie, Limited	20,745	2,267	2·18	32,983	5,127	3·11	43,169	8,252	3·82	72,507	13,175	3·63	60,086	12,857	3·72
9. Cox's Find (Western Mining Corporation, Limited)	....	....	....	....	....	....	5,636	3,236	11·48	21,890	12,397	11·33	19,116	9,200	9·63
10. Edna May Amalgamated Gold Mines, Ltd.	12,409	4,271	6·88	8,681	3,332	7·68	11,797	5,684	9·64	17,371	9,367	10·78	17,339	9,448	10·89
11. Emu Gold Mines, Limited	18,816	4,539	4·82	28,567	7,049	4·93	30,827	7,792	5·06	18,484	3,119	3·37	47,050	11,941	5·07
12. Evanston Gold Mine	....	1,335	....	3,120	796	5·10	9,959	4,448	8·95	15,284	6,219	8·01	11,352	8,391	14·78
13. First Hit Gold Mine, N.L.	5,850	4,315	14·75	4,260	3,099	14·55	5,624	3,849	13·69	7,760	5,397	13·91	8,065	5,570	13·81
14. Gladiator Gold Mine	....	....	....	....	....	....	18,733	4,876	5·21	29,220	6,034	4·13	27,788	7,795	5·61
15. Gold Mines of Kalgoorlie, Limited	98,544	22,969	4·66	87,928	21,610	4·92	132,651	30,278	4·56	162,274	43,053	5·36	140,483	44,278	6·30
16. Great Boulder Pty. Limited	248,313	64,878	5·22	283,201	63,302	4·47	328,277	81,057	4·94	392,779	93,216	4·75	417,298	97,141	4·66
17. Hannan's North (Broken Hill Pty. Ltd.)	....	....	....	695	441	12·69	38,939	14,298	7·34	40,444	16,211	8·26	40,018	16,828	8·41
18. Hill 50 Gold Mine, N.L.	32,082	9,571	5·98	36,459	10,054	5·52	38,068	11,533	5·90	30,863	10,688	6·93	26,065	9,802	7·52
19. Kalgoorlie Enterprise, Limited	37,349	9,490	5·08	54,027	16,110	5·96	62,241	19,911	6·40	70,806	22,495	6·35	66,424	20,953	6·31
20. Lake View and Star, Limited	278,171	90,990	6·54	260,720	87,196	6·69	402,071	127,149	6·32	618,191	170,550	5·52	591,671	165,894	5·61
21. Lancefield (W.A.) Gold Mine, N.L.	....	....	....	....	....	....	....	....	....	....	....	....	49,179	11,690	4·75
22. Moonlight Wiluna, Limited	75,375	12,019	3·19	100,577	17,790	3·54	113,791	24,798	4·36	105,881	26,141	4·94	106,467	26,735	5·07
23. Mt. Magnet Gold Mines, Limited	....	....	....	....	....	....	....	....	....	....	....	....	38,452	4,121	2·14
24. Norseman Gold Mines, N.L.	38,980	6,837	3·52	58,215	11,734	4·03	80,428	18,731	4·66	138,813	26,220	3·78	152,289	25,906	3·40
25. North Kalgurli (1912) Limited	91,444	27,443	6·00	78,181	25,721	6·58	115,488	40,965	7·09	140,911	45,415	6·44	135,957	45,674	6·72
26. North Kalgurli (Croesus Section)	....	....	....	....	....	....	7,488	2,172	5·80	65,450	14,025	4·27	*17,221	3,065	3·56
27. Ora Banda Amalgamated, N.L.	1,295	1,103	17·04	16,230	4,109	5·06	20,745	5,262	5·07	24,065	6,649	5·52	23,775	8,330	7·01
28. Paringa Mining and Exploration Ltd.	67,295	15,446	4·59	74,108	17,104	4·62	83,798	22,185	5·29	92,289	22,460	4·87	92,000	21,206	4·61
29. Phoenix Gold Mines, Limited	28,507	8,061	5·66	24,719	6,695	5·42	28,214	7,942	5·63	33,831	9,631	5·69	24,282	7,329	6·03
30. South Kalgurli Consolidated, Ltd.	56,685	15,603	5·51	63,065	19,135	6·07	75,470	22,696	6·01	91,874	27,467	5·98	84,380	22,894	5·43
31. Spargo's Reward Gold Mine, N.L.	....	....	....	....	....	....	20,533	4,820	4·69	27,182	7,468	5·49	19,815	7,083	7·15
32. State Batteries	18,262	15,595	17·08	19,074	18,591	19·49	40,396	27,309	13·52	73,001	43,518	11·92	100,456	58,831	11·71
33. The Sons of Gwalia, Limited	72,653	22,657	6·24	75,774	24,003	6·34	99,004	31,135	6·39	134,365	42,520	6·33	138,162	44,512	6·44
34. Triton Gold Mines, N.L.	....	....	....	....	....	....	33,272	10,391	6·24	75,742	21,495	5·67	104,525	30,982	5·93
35. Wiluna Gold Mines, Limited	392,246	39,028	1·99	479,069	52,377	2·19	548,226	65,738	2·40	568,900	72,586	2·55	583,516	86,732	2·97
36. Yellowdine Gold Development Ltd.	3,756	1,997	10·64	14,695	5,536	7·53	27,687	8,430	6·09	41,097	13,711	6·67	46,346	19,054	8·22
37. Youanmi Gold Mines, Limited	....	....	....	....	....	....	3,893	2,825	14·51	73,858	17,023	4·61	85,017	22,569	5·31
Total	1,759,253	443,639	5·04	2,015,067	487,314	4·84	3,067,119	759,867	4·95	3,946,657	974,476	4·94	4,008,475	1,012,749	5·05
Other Sources (excluding large retreatment plants)	17,875	19,766	22·12	35,944	33,739	18·77	158,585	72,786	9·19	264,117	116,638	8·85	283,133	109,979	7·77
Total (excluding large retreatment plants)	1,777,128	463,405	5·22	2,051,011	521,053	5·08	3,225,704	832,743	5·16	4,210,774	1,019,114	5·18	4,291,608	1,122,728	5·23
Golden Horseshoe Sands Retreatment	....	9,183	....	....	10,694	....	....	13,029	....	....	12,421	....	....	26,350	....
Morgans Sands Retreatment	....	....	....	....	....	....	....	....	....	....	1,942	....	....	5,765	....
GRAND TOTAL	1,777,128	472,588	5·32	2,051,011	531,747	5·19	3,225,704	845,772	5·24	4,210,774	1,105,477	5·25	4,291,608	1,154,843	5·38

* Tonnage from Croesus Section is for three months only. Prior to September, 1940, ore was treated at Kalgoorlie Ore Treatment Plant and was bulked with other North Kalgurli ore.

This mine has had a very successful year.

This is the principal source of gold from the Pilbara. Other producers were responsible for 1,577 ounces, making a total production of 14,702 ounces.

Blue Spec in the Nullagine district is not yet into production. Progress has been impeded by the difficulties inherent in the situation and by wartime conditions. The water supply position has been improved and it is hoped that production will commence in the coming year.

TABLE H.

Development Footages reported by the Principal Mines for 1944.

Goldfield.	Mine.	Shaft Sinking.	Driving.	Cross-cutting.	Rising and Winzing.	Diamond Drilling.	Total.
		feet.	feet.	feet.	feet.	feet.	feet.
Pilbara	Comet Gold Mines, Limited	270	226	151	213	...	860
East Murchison	Emu Gold Mines, Limited	...	...	602	...	729	1,331
	Wiluna Gold Mines, Limited	...	4,396	896	2,007	1,922	9,221
Murchison ...	Hill 50 Gold Mine, N.L.	...	250	200	441	...	891
Mount Margaret	The Sons of Gwalia, Limited	...	467	256	501	...	1,224
North Coolgardie	First Hit Gold Mine, N.L.	...	683	187	36	...	906
East Coolgardie	Boulder Perseverance, Limited	...	3,187	...	1,344	4,980	9,511
	Gold Mines of Kalgoorlie, Limited ...	...	2,610	2,102	1,548	5,982	12,242
	Great Boulder Proprietary, Limited ...	...	7,012	1,984	2,277	5,354	16,627
	Kalgoorlie Enterprise, Limited	...	1,593	...	172	1,951	3,716
	Lake View and Star, Limited	...	5,998	879	2,966	3,981	13,824
	North Kalgurli (1912) Limited	...	2,758	492	1,173	4,107	8,530
	South Kalgurli Consolidated, Limited ...	...	1,179	791	427	4,874	7,271
Coolgardie ...	Phoenix Gold Mines, Limited	...	70	118	...	...	188
Yilgarn ...	Edward's Reward	...	150	...	...	...	150
	Edna May Amalgamated Gold Mines, Ltd.	...	464	507	210	...	1,181
Dundas ...	Central Norseman Gold Corporation, N.L.	588	1,750	24	588	3,400	6,350
	Norseman Gold Mines, N.L.	...	1,139	85	814	...	2,038
	Totals	858	33,932	9,274	14,717	37,280	96,061

COAL MINING.

The output of the Collie Coalfield during 1944 as compared with 1943 is shown in the following tabulation:—

Mine.	1944.		1943.	
	Tons.	Value.	Tons.	Value.
		£A.		£A.
Proprietary	143,159	155,354	158,072	150,003
Co-operative	76,687	84,009	87,182	82,817
Cardiff	76,095	79,574	69,978	63,538
Stockton	107,449	114,682	118,089	110,166
Stockton Open Cut	66,779	65,527	2,308	2,180
Total, Amalgamated Collieries	470,169	499,146	435,629	418,704
Griffin	78,482	74,706	95,507	80,641
Wyvern	9,670	9,224	410	376
Total Griffin Co	88,152	83,930	95,917	81,017
Grand Total	558,321	583,076	531,546	499,721

The output is approximately 27,000 tons greater than for 1943 and the value approximately £83,000 greater. The average number of men employed rose from 839 in 1943 to 880 in 1944.

Proprietary Mine.

The number of working places in this mine increased from 90 at the beginning of the year to 112 in December. Half of these places are in 10 section.

The left hand panel off 10 dips struck a fault which is being tested by boring.

Power has been taken into the mine by A.C. mains with a motor converter at 12 level supplying D.C. to pumps, coal cutters and boring machines at the faces. The pumps at 12 sump and the No. 10 main haulage are driven by A.C. motors. It is intended to convert No. 11 haulage to A.C.

A better supply of power at the faces is obtained.

The ventilation of the right hand workings still requires improvement.

Co-operative Mine.

Forty-four places were available at the end of the year, which is a reduction of 32 as compared with the figure at the beginning of the year.

The stone drive on the line of dip which is being driven to eliminate the long haulage system, still has 8 chains to go.

The main dip below east slants has again been started.

The 6 left slant heading struck a fault with the upthrow to the south. The extent of the fault is not known.

A fire occurred in old workings behind 5 right dip haulage winch on 15th November. It was enclosed by stoppings and the area sealed off.

Ventilation has been improved by connecting 4 left workings and stone drive. An airscrew used on the upcast instead of the old fan also effected an improvement. Owing to damage due to vibration it had to be removed and the old fan is in use again. It will be replaced by a new fan.

Cardiff Mine.

All places in the "Bertha" section have been stopped and all coal is now loaded by scraper loaders. Stripping of pillars has improved the quality of the coal as the good coal from the pillars is mixed with the poorer stuff from the tops. The roof holds up well.

Stockton Mine.

The number of places available at the end of the year was 58, as compared with 70 at the end of last year. Some places between 10 and 34 bords in 1 right section will soon be worked out. Improved haulage arrangements would give a better output from the north-west section of the workings.

Three pairs of miners with the Joy Loader are working on the extraction of bottom coal.

Stockton Open Cut Area.

The greater part of the top seam has been extracted and about 10 per cent. of the bottom seam has also been won. Sluicing methods for the removal of overburden have been abandoned.

Griffin Mine.

There are 34 places available for hand miners as against 46 at the beginning of the year. Ten places are available for scraper loaders in the stone drive section. These were started during the year.

The workings going east are now out of the Griffin ground.

Scraper loaders are doing good work, but have had to be withdrawn from the dip due to excessive water.

In 10 dip slant the places are looking well and the dip appears to be a little flatter.

Wyvern Mine.

Lack of proper equipment has held up production on this mine.

The main dip heading has been driven 8¼ chains. It struck a fault which brought in additional water 6 chains from the surface. The west back heading is stopped on this fault.

The thickness of the seam remains constant.

This mine should develop into a good producer when the necessary equipment is available.

Conclusion.

Considering difficulties of manpower and supply, the increasing power necessary to win coal from greater depths, and the urgent demand for increased coal production, Collie has had a good year.

Although an acute coal shortage has existed throughout the year, essential demands have been met.

Freedom from major industrial troubles has been an important factor in maintaining the output.

The successful development of the open cut has been of vital importance.

Some technical advances have also contributed to increased production.

All coal produced has been distributed by the Western Australian Coal Committee.

A very comprehensive report entitled "The Collie Coalfield, its problems and its economic importance," was the subject of a Presidential Address to the Royal Society of Western Australia in 1943 by Mr. R. C. Wilson, B.Sc., B.E., State Mining Engineer. The preservation of this paper in a distributable form is important and arrangements have been made by the courtesy of the Royal Society for its inclusion as Appendix No. 3 of this Report.

Coal in Northern Districts.

During the year some investigations were undertaken by this Department into the northern coal measures at Eradu and Irwin River.

A shaft was sunk at Eradu siding with the object of obtaining a bulk sample of coal for testing from a seam in that area proved by boring to exist at a depth of approximately 140 feet. A flow of water struck at a depth of 75 feet was successfully sealed off and the shaft continued to 120 feet, where a very heavy flow of water was encountered. Efforts to seal off this flow by pumping in cement grout through bore holes proved unavailing and as no suitable pumping outfit capable of handling the flow was available, operations were suspended.

The working party was then moved to the outcrop of coal on the Irwin River, about 21 miles north-eastward from Mingenew, to open up an old shaft and a tunnel on the coal seams there and obtain samples for analysis and practical tests. This work was in progress at the close of the year.

MINERALS OTHER THAN GOLD AND COAL.

Mineral production for the year was on a wider scale than usual, owing principally to the production of strategic minerals such as tantalite, beryl and mica, while operations on the blue asbestos deposits of the Hamersley Range by two major companies are also of great interest. Unfortunately the demand for tantalite, beryl and mica has fallen off to a large extent, resulting in the cessation of operations at the end of the year at the Commonwealth controlled projects for tantalite at Wodgina and mica at Yinnietharra.

Information gained in supplying these minerals, however, has been of great value and should assist considerably in assessing the State's resources in the future.

The total value of mineral production other than gold and coal for the year amounted to £236,792 compared with £195,829 during the previous year.

Alunite.—Production of potash from the alunite deposit at Chandler, on Lake Campion, commenced during February under the direction of the Department of Industrial Development. This plant was planned to produce 10 tons of potash per day, but on account of the usual war-time disabilities, some secondhand substitute plant had to be used and a number of initial operating difficulties were encountered, especially with regard to leaching. A continuous leaching machine was installed towards the end of the year, which is reported to be operating successfully.

The process consists of obtaining the ore from the lake at a distance of about one mile from the plant by a wheel scoop powered by a diesel unit. The capacity of the scoop is about five tons and it delivers to the mill bin. Crushing is carried out by a hammer mill.

The crushed ore is roasted in a furnace of the cement kiln type, fired by gas from a battery of wood gas producers. This roasting converts the potash and soda sulphates to a soluble form.

The calcine is leached with hot water and the salt is obtained by cooling, evaporating and centrifuging.

The rate of production after installation of the continuous leaching process was about 10 tons per day and an increased production is anticipated when further projected improvements are carried out.

It is hoped that a market will be found at a later date for the considerable tonnage of alumina formed as a by-product from this process.

The total amount of potash produced for the year amounted to 943 tons valued at £14,229. This was obtained from 19,236 tons of alunite.

Antimony.—Sale of antimonial concentrates from Wiluna Gold Mines, Limited, amounted to 46 tons, valued at £1,230. Further production from this source is unlikely.

Blue Spec Gold Mines, N.L., after a long struggle against adverse conditions, had their plant at the point of completion at the end of the year and should produce appreciable quantities of gold-antimony concentrates in future. Sporadic operations during the year were productive of concentrate containing 3·6 tons of metallic antimony valued at £252.

Arsenic.—Wiluna Gold Mines, Limited, produced 2,304 tons of arsenic for the year, valued at £48,384. This Company has now exhausted its gold ore reserves and at the end of the year was not prepared to carry on arsenic production except with Government assistance in the form of a subsidy to cover operational losses. This proposal was under consideration by the Commonwealth Government at the close of the period under review.

Asbestos.—The total production of asbestos reported for the year was as follows:—

Variety.	Tons.	Value. £
Crocidolite	273	9,974
Chrysotile	12	656
Anthophyllite	23	226

Crocidolite.—The activities of both companies operating on the extensive Hamersley Range deposits were chiefly confined to construction for the year, although an appreciable tonnage of fibre was produced. These companies have both been working under severe handicaps, as, in addition to the usual manpower and stores problems, they have had to contend with a restricted and most erratic shipping service, which has had to give priority to Defence requirements very much to the detriment of all others in the North West. While the necessity for this attitude is fully realised, it has had a very deleterious effect on the opening up of these important mines. Some relief has been afforded by the construction of an aeroplane landing ground within a reasonable distance of both mines, and small stores have been obtainable quickly by this means. Even perishable stores have been delivered in this manner at considerable expense to the operating companies.

The action of the Main Roads Board in constructing good roads in the gorges to the sites of the plants and in reconditioning and renewing the main road from Roebourne, has been much appreciated and when completed should have the effect of reducing haulage costs to an appreciable extent.

Both companies are producing fibre of excellent quality and well graded, which appears to be perfectly satisfactory to consumers to whom it has been submitted. There appears to be a market for the full output of both mills. All grades milled are very clean and free from dust and rock fragments.

Information previously received at this office to the effect that blue asbestos fibre is not satisfactory in the manufacture of asbestos cement goods has now been checked experimentally. The result of the tests indicates that an asbestos cement sheet in which a proportion of blue fibre is used is a better article than that containing white asbestos alone.

It is doubtful whether the optimum proportions have yet been determined, but tests have been made in which up to 30 per cent. of the fibre used is blue.

It is considered that both operating companies have made good progress considering the disabilities under which they have been working. Following are brief reports of their operations.

Australian Blue Asbestos, Limited.—The erection of the mill at Wittenoom Gorge proceeded steadily until June, when production commenced, and since then the mill has operated fairly consistently, producing approximately 150 tons of fibre of all grades.

Up to the end of 1944 some 2,000 feet of driving had been completed at the mine, most of the work being of a developmental nature designed to obtain a first class mine layout suitable for future large scale operations.

After initial mill trials and adjustments of plant had been carried out, the fibre produced has been of excellent quality, well graded and very free from dust and grit.

The nucleus of a settlement has been erected in Wittenoom Gorge and, to date, eight houses and two sets of barracks have been completed, furnishing much improved living conditions for employees.

West Australian Blue Asbestos Fibres, Limited.—Most of the fibre to date has been won from benching operations, which consist of two benches on the eastern side and one bench on the western side of Yampire Gorge.

Underground development completed consists of Nos. 1 and 2 crosscuts, driven for 70 feet and 50 feet respectively, and No. 2 drive, which has been advanced to 60 feet.

At the end of the year the erection of the plant was sufficiently advanced to permit commencement of production and completion of buildings. Additions to the plant are still proceeding and will probably continue during the first half of the current year, by which time it is hoped that the production of asbestos will reach 100 tons per month.

The Company has secured a market for the whole of its No. 3 grade fibre and has made some sales of Nos. 1 and 2 grades in England. It is also hopeful of securing a market for the superior grades in Australia and America.

Chrysotile.—Production of chrysotile fibre fell off for the year. K. Stein produced 10 tons of graded material at his plant at Nunyerri, but was working only during a short period for the year. The development carried out on this mine, though small, will be of vlaue in assessing future possibilities in this industry.

The suggestion of the development of the North West chrysotile deposits, as outlined in my Annual Report for 1943, is one of the utmost importance and should be stressed in any scheme planned for post war works in this area. It is again pointed out that such development cannot be carried out by individuals, but is a matter for consideration by organisations with large capital. The possibilities have not yet been proved, but are sufficiently encouraging to warrant a considerable expenditure on their investigation.

Anthophyllite.—A limited amount of work was carried out on the Bindi Bindi deposit during the early part of the year by Associated Engineers Corporation, Limited, resulting in the production of 23 tons of fibre valued at £226.

This deposit holds possibilities provided that a regular market for this class of fibre is available.

Bentonite.—The production of this mineral amounted to 291 tons, valued at £660. This output was derived from Marchagee, on the Midland Railway.

Beryl.—The demand for beryl for war purposes and its high priority as a strategic mineral have had the result of encouraging prospecting for this valuable mineral, and although the production for 1944 was not as high as in the previous year, the following table will indicate that deposits are more widely spread than was previously realised.

Production for 1944.

District.	Quantity. Long tons.	Value. £
Coolgardie	28·71	861
Wodgina (4 producers) ..	302·11	9,055
Poona (2 producers) ..	21·53	659
Yinnietharra	37·70	1,379
Balingup	·10	2
Total	390·15	11,956

A number of other likely prospects have been reported, but owing to the fact that the Commonwealth Government's contract to supply beryl to the U.S.A. terminated at the end of the year, they have not been opened up.

Indications are that the price of beryl will fall with the termination of the U.S.A. contract, but it is considered likely that it will rise again in the future and that there will be an increased demand for beryl for civil industrial purposes.

Bismuth.—A small parcel of bismuth concentrate weighing 1,466 lbs. and valued at £482, was obtained from the treatment of 52 tons of ore at Yinnietharra.

Clays.—The total reported production of clays, excluding bentonite, amounted to 1,615 tons valued at £1,726.

Copper.

The total output of metallic copper from the State amounted to only 5½ tons, valued at £367. Most of this was derived from parcels of ore sent to Port Kembla for treatment.

Further progress was made during the year with the small smelting plant erected under departmental supervision at Ravensthorpe, a flotation unit having been added to it for concentration of sulphide ores. Only

one ton of metallic copper was produced during the year, but the plant is now ready for practically continuous production. Unfortunately the district has been drained of its prospectors during the war and it cannot be anticipated that much ore will be supplied for treatment until conditions improve.

I feel that great credit is due to Messrs. H. and W. Wehr for the enormous amount of hard work and ingenuity they have put into the construction of this plant. I feel that the thanks of the Department and of the Ravensthorpe district are due to these men, without whose services, I fear, this public utility would not have been available to the field.

Diatomaceous Earth.

No production was reported for the year.

Dolomite.

A small production amounting to 158·5 tons, valued at £794, was produced at Mt. Magnet. It is understood that this production was consumed by local industries.

Felspar.

Production by Australian Glass Manufacturers Company, Pty. Ltd., at their Londonderry quarry, near Coolgardie, dropped by approximately 400 tons to 1,881 tons, valued at £10,376. This value exceeded the previous year's value by £3,509.

Some beryl and tantalite were also produced and marketed from this quarry during this period, but no profitable market has been found for the lithium minerals, petalite and lepidolite which exist there in appreciable quantity.

Felspar was also produced at Balingup, to the extent of 77·5 tons, the reported estimated value being £155.

Glass Sand.

Reported production, all from East Wanneroo, amounted to 157·5 tons valued at £204.

Glauconite.

Production from the Gingin area totalled 144 tons, valued at £3,600, recovered from 720 tons of greensand.

Graphite.

No production for the year was reported. The companies interested in the promising deposits enumerated in my Annual Report for 1943 are marking time until a satisfactory market is available for their product.

Gypsum.

Production from the lake deposits at Baandee, Woolundra and Lake Brown amounted to a total of 3,604·45 tons, worth £3,722.

Mica.

The total production of mica for the year was 8,367 lbs., valued at £1,279. This mica all originated from the Commonwealth operated mine at Yinnietharra. As explained in my last year's Annual Report, the mica, after being mined and split, was roughly trimmed into sheets and packed and shipped to a central store in Melbourne for the final trimming. Results were extremely disappointing and it is felt strongly that, in order that the Yinnietharra deposits may not be condemned on account of the poor yield, some explanation is due.

The quality of the mica produced was good. It was all classed as "commercial clear" or "good stained," i.e., second quality, although some samples received would definitely be classed as first quality or "clear."

When production commenced on this mine, a representative sample of the material forwarded was fully trimmed and it was estimated that the approximate yield of useful sheet mica would be 25 per cent. The actual average recovery on mica forwarded for the first three months' production was 8·62 per cent. The total production for this period was 12,050 lbs., from which was cut 1,039 lbs. of sheet mica.

One particular shipment of 5,162 lbs. was sampled while packing by placing on one side every 30th sheet handled. This was considered the fairest method of taking a sample which should be fairly representative. The sample weighed 300 lbs. and was properly trimmed on the mine, yielding 90 lbs. of trimmed mica, which was sent separately to the store and accepted in toto. This yield was 30 per cent. of the sample.

The consignment of 5,612 lbs. was sent to the store for trimming and yielded 250 lbs. of trimmed mica, or 4·84 per cent. of the total. These figures speak for themselves.

Mica trimming is an occupation which requires a considerable degree of expertness and patience and much valuable mica may be destroyed or wasted by inexpert or impatient handling. It is very questionable whether it is practicable to have this work done on a wages basis unless under constant strict and expert supervision.

It is clear that much valuable mica was sent to the scrap heap for grinding purposes, which had the dual effect of impeding the war effort and giving Western Australian mica a bad name which it does not deserve.

The Commonwealth Mica Project at Yinnietharra was closed down late in the year and the plant disposed of.

Phosphate Guano.

A production of 2,215 tons, valued at £12,183, was reported for the year. The output was under the direction of the British Phosphate Commissioners.

Pyrites.

The Iron King Mine, a subsidiary of Norseman Gold Mines, N.L., was fully equipped during the year to develop and mine a greater tonnage of iron pyrites, urgently needed as a source of sulphuric acid in superphosphate manufacture. The sum of £7,000 was spent on equipping the Campbell shaft with a steel headframe, bins and electric winding engine.

Considerable difficulty was experienced early in the year with the flotation plant, the average extraction over the year being only 70 per cent. During the latter half of the year metallurgical and mechanical problems were solved and the extraction was improved to 86 per cent., which figure is being maintained.

Development completed consisted of 80 feet of shaft sinking, 141 feet of winzing, 787 feet of rising, 1,307 feet of driving and 107 feet of crosscutting.

The principal development was on the No. 4 level, where the lode has been exposed over a length of 950 feet. As a result of this development 104,000 tons of ore averaging 29·9 per cent. sulphur has been proved.

The Campbell shaft was sunk a further 80 feet to a depth of 16 feet below the No. 4 level plat. From 233 feet to 250 feet the shaft passed through the pyritic lode, which averaged 27·2 per cent. sulphur over a true width of 13½ feet.

At No. 3 level the North drive was advanced 305 feet to a total distance of 858 feet, while the South drive was continued 69 feet to a total of 465 feet south of the Red, White and Blue shaft. Ore of average grade was exposed in both drives.

On No. 4 level driving north was continued for a distance of 718 feet, the total now being 968 feet north of the Red, White and Blue shaft, in good ore.

A winze was sunk to a depth of 67 feet below the No. 4 level in ore containing a higher percentage of sulphur than that on the No. 4 level.

On account of the urgency of the demand for pyrites, this mine has enjoyed a high priority as regards manpower and has consequently been able to maintain sufficient miners to carry out the desired programme.

The higher grade mineral from the mine averaging about 36 per cent. sulphur was railed direct to the factory, while the lower grade material was concentrated by flotation to approximately 48 per cent. sulphur for disposal.

Following was the output for the year:—

Ore railed direct—8,083 tons valued at £19,280.

Ore treated—35,665 tons.

Concentrates recovered—15,619 tons valued at £49,060.

Total tonnage sold—23,702 tons valued at £68,340.

Red Ochre.

Production was reported from three localities as follows:—

Cue	.. .. ..	74	tons valued at	£563
Mt. Monger	.. ..	20	„ „ „	£80
Ophthalmia Range	..	851	„ „ „	£7,064
Total	.. ..	945	„ „ „	£7,707

This output represents a considerable advance on last year's production, which totalled 397 tons, valued at £3,820.

Silver.

The quantity of silver exported amounted to 123,199 fine ounces, valued at £15,807. The whole of this output was derived as a by-product of gold production.

Soapstone.

The production of 262 tons of soapstone, valued at £828, was reported from Bridgetown.

Tantalite.

The production of tantalite, for sale under contract to the United States Government, amounted to 10.20 tons from the Pilbara Goldfield. Of this quantity 9.82 tons originated from the Commonwealth Government's Project No. 83 at Wodgina. The value of 1.88 tons of this material is unknown at the time of writing, but the remainder is estimated to be worth £12,916.

The contract with U.S.A. terminated at the end of the year and the Wodgina project was closed down.

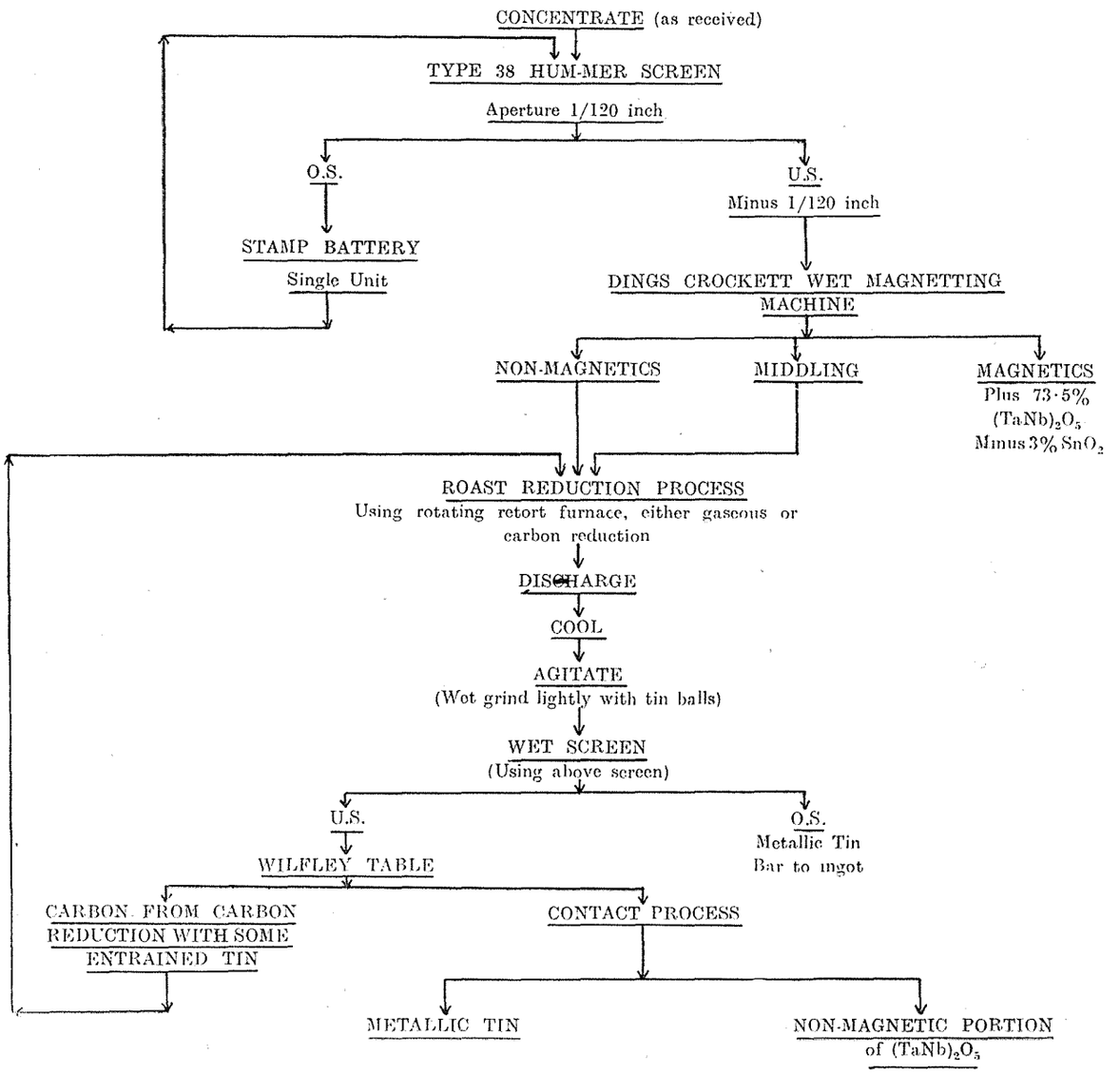
There was no production of tantalite as such from Greenbushes during the year, but an output of 20.16 tons of cassiterite-tantalite concentrate was reported from this area, which was sent to Sydney for magnetic separation of the tantalite fraction.

The yield of tantalite from such concentrate cannot yet be assessed, but the tin content is valued at £2,045.

It would appear that the future of Greenbushes as a tantalite producing centre depends largely on the degree of perfection attainable in its separation from tin concentrate. Some very high grade deposits of tantalite have been worked in this area, but it would appear that the bulk of this mineral is associated with cassiterite. As mentioned in my Annual Report for 1943, the magnetic separation of these two minerals to date has resulted in a very low yield of the tantalum minerals.

An interesting investigation was carried out by the Kalgoorlie Metallurgical Laboratory during the year, which indicated that a very satisfactory yield might be obtainable by means of a combination of magnetic and chemical methods and a provisional flow sheet was drawn up as follows:—

FIG. 1.—*Provisional Flow Sheet for Treatment of cassiterite-tantalite concentrate from Greenbushes.*



The result of this investigation indicates that probably over 90 per cent. of the contained Ta_2O_5 is recoverable by this method, as against 55 per cent. to 60 per cent., which has been recovered to date by straight magnetic separation.

The termination of the contract with U.S.A. and the closing of the Wodgina project is a severe setback to the State's tantalite production, but new uses discovered for tantalum have increased its importance, and indications are that a ready market still exists at prices comparable to those paid under the late agreement.

Reports of comparatively large production of tantalite from Brazil, Uganda, Nigeria and the Belgian Congo indicate that this State should do all in its power to foster this industry if it wishes to retain its former pre-eminence in the supply of this valuable mineral.

The whole of the Wodgina output for the year assayed roughly 65 per cent Ta_2O_5, while that derived from Greenbushes varied from 38 per cent. to 50 per cent. Ta_2O_5.

Tin.

Concentrates totalling 9·87 tons, valued at £2,175, were reported as a result of small scale operations on the Pilbara Goldfield.

At Greenbushes 3·95 tons, valued at £626, was the total output directly disposed of as tin concentrate, while 20·16 tons of mixed tin-tantalite concentrate (mentioned above under Tantalite) was shipped to Sydney for magnetic treatment. The tin concentrate recovered from this operation is valued at £2,045.

Assistance was given to Greenbushes producers by this Department by paying an advance after assay of the total estimated value of the tin content of individual parcels. In view of the somewhat patchy results of the separation process, no estimate can yet be made of the total value of a parcel of mixed concentrate.

Tungsten.

Owing to operations at the Edna May Amalgamated Gold Mines, N.L., at Westonia, the production of tungsten (scheelite and wolfram) concentrates was greater during the year under review than the previous total State production.

Edna May Amalgamated treated at their new concentrating plant 32,177 tons of accumulated sands for the production of 59·43 tons of wolfram-scheelite concentrate, averaging 65·2 per cent WO_3 and valued at £21,270. This performance in the first year of production is very pleasing, and a great deal of the credit is due to the Kalgoorlie School of Mines Metallurgical Laboratory, whose investigations and research work were of vital importance in working out the flow sheet finally adopted.

The only other production reported for the State consisted of ·25 ton from Higginsville, worth £90, and ·16 ton from Callie Spring on the Murchison Goldfield, valued at £59.

Vermiculite.

The output of this mineral was all from the Perth Modelling Works' Young River deposit and showed a very considerable decrease on the previous year's figure. The tonnage and value were 123 tons and £738 respectively, as compared with 343 tons and £2,057 for 1943.

CONCLUDING REMARKS.

Although the gold mining industry showed a further decline for the year, it was not nearly so marked as in the previous two years, and it is encouraging to note that seven mines actually showed increased tonnage and gold output over the 1943 figures, while an eighth increased the gold output with a very slight decrease of tonnage.

The high rate of output per man employed was maintained and is very creditable to the larger operating mines.

It would appear that the 1944 production might at least be kept up for the current year, after which a progressive improvement might reasonably be anticipated.

A further pleasing feature of the year's work is the fall in the number of fatal accidents per 1,000 men employed, which is the lowest rate since 1928.

Coal production for the year, although approximately 27,000 tons in advance of the previous year's output, was rather disappointing, especially in view of the increased mechanisation on the mines and the increased number of men employed. These factors do not appear to have made any improvement and it is due only to the fact that the Stockton Open Cut, commencing operations early in the year, and gradually increasing its output, produced nearly 67,000 tons that the production did not lag substantially behind that of 1943.

Coal from the Open Cut and the Cardiff Mine has been under criticism from the Railway Department and from the Engine Drivers' and Firemen's Union. The Open Cut coal is somewhat liable to adulteration and, to date, has been consigned direct to trucks as run of mine coal. On the installation of a conveyor to the picking belt and screen this disability should be minimised. Cardiff coal, on the other hand, is admittedly a poorer quality coal and should not be used alone for locomotive boilers. It is known, however, that this coal is satisfactory if blended with other coals on the field, and it is felt strongly that, if the Railway Department installed a blending plant a perfectly satisfactory locomotive fuel would be obtainable from native Collie coals, which would not only result in smoother running of the Railways, but would also make available large areas of coal which is unsuitable for locomotives when used alone.

The search for minerals other than gold and coal has received a somewhat severe setback by the closing down of the Commonwealth mica and tantalite mines and by the termination of the agreement with U.S.A. for the supply of tantalite and beryl. Nevertheless, a great deal of valuable information has been gained, and it is felt that we have a sounder knowledge of our mineral resources than ever before. The development of the Hamersley Range blue asbestos is at an interesting stage and a market for the product seems assured. The opening up of the North-West chrysotile deposits should naturally follow the establishment of the blue asbestos industry.

The tantalite mines at Wodgina and Strelley are fully equipped and it seems likely that a good market still exists at prices comparable with those received during the term of the contract with U.S.A.

Tin and tantalite production in Greenbushes is still more or less in the prospecting stage, where it seems likely to remain unless some big capital is introduced.

Pyrites, antimony, alunite, beryl, vermiculite and red ochre appear to be obtainable in quantity, and graphite of good quality is available, given a suitable market. Production of minor minerals mentioned in the body of this report could doubtless be expanded if necessary.

In conclusion, I wish to express my appreciation of the assistance and co-operation I have received from officers of all branches of the Department since taking over the duties of this office during the latter half of the year, and more particularly the Assistant State Mining Engineer and Inspectors of Mines on the Goldfields and at Collie for the continuation of the loyal support that they have always given to my predecessor.

JOHN S. FOXALL,
State Mining Engineer.

APPENDIX NO. 1.

Coal Mines Regulation Act, 1902-1926.

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

Office of the State Mining Engineer,
Mines Department,
Perth, 29th March, 1945.

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 1944.

Certificate without Examination.

An application for Second Class Certificate of Competency under the Coal Mines Regulation Act, 1902-1926, was received from the holder of a New South Wales Under Manager's Certificate of Competency. The Board considered he complied generally with the requirements of the Act and issued a Second Class Certificate in January.

Examinations for Certificates.

April Examination.

One candidate presented himself for the First Class Examination in April. At the meeting of the Board on the 19th May, it was decided to issue him a First Class Certificate of Competency.

October Examination.

Examinations for First and Second Class Certificates were advertised to be held in October, but no candidates were forthcoming and no meeting of the Board was held in that month.

Copies of the papers set for the examination 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.,

(Sgd.) JOHN S. FOXALL,
State Mining Engineer,
(Chairman.)

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

(Sgd.) JAMES GILLESPIE,
Inspector of Mines, Collie,
(Member.)

Western Australia.

Department of Mines.

Coal Mines Regulation Act, 1902-1926.

EXAMINATION FOR FIRST CLASS CERTIFICATE OF COMPETENCY.

Subject: Arithmetic.

Wednesday, 19th April, 1944: 9 a.m. to 11 a.m.

Possible Marks.	
17	(1) A drum 8 feet in diameter is used to wind two cages from a depth of 360 feet; it is desired to make one cage wind from a depth of 510 feet by increasing the diameter of half the drum. Find the diameter required.
16	(2) A wagon contains contains 11 tons 8 dwt. of coal, the price of which is 8s. 10d. per ton. Reduce these quantities to decimals of 1 ton and £1 respectively, and find the cost of the wagon load.
17	(3) In driving a tunnel through water-bearing strata compressed air was used to fill the space in which men worked; if the pressure employed was 10 lbs. per square inch in excess of atmospheric pressure (15 lbs. per square inch), what volume of ordinary air would be required to fill a space of 300 cubic feet with compressed air?
16	(4) Simplify $\sqrt{\frac{3}{4}} \times (\frac{3}{4})^2$.
17	(5) The circumference in inches of a plough steel wire rope suitable for raising a load of w tons from a depth of d yards is equal to $\frac{\sqrt{10w}}{4 - \frac{9d}{2240}}$ What size of rope is required in order to raise 4 tons from a depth of 120 yards?
17	(6) The weight of a wagon is one-third of the weight of the coal it contains; when half of the weight of coal has been taken out, the weight of the wagon is 1¾ cwt. less than the weight of coal that remains. Find the weight of the wagon.
100	

Western Australia.

Department of Mines.

Coal Mines Regulation Act, 1902-1926.

EXAMINATION FOR FIRST CLASS CERTIFICATE OF COMPETENCY.

Subject: Geology.

Wednesday, 19th April, 1944: 11 a.m. to 1 p.m.

Possible Marks.	
20	(1) Write a short essay on faults with particular reference to types, fault elements and the various effects of faults on sedimentary strata.
15	(2) Write brief notes on the following:— Conglomerate, Sandstone, Shale, Basalt, Dolerite, Granite.
25	(3) Set out a classification of coals based on composition and briefly discuss the basis of your subdivision. Describe fully the composition and properties of any one type with which you are familiar.
20	(4) What are the uses of fossils in the interpretation of the geology of a sedimentary area? Make your answer as detailed as possible.
20	(5) Describe broadly the geology of the country lying between Perth and Collie in Western Australia.
100	

Western Australia.

Department of Mines.

Coal Mines Regulation Act, 1902-1926.

EXAMINATION FOR FIRST CLASS CERTIFICATE OF COMPETENCY.

Subject: Machinery.

Wednesday, 19th April, 1944: 3 p.m. to 5 p.m.

Possible Marks.	
16	(1) How is the centrifugal force of a train running round a curve counteracted
17	(2) The imput to a 3-phase transmission line is 1,000 kilowatts at 6,600 volts between phases. The power factor is 0·8. The line is 1,800 yards. Calculate (a) the current per phase, (b) the voltage between phases at the delivery end of the line, (c) efficiency of transmission.
17	(3) Describe the principle employed in cleaning coal by water process.
17	(4) Define the following terms in their relation to alternating current circuits:— (a) Cycle. (b) Frequency. (c) Alternation. (d) Period.
17	(5) A pump raises 1,500 gallons per minute continuously from a depth of 750 feet. Calculate the annual cost of pumping on a basis that it cost .93 pence per h.p. hour. Neglect friction.
16	(6) A 3-phase A.C. motor takes 47 amperes at 440 volts and has an efficiency of 90 per cent. Calculate the brake-horse power of the motor.
100	

Western Australia.

Department of Mines.

Coal Mines Regulation Act, 1902-1926.

EXAMINATION FOR FIRST CLASS CERTIFICATE OF COMPETENCY.

Subject: Mining of Coal.

Thursday, 20th April, 1944: 10 a.m. to 1 p.m.

Possible Marks.	
25	(1) Before selecting a site on which to sink a pair of shafts, what are the considerations that have to be taken into account, above and below ground?
25	(2) Discuss in detail the effects of subsidence on surface and buildings due to coal workings in the following cases:— (a) Where hard stratified measures are met with near the surface. (b) Where thick beds of clay, sand and gravel overlie the hard measures.
25	(3) Where men are conveyed to and from their work in a steep main incline, what method of haulage would you adopt and what special precautions would you take to reduce the risk of accidents?
25	(4) Lay out, with the aid of sketches, a small district of bord and pillar in a seam dipping 1 in 4, where it is intended to use mechanical loaders. State the size of pillars, assuming the depth to be 400 yards. Also show roads and loading points and estimate the output from the district and the number of men of the various classes you would employ.
25	(5) What are the causes of blown-out shots and miss-fire shots, respectively, and why are they dangerous? Discuss the effect of placing a coal shot so near to the roof that it penetrates it at the far end.
25	(6) What in your opinion determines the system of timbering of the various roofs in coal mines for headings and bords?
25	(7) Describe two methods of putting in and securing a midwall in a rectangular shaft.
25	(8) (a) In what manner does a weak roof affect the size of a main road? (b) How does the thickness of the seam influence the size of the skip in general use in a mine?
200	

Western Australia.

Department of Mines.

Coal Mines Regulation Act, 1902-1926.

EXAMINATION FOR FIRST CLASS CERTIFICATE OF COMPETENCY.

Subject: Surveying.

Thursday, 20th April, 1944: 2 p.m. to 5 p.m.

Possible Marks.	
25	(1) Name the various adjustments of a transit theodolite and state with reasons the order in which they should be made. Describe in detail the complete adjustment of a dumpy level.
25	(2) The undermentioned readings were obtained in levelling along a back heading in a mine. Set out a specimen page of a levelling book and enter the readings as you would during the survey. What is the level of point B, assuming that point A is 120·6 feet above datum? From A Rise 2·54 „ 2·90 „ 3·12 „ 2·17 „ 1·43 „ 0·26 Fall 0·47 „ 1·63 „ 1·85 Rise 0·39 B face of heading.
25	(3) The following data were obtained in a surface traverse between two points A and B, the direct distance between which cannot be measured because of obstructions. Calculate the bearing and length of a line AB. What is the difference in height between A and B?

	Bearing.	Distance. (links)	Vert. angle.
A–X	185° 36′	306·4	+ 5° 37′
X–Y	97° 45′	120·0	+ 3° 15′
Y–B	7° 22′	330·6	— 7° 23′

25	(4) Three boreholes on a level surface A, B and C intersect the same coal seam at depths of respectively 200 feet, 370 feet and 540 feet. Borehole C is 11 chains from A and 10 chains from B. Boreholes A and B are 8 chains apart. Using a graphic method, discover the rate of dip of the seam.
25	(5) Describe the method of measuring distances with a steel tape on horizontal ground and sloping ground, stating fully all precautions you would take to avoid error.

Possible Marks.	
25	(6) Two straight stretches on a railway survey make an angle with one another of 160°. Explain how you would set out, and make the necessary calculations for a circular curve of ten chains radius to join the two straights.
150	

Western Australia.

Department of Mines.

Coal Mines Regulation Act, 1902-1926.

EXAMINATION FOR FIRST CLASS CERTIFICATE OF COMPETENCY.

Subject: Ventilation and Dangerous Gases.

Friday, 21st April, 1944: 10 a.m. to 1 p.m.

Possible Marks.	
25	(1) When a cubic foot of air at a barometric pressure of 30 inches and a temperature of 60° Fahrenheit is subjected to a pressure of 31½ inches and raised to a temperature of 90° Fahrenheit, what volumes does it occupy in cubic inches?
25	(2) Describe the process of diffusion of gases. State what conditions are necessary for rapid and slow diffusion, respectively. Name the two gases commonly met with in mines that diffuse into each other more rapidly than either of them diffuses into any other gas in the mine.
25	(3) Enumerate the common causes of explosions in mines, and state what precautions you would take in order to minimise the risk of explosion.
25	(4) The following sample was collected from an area where a fire has been sealed off for a considerable time. Calculate the $\frac{CO}{O_2}$ ratio and the $\frac{CO_2}{O_2}$ ratio.

CO_2 equals 5.7 per cent.
CH_4 „ 48.95 „ „
O_2 „ 0.5 „ „
N_2 „ 44.85 „ „
CO „ 0.035 „ „

25	(5) The temperature and humidity of mine air are influenced by a variety of causes. Discuss the most important of such causes. What are the physiological effects of heat and moisture in mine air?
25	(6) In a dry and dusty mine, what in your opinion is the best method of rendering coal dust harmless?
25	(7) A quantity of air amounting to 75,000 cubic feet per minute requires a pressure equal to 4 inches W.G. to pass it through an airway of given length. What W.G. will be required to cause it to pass two airways, each of exactly the same dimensions as the first? Calculate H.P. in ventilation in each case.
25	(8) On the plan of a mine accompanying this paper, show how you would ventilate the workings, having regard to the requirements of hauling the coal, etc. Use the customary ventilation symbols to indicate the direction of each air current, position of air-crossings, doors, stoppings, brattice and regulators.
200	

Western Australia.

Department of Mines.

Coal Mines Regulation Act, 1902-1926.

EXAMINATION FOR FIRST CLASS CERTIFICATE OF COMPETENCY.

Subject: Coal Mines Regulation Act, 1902-1926.

Friday, 21st April, 1944: 2 p.m. to 4 p.m.

Possible Marks.	
22	(1) What are the duties and responsibilities of a manager, as defined in the Coal Mines Regulation Act, 1902-1926? Under what section does it specify them?
21	(2) What section deals with the cancellation of a manager's certificate and what does it say?
21	(3) What does the Schedule, Part VI., say in regard to earthing frames, etc.?
21	(4) What does the Act say in regard to Electrical Signal Appliances?
21	(5) The Act refers to single shafts, etc. State what section it is and what it says.
22	(6) Section 37 of the Act refers to Power of the Inspector. Enumerate what these powers are?
22	(7) What rule of the Schedule deals with the securing of roofs and sides? What does it say?
150	

APPENDIX No. 2.

Mines Department,
Kalgoorlie, 14th February, 1945.

The Chairman,

Board of Examiners for Underground Supervisors,
Perth.

REPORT ON ACTIVITIES OF BOARD OF EXAMINERS FOR UNDERGROUND SUPERVISORS FOR 1944.

I beg to submit the undermentioned report on the operations of the Board of Examiners for Underground Supervisors during the year ended 31st December, 1944.

A total number of 12 candidates sat for examinations. Nine at Kalgoorlie, two at Norseman and one at Agnew. Of these, 11 were granted certificates.

In July, 1944, Mr. Verran was appointed a member of the Board of Examiners in place of the late Mr. Winzar.

Examinations were held as applications were received, and oral examinations were conducted at Kalgoorlie by the late Mr. Winzar, Dr. Moore, Mr. Foxall and Mr. Verran. On the 26th and 27th September, Dr. Moore and Mr. Verran conducted two oral examinations at Norseman, and on the 28th September Mr. Lloyd conducted an examination at Agnew.

One Certificate of Service was issued during the year, and also one Duplicate Certificate of Competency. No Duplicate Certificate of Service was issued.

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

Underground Supervisors' Certificates of Competency.
1944.

574 Braun, Leslie Louis.
571 Cackett, William Stanley.
570 Doyle, Mitchell Ronald.
563 Gale, James.
569 Haddow, Jack Forsythe.
567 Mullins, Michael P.
568 McDermott, William Francis.
566 Pearce, Owen Harold.
573 Scollick, James.
565 Wilson, Nolan.
572 Wells, Jack Medworth.

Certificate of Service.

0330 Kennedy, Alexander Lorimer.

Duplicate Certificate of Competency.

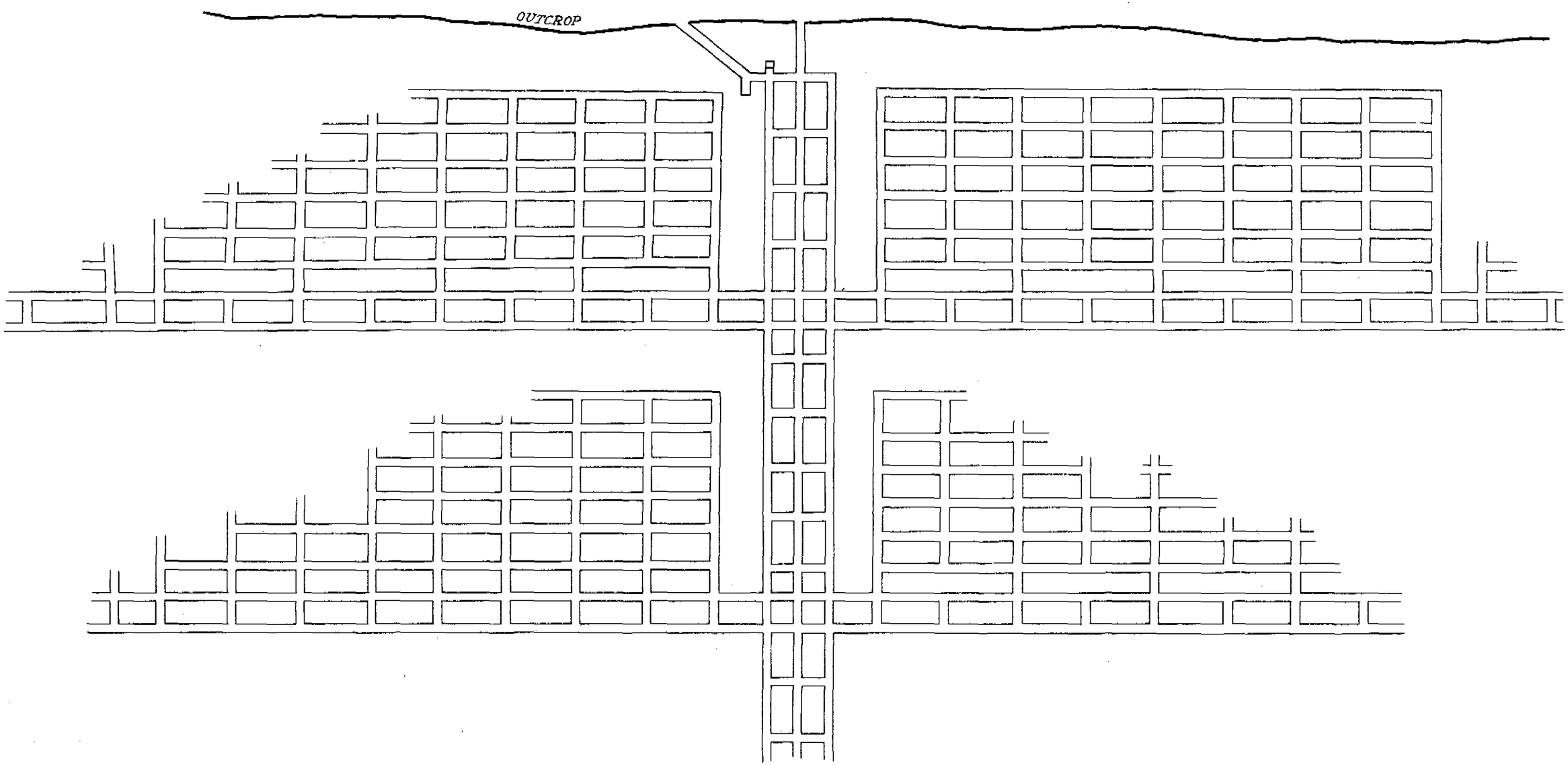
564 Platt, Thomas.

(Sgd.) BRON FARISS,
Secretary to Board of Examiners
for Underground Supervisors.

THE COAL MINES REGULATION ACT, 1902-1926

EXAMINATION FOR FIRST CLASS CERTIFICATE OF COMPETENCY

APRIL 19TH-21ST, 1944



APPENDIX No. 3.

THE COLLIE COALFIELD, ITS PROBLEMS AND ITS ECONOMIC IMPORTANCE.

By R. C. Wilson, B.Sc., B.E.

Read 13th July, 1943, before the Royal Society of Western Australia.

CONTENTS.

ILLUSTRATIONS.

INTRODUCTION.

It is the duty of each retiring President of the Royal Society to give a presidential address.

After consideration and bearing in mind the immense importance attached to the Coal Mining Industry in all parts of the world, I finally decided to deal with the Collie Coalfield, and to have something to say concerning its problems and its economic importance.

Our present knowledge of the coalfield is reviewed.

Estimates of coal reserves based on our present information have been made and care has been taken to show precisely how such estimates have been computed.

The geology of the field is dealt with in a general way and principally in so far as it concerns the amount of available coal or affects exploratory and underground mining operations.

An instructive model of the coalfield prepared under the author's supervision by Mr. I. R. Berry, Chief Draftsman of the Mines Department, and his assistants, Mr. A. A. Hall and Mr. J. McLean is exhibited. It is felt that by the aid of this model the numerous coal seams which exist can be more readily traced throughout the field than was previously possible.

Great importance is attached to a knowledge of the faults which occur. Some of the principal ones are described and the nature of a number of them is clearly shown on the model.

Attention is drawn to our incomplete information concerning a large portion of the coalfield and also, in the absence of deep boreholes, to our lack of knowledge of the behaviour of the coal seams at depth.

Reference is made to the occurrence of artesian water and underground water generally.

A brief description is given of the method of mining adopted on the field and the risk of creeps incurred thereby.

Mention is made of some proposals to increase production.

The address concludes with a brief description of the nature of the coal and the increasing demand for it as the result of the increased activities of the Railways and the Power House combined with the development of the secondary industries in the State.

Attention is drawn to the fact that the State policy of utilising Collie Coal whenever possible has given us an independence which we would not otherwise have had and which is most valuable at the present time when the shipping position has rendered the importation of large quantities of New South Wales coal impracticable.

Discovery of Coal at Collie.

Arthur Perren appears to have been the discoverer of coal at Collie. He had a run at Collie and according to his own story* he found, in 1883, pieces of coal just on the edge of the river about four miles down from the fall. The small pieces he threw into the river and the larger ones he took home.

He does not appear to have pursued the matter further until 1889, when he interested David Hay, a Bunbury merchant, in the matter.

* See "Sunday Times," August 9th, 1936.

Arthur Perren's son, Mr. A. J. Perren, kindly made available to me a copy of an agreement made between Arthur Perren and David Hay, which appears to me to be of sufficient interest to place on record. It reads as follows:—

Roelands,
23rd September, 1889.

Memorandum of Agreement made this date between Arthur Perren, Roelands Farmer and D. A. Hay, Bunbury Merchant, whereby the said Arthur Perren agrees to show the said D. A. Hay the locality where the said Arthur Perren obtained a substance resembling coal, a specimen of which is handed over to the said D. A. Hay in consideration of the said D. A. Hay taking up at his own cost and expense and further keeping the rent paid of 300 acres from the Government under lease in the joint names of Arthur Perren and D. A. Hay, both to hold equal shares in the said land with the view of further prospecting it for coal or other minerals. The said land is situated 30 miles from Bunbury. The said D. A. Hay further agrees to transfer 20 shares of the Bunbury Mineral Prospecting Co., No Liability, to the said Arthur Perren for the above-mentioned service.

Witness our hands this 23rd day of September, 1889.
(Sgd.) ARTHUR PERREN.
(Sgd.) D. A. HAY.

Extract from Arthur Perren's Diary.

September 24, 1889.

I took D. Hay up the Collie to show him the coal. Returned home next night 25th.

The late H. P. Woodward in a report on the Collie Coalfield in 1894, states that although coal was supposed to have been found many years before that date, nothing was done until the year 1889, when David Hay was induced to prospect the river bed.

After searching the river bed and the bottoms of pools, he and his party were rewarded by the discovery of fragments of coal, near T 17 and they decided to sink a shaft in the east bank of the river. This shaft was sunk to a depth of 18ft. and at 11ft. a 3ft. seam of very good coal was met with.

According to the report further prospecting disclosed an outcrop of coal on the south bank of a pool a little west of T. 26. This seam was tested by Shaft C and proved to be 11ft. 3in. in thickness.

A few other shafts are reported to have been sunk with varying success, but the first real attempt to prove the field was made by the Government in 1892, when on the recommendation of Dr. Robertson, F.G.S., the north-western portion of the field was tested by 18 boreholes.

This work would appear to have given production an impetus and by 1900 the output had reached 118,410 tons per annum.

The rate of progress since that date is indicated from the following figures:—

	Tons.
1900	118,410
1910	262,166
1920	462,021
1930	510,425
1940	539,427
1942	581,176

The total coal won from the field up to December 31st, 1942, was 16,112,000 tons, details of which are set out hereunder:—

Output of Coal from the Mines.

	Tons.
Westralia	1,589,308
Proprietary	5,192,461
Co-operative	3,344,460
Cardiff	2,755,187
Stockton	1,296,402
Griffin	935,520
Collie Burn	505,002
Premier	468,086
Others	25,574
	16,112,000

Geology.

The principal geological formations which concern the Collie Coalfield are set out in the order of their increasing age in the report of the 1916 Royal Commission, as follows:—

Cainozoic—Extensive alluvial deposits (Recent).
Laterite (Pleistocene?).
Lake Beds (Pleistocene?)

Permo Carboniferous—Collie Coal Measures.

Pre-Cambrian?—Crystalline rocks chiefly granites but including also gneisses amphobolites and quartz schists.

Whatever divergence of opinion there may be as to the precise geological age of these formations, there appears to be no doubt whatever that the formations are correctly set out in the order of their increasing age.

It is generally accepted that the Collie coal measures were far more extensive when they were laid down. The present coalfield can indeed be regarded as a remnant which has been preserved by being faulted down into the older crystalline rocks (granites) which completely surround it.

These original coal measures were no doubt laid down horizontally. They now, however, have a general dip of about 1 in 10 and it seems reasonable to suppose that this tilting of the measures is largely the result of hinge faulting, the southern end of the field having been dropped furthest into the granite.

The Wilga coalfield appears to represent another remnant of the same coal measures faulted down into the granite in a similar manner.

In this connection it is interesting to record the following statement by the late A. Montgomery, State Mining Engineer, in evidence before the 1916 Royal Commission prior to the discovery of coal at Wilga:—

I have made no examination of the country round the Collie field, but from the nature of the coal occurrence and from general geological conditions, I should think it extremely probable that there may be similar patches of coal measure country in the district, or in fact anywhere along the Darling Range, thrown down by faults into the shelter of the granite.

ECONOMIC IMPORTANCE OF THE GEOLOGICAL FORMATIONS.

Cainozoic.

These formations can be grouped together under the general term of superficial deposits and from a coal mining point of view they have no merit. They contain nothing of known economic value and rest unconformably upon the coal measures and effectively obscure all outcrops on the field.

Their mode of occurrence is shown in Plate 1, which is taken from the report of the 1916 Royal Commission.

In that report it is stated that at the Proprietary Mine the outcrop of the mine is concealed under a thickness of about 80 feet of Lake Beds.

Fortunately the beds do not cover all outcrops of the coal seams to this depth, many coal seams having been intersected at less than 20 feet. Nevertheless, no coal seam can be located anywhere in the field except by means of a borehole, shaft, or other excavation.

We have already seen that the discovery of the coal was made in the river bed, the river having cut its way through the superficial deposits.

Permo Carboniferous—The Collie Coal Measures.

These measures underlie the Cainozoic or superficial deposits which rest unconformably upon them. Their boundaries are not easily determinable, but the generally accepted mapping shows them to occupy an area of approximately 76 square miles and to be surrounded on all sides by pre-Cambrian granites, and as we will see later, the boundaries are largely fault planes. The thickness of the measures is estimated to be at least 2,000 feet.

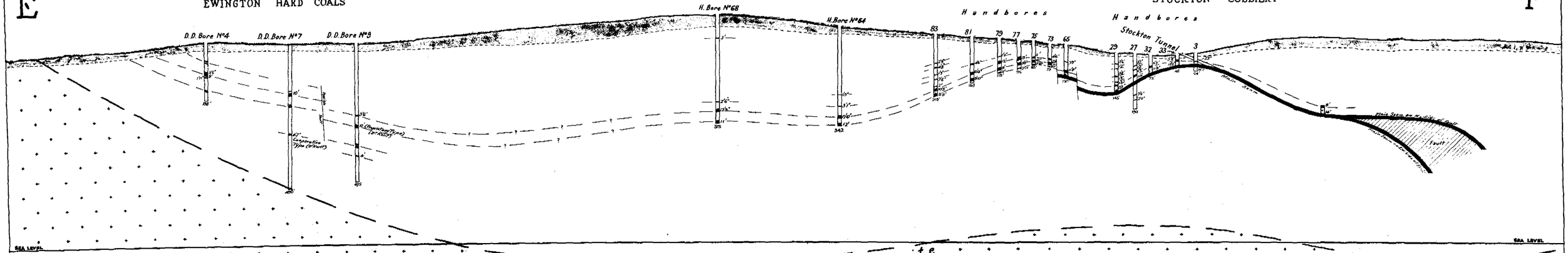
Reference has frequently been made to the remarkable uniformity in direction and dip of the coal seams, which can also be taken to represent the direction and dip of the measures including them. While this can be accepted as being generally correct, reference to the model will show that while the coal seams generally dip in a

E

EWINGTON HARD COALS

STOCKTON COLLIERY

F



Possible position of Granite

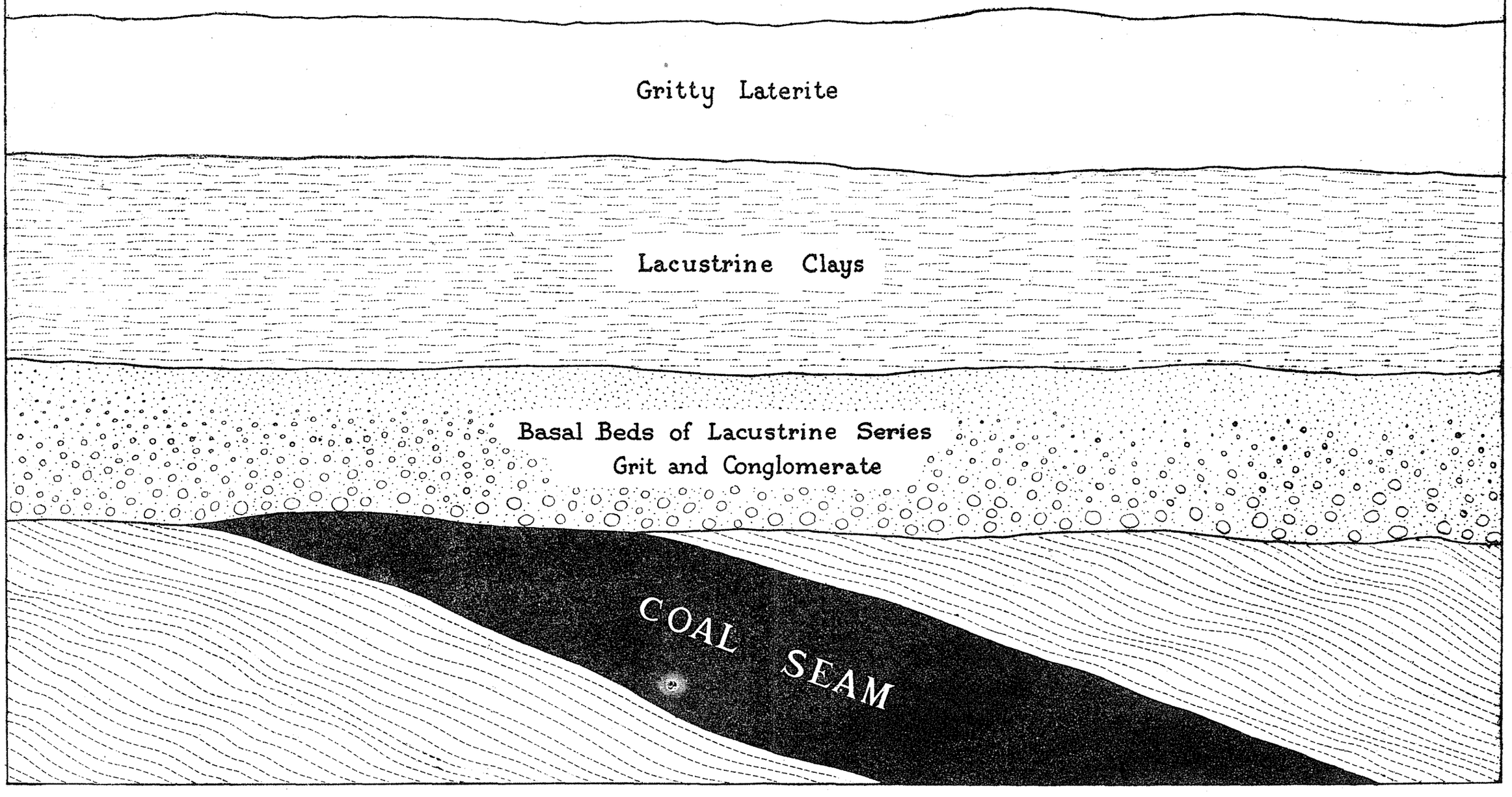
SECTION THROUGH STOCKTON AND EWINGTON

Horizontal Scale : 0 4 8 12 16 20 Chains

Vertical Scale : 0 50 100 200 300 400 Feet

PLATE Nº I

SECTION OF LACUSTRINE BEDS
UNCONFORMABLY OVERLYING COAL MEASURES
PROPRIETARY (BULLFINCH) TUNNEL
COLLIE



southerly direction at an angle of about 1 in 10, there are many local rolls, causing flattening and steepening of the seams.

Furthermore, for a considerable area north of the Stockton tunnel mouth, the beds have flattened out and have completely lost their southerly dip, becoming comparatively horizontal.

A similar condition exists at the southern portion of the Cardiff Mine, where the beds after flattening out finally rise in a southerly direction as the boundary fault of the field is approached.

In composition the beds consist predominantly of coarse and fine sandstones interbedded with shales and coal seams, particulars of which can be ascertained from the logs of the bores. On the model consideration was given to showing details of strata met with in the boreholes, but as it seemed that this extra work was unlikely to give much additional information regarding horizons, it was not proceeded with.

The information shown on the model has proved very helpful in the preparation of cross-sections. A cross section on a line A.B. (Plate III.) through the Proprietary Mine, the Scottish Colliery and alongside the Cardiff Mine indicates that the coal seams of 5 ft. and over and the strata between them are somewhat as set out hereunder.

COAL MEASURES AS INDICATED BY THE CROSS SECTION A–B

Depth.				Width.		Strata or Coal.	Bore Information Taken From.
ft.	in.	ft.	in.	ft.	in.		
0	0 —	67	0	67	0	Strata	Cardiff (Calyx) No. 2.
67	0 —	72	0	5	0	Coal	Cardiff (Calyx) No. 2, No. 1 Seam.
72	0 —	77	0	5	0	Strata	do. do. do.
77	0 —	82	6	5	6	Coal	Cardiff (Calyx) No. 2, No. 2 Seam.
82	6 —	310	6	228	0	Strata	do. do. do.
310	6 —	317	7	7	1	Coal	Cardiff (Calyx) No. 2, No. 3 Seam (Cardiff).
317	7 —	362	7	45	0	Strata	Cardiff (Calyx) No. 1.
362	7 —	369	11	7	4	Coal	Cardiff (Calyx) No. 1, No. 4 Seam.
369	11 —	620	11	251	0	Strata	do. do. do.
620	11 —	626	11	6	0	Coal	Cardiff (Calyx) No. 1, No. 5 Seam.
626	11 —	842	11	216	0	Strata	Collie Boulder (Calyx) No. 3.
842	11 —	848	11	6	0	Coal	Collie Boulder (Calyx) No. 3, No. 6 Seam.
848	11 —	965	11	117	0	Strata	do. do. do.
965	11 —	973	9	7	10	Coal	Collie Boulder (Calyx) No. 3, No. 7 Seam.
973	9 —	1107	9	134	0	Strata	do. do. do.
1107	9 —	1115	6	7	9	Coal	Collie Boulder (Calyx) No. 1, No. 8 Seam (Collie Burn Seam).
1115	6 —	1223	6	108	0	Strata	do. do. do.
1223	6 —	1229	6	6	0	Coal	Collie Boulder (Calyx) No. 1, No. 9 Seam.
1229	6 —	1424	6	195	0	Strata	Collie Boulder (Calyx) No. 5.
1424	6 —	1430	5	5	11	Coal	Collie Boulder (Calyx) No. 5, No. 10 Seam (Collie Burn Seam No. 2).
1430	5 —	1613	5	183	0	Strata	do. do. do.
1613	5 —	1619	1	5	8	Coal	Collie Boulder (Calyx) No. 5, No. 11 Seam.
1619	1 —	1769	1	150	0	Strata	Proprietary (Calyx) No. 3.
1769	1 —	1775	1	6	0	Coal	Proprietary (Calyx) No. 3, No. 12 Seam.
1775	1 —	2265	1	495	0	Strata	do. do. do.
2265	1 —	2273	1	8	0	Coal	Proprietary (Calyx) No. 3, No. 13 Seam (Moira).
2273	1 —	2283	1	10	0	Strata	do. do. do.
2283	1 —	2291	1	8	0	Coal	Proprietary (Calyx) No. 3, No. 14 Seam (Dirty).
2291	1 —	2324	1	33	0	Strata	do. do. do.
2324	1 —	2334	7	10	6	Coal	Proprietary (Calyx) No. 3, No. 15 Seam (Proprietary Seam).

Pre-Cambrian.

The pre-Cambrian rocks, mostly granites, form the floor on which the coal measures have been laid down.

This granite floor has unfortunately been intersected by so few boreholes that we know little or nothing of its contour. It may be of the nature of an inclined plane, but on the other hand it may be quite hilly and irregular. The small granite outcrops which appear as islands in the coal measures, quite likely represent ancient granite peaks.

Its economic interest is, of course, that when met with in a borehole it is known that the bottom has been reached and boring for coal may be discontinued.

Correlation of the Principal Coal Seams.

The model of the coalfield is most helpful in an attempt to correlate the coal seams.

After a study of the information now available, the author is in general agreement with the correlation submitted by the late T. Blatchford in a report to the Herman Commission, dated the 17th November, 1932.

The seams worked occur at three principal horizons, viz.:—

The Co-operative Horizon (the deepest).
The Collie-burn Horizon (the middle).
The Cardiff Horizon (the top).

The Co-operative Horizon.

Blatchford expressed the opinion that the Co-operative Horizon extended through the following collieries, starting from the West—Westralian, Co-operative, Old Proprietary (Wallsend), Proprietary, Stockton and possibly the Premier.

A study of the model supports this view, except that bearing in mind the nature of the coal, there seems more reason to include the Premier Mine in the Collie-burn Horizon. Recent developments at the Stockton Mine now point strongly to the fact that the seams proved by Hard Coals Ltd. also belong to the Co-operative Horizon.

An interesting fact is that the coal in the principal seam worked improves in quality going westward. This advantage is, however, offset by the fact that at the west end of the field the seam is split in two by a stone (shale) band.

At the Proprietary Mine the seam is free from any stone band. At the east end of the Co-operative Mine it is a few inches in width and in the west end it is 27 inches in width.

This Horizon has three principal seams, viz.:—

The Moira Seam (top).
The Dirty Seam (middle).
The Main Seam (bottom).

The Moira Seam was worked over a small area.

The Dirty Seam has not been worked at all, but some coal from this seam will be obtained shortly by open cut mining (see page 41).

The Main Seam has produced practically the whole of the eleven million tons of coal won from this Horizon up to 31st December, 1942.

The Collie-burn Horizon.

At the eastern end of this horizon two seams have been worked, viz.:—

No. 1 Collie-burn Seam,
and
No. 2 Collie-burn Seam.

At the western end of this horizon the Griffin Main Seam has been extensively worked and preparations are in progress to open up another seam 12 feet in width which appears to be some 250 feet above the main seam.

For the present it is sufficient to suggest that these two seams may be the western continuations of the No. 1 and No. 2 Collie-burn Seams.

The seam worked at the Premier Mine is of the Collie-burn type and for this reason it seems probable that it belongs to this horizon. This view also receives some support from the fact that the Stockton Seam at the east end of the mine has a distinct easterly dip, indicating that if it persists it will be found under the Premier Seam.

The Cardiff Horizon.

The principal seam in this horizon is estimated to be approximately 800 feet above the No. 1 Collie-burn. The coal is, however, similar in type and has about the same carbon ratio. The coal won has been somewhat lower in calorific value than that won from the other horizons.

Faulting on both sides of the Cardiff Mine has thrown the continuations of the seam nearer the surface and a portion of it has been removed by denudation.

A limited amount of coal only can be anticipated from this horizon.

MODEL OF MINES AND COALFIELD.

The model, to which reference has already been made, aims at showing in their correct position all coal seams met with in mine workings and boreholes on the coalfield. It also shows all the mine workings themselves.

Prior to its construction a very considerable time was spent searching through departmental files, geological reports, etc., for the necessary data.

The model was then constructed as follows:—

Mine plans to a scale of 8 chains to an inch, covering all that portion of the coalfield prospected by mine workings or boreholes, were mounted on a plywood base, approximately ½ inch thick.

A number of wires (13 gauge) were then covered with paper to represent boreholes (about 400 in all) and fitted into tightly fitting vertical holes in the plywood base.

As the deepest bore is some 1,134 feet in depth and the average height above sea level of the coalfield is 600 feet, a vertical scale of 100 feet to an inch was selected and the datum level of the base board was fixed at 450 feet below sea level.

Subsequently plans on cardboard of the workings of all the mines were suspended in their vertical positions. As the coal seams roll in places and are faulted in others, the cardboard had to be moulded into the correct shape. Faults have been shown by slitting the cardboard and inserting lens or wedge shaped pieces which represent the fault planes and show the correct displacement of the coal seams.

The value of the model for all future operations can hardly be over-estimated and it is proposed that it will be continually kept up to date.

ESTIMATE OF AVAILABLE COAL IN COALFIELD.

The available coal at Collie was estimated by Professor Woolnough in 1916 at 3,500 million tons.

Dr. Jack's estimate in 1904, evidently on a much more conservative basis, was 310 million tons.

Unfortunately, neither of these estimates gives any details as to the manner in which the estimate was made.

The estimate of coal reserves set out hereunder has been compiled in the following manner.

The coalfield, as defined by the Geological Survey plans has been divided into Area A of 48 square miles, which has been tested to some extent by workings and boreholes and Area B of 28 square miles, concerning which we have very little information.

No coal which may exist in Area B is included in this estimate.

No seams under 5 feet in width are included in the estimate.

All coal seams of 5 feet and over which are shown in Section AB are included with the exception of Seam No. 1 and Seam No. 14. The former seam can extend over a small unknown area only and the latter, known as the dirty seam, has been omitted because it contains so many shale bands.

Each seam is assumed to extend over that part of Area A included between the outcrop and the southern boundary as at present defined.

Thus, Seam 13, which outcrops at the northern end of the field, is assumed to extend over an area of 36 square miles, while Seam 7, which outcrops in the middle of the field, is assumed to extend over 13 square miles.

Future operations will no doubt give more precise information regarding the average width of the seams and the areas over which they extend, but it is thought that no estimate can at present be computed on a more reliable basis than that tentatively set out hereunder.

COLLIE COALFIELD.

Estimated Coal in Seams of 5ft. and over in Area A (Prospected Portion) of Coalfield.

Coal Seam.	Area Covered by Seam. Total Area. sq. mls.	Area Worked sq. mls.	Area Unworked. sq. mls.	Average Width of Seam. ft. in.	Information on which Width is based	Average. Width Worked Ft. In.	Total Tonnage in Unworked Are . Tons.	Coal Mined up to 31st Dec., 1942. Tons.	Remarks.
No. 1	....	....	....	....	....	....	....	....	Insufficient information.
No. 2	1·75	....	1·75	5 0	Cardiff No. 2 (Calyx) 5 ft. 6 in. .... Cardiff No. 35 (Hand) 5 ft. 6 in. .... Cardiff No. 31 (Hand) 3 ft. 9 in.	....	9,000,000		
No. 3	3·00	0·72	2·28	12 0	Mine Workings	7 0	37,000,000	2,755,187	
No. 4	5·00	....	5·00	7 6	Cardiff No. 1 (Calyx) 7 ft. 4 in. .... Cardiff No. 9 (Hand) 8 ft. 5 in. .... Cardiff No. 35 (Hand) 13 ft. .... Cardiff No. 17 (Hand) 7 ft. 5 in.		39,000,000	....	The 13 ft. Seam in Cardiff No. 35 Bore is omitted in computing the average width as this may turn out to be the Main Cardiff Seam.
No. 5	9·00	....	9·00	5 6	Collie Boulder No. 3 (Calyx) 5 ft. 4 in. Cardiff No. 1 (Calyx) 6 ft.	....	51,000,000		
No. 6	11·00	....	11·00	5 0	Collie Boulder No. 7 (Hand) 2 ft. .... Collie Boulder No. 2 (Calyx) 8 ft. .... Collie Boulder No. 3 (Calyx) 3 ft. 6 in. Cardiff No. 1 (Calyx) 6 ft.	....	57,000,000		
No. 7	12·00	....	12·00	6 0	Collie Boulder No. 7 (Hand) 4 ft. 9 in. Collie Boulder No. 2 (Calyx) 6 ft. .... Collie Boulder No. 3 (Calyx) 7 ft. 10 in.	....	74,000,000		
No. 8	13·00	0·04	12·06	8 6	Collie Boulder No. 1 (Calyx) 7 ft. 9 in. Collie Boulder No. 2 (Calyx) 9 ft. 4 in.	7 6	114,000,000	505,002	Collie Boulder No. 1 tentatively assumed to be the Griffin Top Seam.
No. 9	14·00	....	14·00	5 0	Collie Boulder No. 1 (Calyx) 6 ft. .... Collie Boulder No. 3 (Calyx) 4 ft.	....	72,000,000		
No. 10	16·00	0·30	15·70	7 0	Collie Boulder No. 5 (Calyx) 5 ft. 11 in. Grillin Workings 8 ft. 2 in.	7 0	116,000,000	935,520	Collie Boulder No. 2 tentatively assumed to be Griffin Main Seam.
No. 11	20·00	....	20·00	5 6	North Collie Burn No. 13 (Hand) 5 ft. 11 in. North Collie Burn No. 18 5 ft. 6 in. Collie Boulder No. 5 (Calyx) 5 ft. 8 in.	....	114,000,000		
No. 12	24·00	....	24·00	6 0	Proprietary No. 3 (Calyx) 6 ft.	....	149,000,000		
No. 13	33·00	0·006	32·994	6 0	Proprietary No. 1 (Calyx) 4 ft. .... Proprietary No. 5 (Calyx) 8 ft.	....	205,000,000	9,290*	Assumed to be the Moira Seam met with in Westralia and Co-operative Mines.
No. 14	34·00	....	34·00	6 0	Proprietary No. 1 (Calyx) 4 ft. .... Proprietary No. 5 (Calyx) 8 ft.	....	211,000,000	....	Assumed to be the Dirty Seam met with in Westralia and Co-operative Mines.
No. 15	36·00	3·00	33·00	8 0	Mine Workings	7 6	273,000,000	11,413,341	Proprietary Seam assumed to also be main seam worked in Westralia, Co-operative, and Stockton Mines.
Coal from Premier and other uncorrelated seams						....	....	493,660	
							1,521,000,000	16,112,000	

* Estimated from Plan of Workings.

Note.—Operations at the Stockton Mine subsequent to the reading of this paper have indicated that seams assumed to be Nos. 14 and 15 are considerably wider than the average width of these seams used in this estimate.

PLATE VII.

AMALGAMATED COLLIERIES OF W.A. LTD.

PROPRIETARY COLLIERY.

Collie Coalfield (C.M.L. 93).

Collie.

Section of No. 3 Proprietary Seam.

Sandstone

2′ 0″ Coal

1′ 6″ Black Shale

8′ 0″ Coal

Working Height 7′ 6″

4″ Sandy Shale

2″ Black Shale

2′ 6″ Coal

Shale

CO-OPERATIVE COLLIERY.

Collie Coalfield (C.M.L. 113).

Collie.

Section of No. 3 Co-operative Seam.

Sandstone.

1′ 0″ Coal

1′ 10″ Sandy Shale

11″ Coal (High Ash)

3′ 7″ Coal

Working Height 7′ 3″

5″ Gray Stone Band

4″ Dark Splint

5″ Gray Stone Band

2′ 6″ Coal

6″ Dark Sandy Shale

Sandstone

CARDIFF COLLIERY.

Collie Coalfield (C.M.L. 203)

Cardiff.

Section of No. 1 Cardiff Seam.

Shale

(High Ash)

12′ 4″ Coal

Working Height 7′ 0″

Shale

STOCKTON COLLIERY.

Collie Coalfield (C.M.L. 78)

Collie.

Section of No. 2 Stockton Seam.

Sandstone

Working Height 8′ 6″ 9′ 0″ Coal

1′ 3″ Black Shale

2′ 0″ Coal

Shale

PLATE Nº III

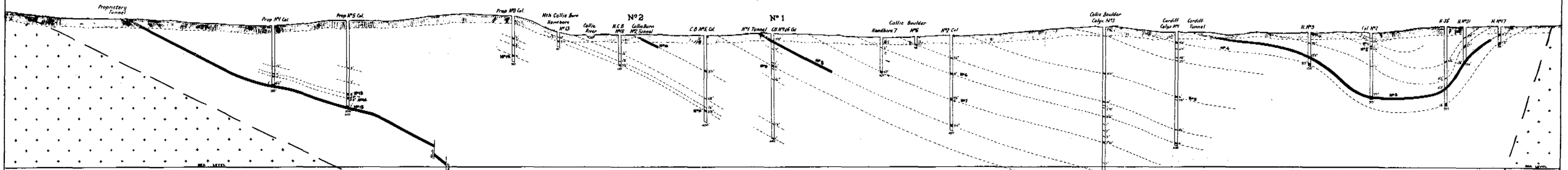
A

PROPRIETARY COLLIERY

COLLIE BURN COLLIERY

CARDIFF COLLIERY

B



Horizontal Scale: 0 4 8 16 24 32 Chains

Vertical Scale: 0 50 100 200 300 400 Feet

Nota. Bores projected on Strike to line of Section.

CROSS SECTION
— OF —
COALFIELD

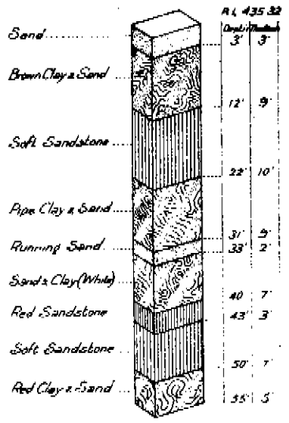
Possible position of Granite

PLAN OF
COLLIE COAL BASIN
Showing position of Outcrops of Seams assumed for Estimation of Coal Reserves

WESTRALIA COLLIERY
Hay's Shaft
CO-OPERATIVE COLLIERY
WALLSEND COLLIERY
PROPRIETARY COLLIERY
GRIFFIN COLLIERY
COLLIEBURN (SCOTTISH) COLLIERY
CARDIFF COLLIERY
STOCKTON COLLIERY
PREMIER COLLIERY (Closed)
MUJA
WALLSENDS FAULT
FAULT
EAST COLLIE BORES
SEAM No 15 14 13
Approx 48 sq. miles
Approx 28 sq. miles
MUNGALUP TOWNSITE
Water Supply Catchment Area
State Forest
No 26
Scale of Chains 0 40 80 120 160
Hon. A. H. Panton, M.L.A. Minister for Mines
DEPARTMENT OF MINES WESTERN AUSTRALIA

SECTIONS OF BORES ON THE
EAST COLLIE COAL MINING BRIQUETTING & BY-PRODUCTS Cº (1920) LTD
BLACK DIAMOND PROPERTY

Nº 1.



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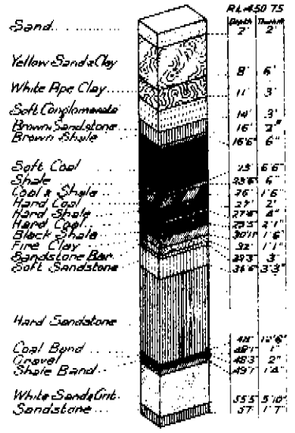

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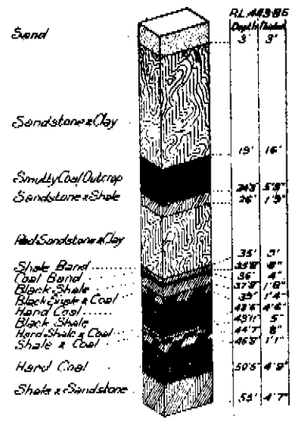

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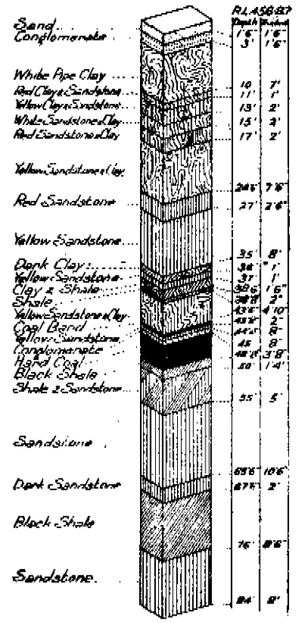

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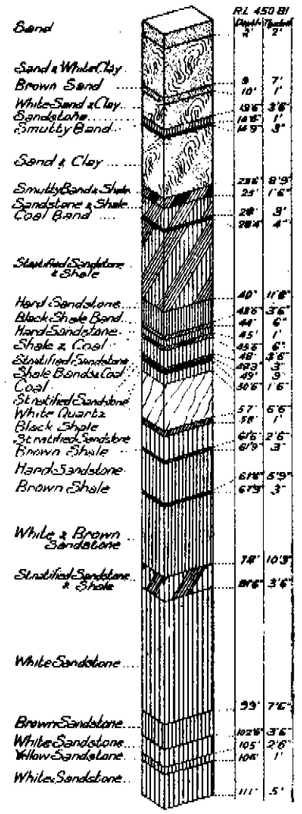

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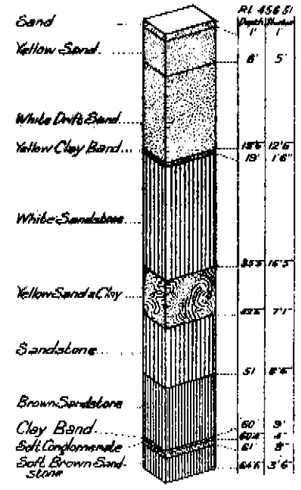

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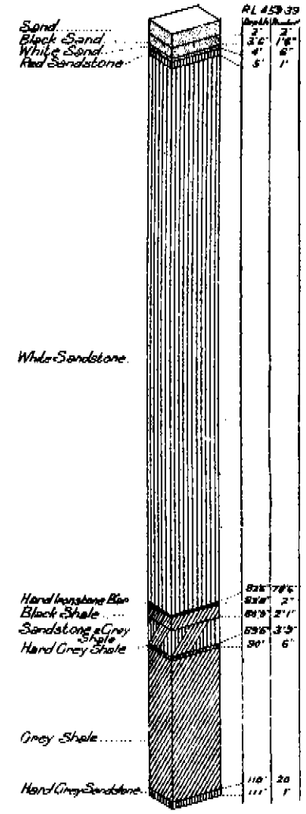

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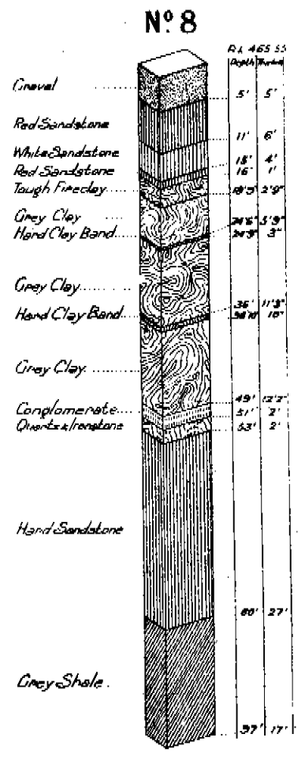

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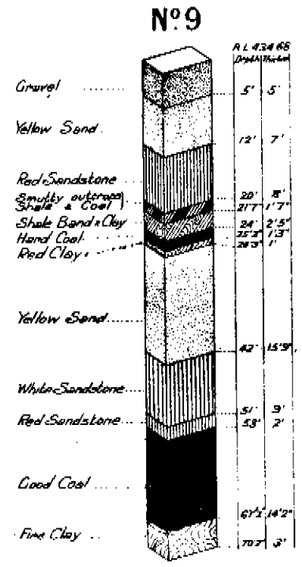

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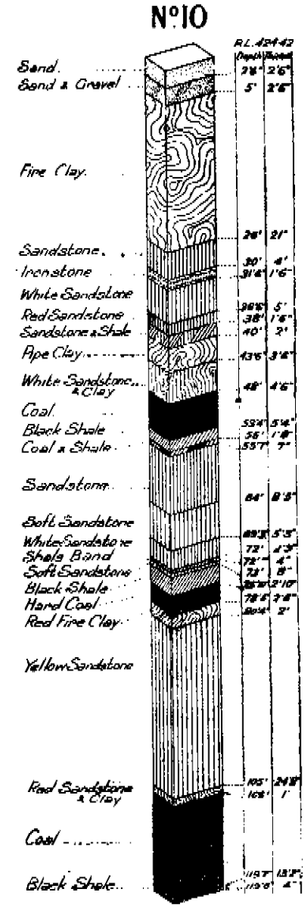

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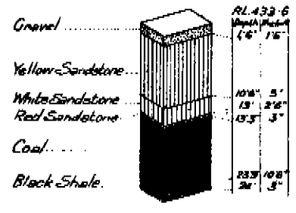

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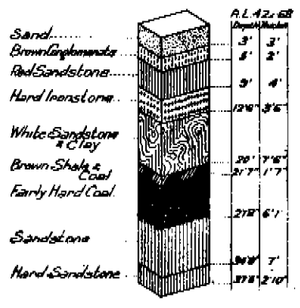

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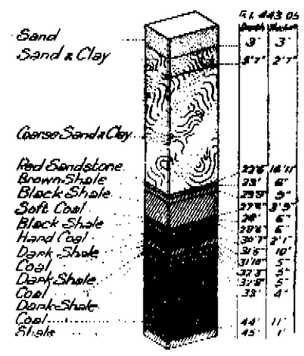

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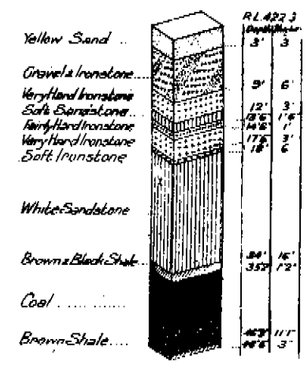


I hereby Certify that these records are correct, and were obtained under my personal supervision

John Ewing

Licensed Surveyor

22 · 9 · 20

VERTICAL SCALE

SECTIONS OF BORES ON THE

EAST COLLIE COAL MINING, BRIQUETTING & BY-PRODUCTS Cº. (1920) LTD.

EAST COLLIE PROPERTY.

Nº1

Hard Ironstone
White Clay
Red Clay
Pipe Clay & Red Clay
Sandstone
Sandy Clay Shale
White Clay
Sandy Clay
Red Clay
Sandy Clay
Blue Clay
Sandy Clay
Sandy Grit
Brown Shale
Loose Sandstone
White Sandy Gravel
Sandy Clay
Red Clay

Nº2

Ironstone
White Clay
Loose Sandstone
White Clay
Sandstone Clay
Red Ironstone Clay
Yellow Sandy Clay
Granite

Nº12

White Sand Ironstone & Quartz
Sandstone
Brown Shale
Sandstone
Hard Ironstone Black Shale & Quartz
Hard Country
Very Hard Rock

Nº3

Sandy Gravel
Red Clay
Brown Clay
Quartz & Sand
Quartz & Grit
Brown Shale
White Sandy Clay
Light Brown Shale
Yellow Grit
Dark Shale
White Clay
Brown Clay Shale
Brown & White Shale
Black & Brown Shale
Coal
Brown & White Shale
Brown Shale
Brown Sandstone
Brown Shale
Sandstone
Dark Shale
Coal
Brown Shale

Nº4

Sand
Ironstone
Conglomerate
Yellow Sand
Yellow Clay
Conglomerate
Brown Shale
Brown Sandstone
Brown Shale
Black Shale
Sandstone
Brown Shale
Sandstone & Quartz
White Shale Clay
Brown Shale
Black Shale
Coal
Sandstone
Brown Shale
Sandstone
Black Shale
Sandstone
Sandstone & Quartz
Brown Shale
Sandstone

Nº5

Soil
Ironstone
Conglomerate
Sandstone
Sandstone & Ironstone Clay
Brown Shale
Sandstone & White Clay
Light Brown Shale
Soft Sandstone
Brown Shale & Clay
Soft Sandstone
Hard Sandstone
Soft Sandstone
Hard Sandstone

Nº13

White Sand
Brown Sand
Clay & Sandstone
Clay & Quartz
Yellow Sand & Quartz
Granite

Nº6

Ironstone Gravel
Red Ironstone
Light Red Ironstone
Light Brown Shale
Pink Ironstone
Brown Shale
Black Shale
White Shale & Clay
Sandstone
Clay & Shale
Pink Ironstone
White Clay & Quartz
Sandstone
Brown & Black Shale
Coal
Brown Shale
Brown Ironstone
Brown Shale
Sandstone
Black Shale
Coal
Brown Shale
Sandstone
Brown Shale
Sandstone
Brown Shale
Sandstone
Brown Shale
Sandstone
Brown Shale
Sandstone

Nº7

Gravel
Ironstone
Conglomerate
Clay & Quartz
Clay & Ironstone
Red Clay
Yellow Sand Grit
Brown Shale
Hard Quartz
Sandstone
Brown Shale
Red Sandstone
Brown Shale
Red Clay & Sand
Red Sand Rock
White Sandstone
Brown Shale
White Sandstone
Black Shale
Coal
Brown Shale
Hard Sandstone
Brown Shale
Hard Black Shale
Sandstone
Brown Shale
Sandstone
Brown Shale
Sandstone
Brown Shale
Coal
Brown Shale
Sandstone
Brown Shale

Nº8

Ironstone Gravel
Ironstone & Clay
Hard Ironstone
Ironstone Clay
Red Sandstone
White Sandstone
Pipe Clay
White Sandstone
Red Clay & Sandstone
Brown Sandstone
Pink Sandstone
Light Brown Shale
Brown Sandstone
White Sandstone
Ironstone Clay
Dark Brown Shale
Light Brown Shale
Conglomerate
Hard Very Hard
Brown Shale
Good Sandstone
Tough Sandstone
Light Brown Shale
Sandy Clay
Sandstone & Shale
Sandy Conglomerate
Dark Brown Shale
White Sandstone
Mixed Brown Shale
Sandstone
Dark Brown Shale
Sandstone
Dark Brown Shale
Sandstone

Nº9

Sand
Sandstone & Gravel
Clay & Sandstone
Clay & Red Sandstone
Hard Clay & Sandstone
Sandstone & Gravel
Red Clay
Sandstone
Clayey Sandstone
White Sandstone
Black Shale
Coal
Brown Shale
Black Shale & Coal
Brown Shale
White Sandstone
Brown Shale
Dark Brown Shale
Sand Drift
Sandstone
White Brown Shale
Sandy Clay
Sandstone
Soft Sandstone
White Sandy Clay
Black Shale & Coal
Hard Black Shale
Shale & Sandstone
Hard Pitch
Soft Sandstone
Brown Sandstone
Dark Sandstone
Black Shale
Coal
Sandstone
Coal
Sandstone
Black Shale
Sandstone
White Shale & Clay
Brown Shale & White Shale
Sandstone
Brown Shale
Black Shale
Brown Shale
Sandstone
Black Shale
Brown Shale & Very Hard Sandstone
Brown Shale
Sandstone & Clay

Nº10

Ironstone Gravel
Hard Ironstone
Soft Ironstone
Sandstone
White Clay
Brown Shale
Sandstone
Dark Shale
Yellow Sandstone
Brown Shale
Black Shale
Brown Shale
Sandstone
Conglomerate
White Pig
Sandstone
Brown Shale
Sandstone
Gravel & Pebble Sandstone
Sandstone
White Clay Quartz
Brown Shale
Dark Shale
Shale & Sandstone
Soft Sandstone
Clay & Sandstone
Hard Sandstone

Nº24

Sand
Ironstone
Soft Sand
Sandstone & Clay
Brown Shale & Clay
Black Shale & Coal
Brown Shale
Sandstone & Clay
Brown Shale
Sandstone
Coal
Quartz & Stone
Coal
Shale & Sandstone
Coal
Shale & Coal Blends
Shale & Sandstone
White Sandstone
Shale & Sandstone
Hard Black Shale
Coal
Black Shale
Coal
Black Shale
Sandstone & Drift

Nº11

Hard Sandstone & Sandstone
Sandstone & Clay
Rubble Clay & Sandstone
Brown Sandstone
Brown & White Sandstone
Yellow Sandstone
White Sandstone
Brown Sandstone
White Sandstone
White Sandstone & Quartz
White Clay & Sandstone
White Sandstone
Clay Quartz & Sandstone
Brown Shale
Dark Shale
Shale & Sandstone
Hard Black Shale
Soft Black Shale
Hard Black Shale
Black Sandstone
Sandstone
Shale & Sandstone
Light Coal Clay
Black Shale
Coal
Black Shale
Black & Brown Shale
Black Shale
Brown Sandstone
Brown Sandstone
Hard Black Shale
Black Shale
Brown Sandstone
White Sandstone
White Sandstone & Clay
Sandstone & Clay
Sandstone & Shale
Black Shale
Coal
Sandstone & Drift

Nº23

Black Sand
White Sand
Ironstone
Hard Sandstone
White Clay
Sandstone
Sandstone & Clay
Light Clay
Clay & Sandstone
Ironstone Clay
Sandstone & Shale
Black Shale
Hard Black Shale
Sand Drift
Sandstone & Clay
White Clay
Black Shale
Sandstone
Brown Shale
White Sandstone
Shale & Sandstone
Hard Black Shale
Coal
Black Shale
Coal
Black Shale
Shale & Sandstone
Black Shale
Sandstone & Drift
Sandstone & Shale
Black Shale
Shale & Sandstone
Black Shale
Coal
Black Shale
Sandstone & Drift

Nº14

Sand
Clay & Sand
Brown Shale
Brown Sandstone
Clay & Sandstone
Brown Shale & Sandstone
Black Shale
Brown Shale
Black Shale
Grey Shale
Black Shale
Coal
Black Shale
Brown Shale
Sandstone & Shale
Sandstone & Shale
Black Shale
Coal
Black Shale
Brown Sandstone
Black Shale
Coal
Ironstone Clay
Brown Shale
Sandstone
Black Shale
Sandstone & Black Shale
Sandstone

Nº15

Sand
Pipe Clay
Brown Shale & Clay
Brown Shale
Black & Brown Shale
Black Shale
Black Shale
Coal
Brown Shale
Sandstone
Black Shale
Coal
Brown Shale & Sandstone
Black Shale & Sandstone
Coal
Black Shale
Hard Black Shale & Sandstone
Clay & Sandstone
Black Shale & Sandstone
Hard Black Shale
Coal
Brown Shale
Coal
Black Shale
Coal
Black Shale
Sandstone & Clay
Soft Sandstone & Clay

Nº16

White Sand
Brown Sand
Ironstone
White Clay
Sandstone & Clay
Ironstone & Clay
Brown Shale
Black Shale
Black Shale & Sandstone
Coal
Soft Sandstone
Black Shale
Hard Black Shale
Coal
Brown Shale
Brown Shale & Sandstone
Coal
Black Shale
Coal
Brown Shale
Sandstone

Nº17

Sand
Conglomerate
White Sand & Quartz
White Clay
Brown Shale
Black Shale
Very Hard Black Shale
Hard Coal
Brown Shale
Brown Shale & Sandstone
Sandstone & Clay
Brown Shale
Black Shale
Coal
Black Shale
Shale Sandstone & Clay
Sandstone
Hard Black Shale
Coal
Black Shale
Coal
Shale & Clay
Coal
Black Shale
Shale & Sandstone
Sandstone Drift

Nº18

Sand
Ironstone
Conglomerate
Clay Sandstone & Quartz
Shale Sandstone
Black Shale & Clay
Black Shale
Hard Red Sandstone
Red Sandstone
Red Sandstone Drift
Brown Shale
Black Shale
Coal
Black Shale
Sand Drift
Brown Shale
Black Shale
Coal
Hard Black Shale
Coal
Black Shale & Sandstone
Black Shale
Coal
Sandstone Drift

Nº19

Sand
Ironstone
Hard Sandstone Clay
Ironstone
Hard White Clay
Sandstone
White Clay
Ironstone & Clay
Brown Sandstone
Red Clay
Red Sandstone
Brown Shale & Clay
Sandstone & Clay
Light Brown Shale
Black Shale
Black & Brown Shale
Light Brown Shale
Sandstone
Brown Shale
Black Shale
Coal
Brown Shale
Coal
Black Shale & Coal
Black Shale
Brown Shale & Sandstone
Sandstone

Nº20

Sand
Conglomerate
Ironstone
Hard White Clay
Sandstone
White Clay
Ironstone & Clay
Brown Shale & Sandstone
White Clay & Sandstone
Brown Shale
Brown Shale & Sandstone
Clay & Sandstone
Brown Shale & Sandstone
Black Shale
Coal
Hard Black Shale
Brown Black Shale
Coal
Black Shale
Coal
Hard Stone & Conglomerate

Nº21

Sand
Ironstone
Hard Sandstone
Red Sand
White Clay
Brown Clay
Red Sandstone
Drift Sand
Brown Shale
Brown Shale
Brown Shale
White Sandstone
Sandstone & Clay
Brown Shale & Clay
Hard Black Shale
Hard Sandstone
Brown Shale
Black Shale
Brown Shale & Clay
Clay & Sandstone
Sandstone
Black Shale
Sandstone
Brown Shale
Brown Shale
Brown Shale
Sandstone & Clay
Brown Shale & Sandstone
Clay & Sandstone
Brown Shale
Coal
Hard Black Shale
Shale & Sandstone
Hard Black Shale
Coal
Brown Shale

Nº22

Sand
Ironstone
Hard Sandstone
White Clay
White & Brown Clay
Sandstone & Clay
Brown Shale
Brown Shale
Sandstone & Clay
Brown Shale
Black Shale
Coal
Quartz & Stone
Coal
Shale & Sandstone
Coal
Shale & Coal Blends
Shale & Sandstone
White Sandstone
Shale & Sandstone
Hard Black Shale
Coal
Hard Black Shale
Coal
Black Shale
Hard Sandstone
Black Shale
Coal
Black Shale

I hereby certify that these records are correct, and were obtained under my personal supervision

Jno Ewing

Licensed Surveyor

22 9 20

VERTICAL SCALE

In regard to the nature and quality of the coal in the coal seams included in this estimate of coal reserves we are in possession of considerable information concerning the coal in the seams which have been worked, but unfortunately a somewhat limited knowledge of the nature of the coal in those seams met with in boreholes only.

It is to be regretted that complete information was not obtained at the time the boreholes were put down and it is urged that every opportunity be taken to remedy this omission in the future, as it is felt that the estimate of coal reserves would be of much greater value if the quality of the coal in each seam could be given as well as the quantity.

In a general way it may be stated that there is a general similarity in the coals met with at approximately the same horizon, but that some of the seams in the same horizons are higher in ash content than others, thus causing differences in calorific value. Various sections of the same coal seam also vary in ash content as will be noted from Plate V.

No coal which exists in Area B is included in the estimate of coal reserves as it is considered that the information available is insufficient. Coal, however, has been worked in this area at the Premier Mine and has also been located in a series of hand bores concerning which Mr. J. McVee, ex-District Inspector of Mines, reported upon in October, 1920, as follows:—

> The East Collie Coal Mining Company have done a considerable amount of boring on an area adjoining the southern boundary of the Premier Coal Mining leases, and have proved the existence of several good seams of coal, ranging from 5 feet to 9 feet 2 inches. The coal measures are in all probability a continuation of the upper or Cardiff measures, and no great difficulty should be experienced in working these seams on similar lines to those adopted at the adjoining collieries. The boring has been confined practically to the outcrops of the different seams, and although the overlying strata in some instances are of a soft nature, this may alter with depth, especially with the shale roofs. This could only be proved definitely by means of deep boring with a Calyx drill, when a core of the strata passed through can be obtained, showing the true character of the strata, also the coal passed through.

Sections of these boring operations certified correct by Mr. J. Ewing, Licensed Surveyor, were published in the Prospectus of the East Collie Coal Mining, Briquetting and By-Products Coy. (1920) Ltd., and are placed on record herein (Plate VI.), and indicate that additional boring operations on Area B might materially increase the known coal reserves at Collie.

The question now arises as to what proportion of the total coal in the estimate of coal reserves may be recoverable by mining methods.

Up to the present somewhat less than half the coal existing in the mines has been recovered. The area occupied by pillars of coal left to support the roof is approximately half the total area of the mine workings and it has to be borne in mind that in most instances the full width of the coal has not been extracted. For specific instances see diagram facing page 36.

At present an effort is being made to improve the position in this regard. Some pillars are being split in the Stockton and the Cardiff Mines. Consideration is also being given to a proposal to mine the coal, amounting to approximately five feet left in the roof of the Cardiff Mine. The question of the extraction of the pillars, which in this mine have a relatively small amount of cover, is also under consideration. Similar operations may reasonably be expected to be carried out in the Stockton Mine, where over quite a large area coal occurs at a comparatively shallow depth.

These proposals may materially improve the percentage of extraction, but quite a large amount of coal in old workings must be regarded as being irretrievably lost owing to such occurrences as creeps, falls and fires.

Amongst other considerations which have a bearing on the probable percentage of recoverable coal, the following seem deserving of special mention:—

1. Some areas in the coalfield may be so faulted as to adversely affect the coal and to render mining operations difficult, if not impossible.

2. One area is known to occur in which the coal is so impregnated with siderite (carbonate of iron) to cause serious clinkering when the coal is burnt in railway locomotives.

3. A number of boreholes have not intersected the coal seams anticipated. In some instances this is due to faulting, but the Woolnough Commission considers that a certain amount of contemporaneous erosion has also occurred.

4. Mining problems may be expected to increase with depth.

5. The nature of the coal at depth has not yet been ascertained.

In regard to Item 1, it should be mentioned that the lower workings at the Stockton Mine were discontinued because the coal was so badly affected by faulting. The fact that it has been possible to mine the Westralia, Co-operative, Proprietary seam continuously over so extensive an area gives us reason to hope that such areas will represent a comparatively small proportion of the total.

Regarding Item 2, the siderite coal as it is called occurs in the south-west slant at the Co-operative Mine over a known area of approximately 400 acres.

On account of its clinkering habit, the Railway Department has up to the present refused to purchase this coal, although it is of the desired hard coal type and of high calorific value. One can only speculate on the total extent of this area and the possibility of other areas similarly affected. It should be mentioned, however, that this coal can fortunately be usefully employed for other purposes and it is a reasonable anticipation that it will not be permanently unextracted.

Regarding Item 3, there seems reason to hope that the affected areas will be found to be infrequent and limited in extent.

Regarding Item 4, it will be noted from the following extract from the report of the Woolnough Royal Commission that the Commissioners took a very serious view of the difficulties which would be encountered:—

> As above stated, correlation of the seams is apparently impossible at present. Assuming, however, as a basis of calculation that the seams revealed by prospecting operations at the Proprietary Mine are not identical with the Wallsend Seam, and that the Westralian and Co-operative Seams are comparable, we have a total thickness of workable coal (in seams of three feet and upwards) of 103 feet. At a depth not exceeding 2,000 feet, the available coal may be estimated at 3,500 million tons.
>
> It may be understood, however, that we place absolutely no reliance on these figures, as too many of the factors of the calculations are open to serious doubt. It is quite possible that the result understates the actual amount. A depth of 2,000 feet has been assumed as a maximum workable depth, but we doubt very much whether it will be found possible to work some of the seams to even half this depth. The associated sediments are often highly porous and are completely saturated with water. The experience of the Scottish and Proprietary and Co-operative Mines, in which vast and sudden inrushes of water have taken place, is only too likely to be repeated all over the field; and the danger will be accentuated as the depth of the workings increases.

In fixing the limiting depth of working at 2,000 feet and possibly less than 1,000 feet for some of the seams, it is felt that the Commissioners have taken an unduly pessimistic view as the conditions of workings are reasonably good in the bottom workings of the existing mines, which in the case of the Co-operative Mine have reached a vertical depth of 800 feet. Nevertheless it is felt that the percentage of extraction will decrease with depth.

Regarding Item 5, it has been assumed tentatively that the coal seams maintain both their widths and quality with depth. This assumption has not yet been proved and certainly needs confirmation by deep bore holes.

Taking all these facts into consideration, it is felt that a higher extraction than 50 per cent. should be possible from the mines at their existing depths, but that in the present state of our knowledge it is not possible to express an intelligent opinion as to the percentage of coal included in the estimate which can be anticipated from the deep workings.

Underground Water—Surface and Artesian.

Surface and artesian water are both met with on the Collie Coalfield.

Surface water is that water which sinks into the ground and is met with at the shallow depth of from 10 to 15 feet.

Artesian water is encountered at depth by boring when certain porous sandstone beds overlain by impervious beds are intersected.

The water pumped from the mines each day, which is principally surface water, but which is thought to also contain a certain proportion of artesian water introduced at depth, is approximately as follows:—

	Gallons per 24 hours.
Proprietary Mine	1,250,000
Stockton Mine	400,000
Co-operative Mine	400,000
Cardiff Mine	480,000
Griffin Mine	750,000
	3,280,000

= 1,197 million gallons per annum.

At the Collie-Burn Mine, now closed down, heavy water was encountered in the workings under the south branch of the Collie River and presumably derived from the river.

At the Westralian Mine in 1929, a large creep or fall, to which further reference will be made later, occurred between two faults, which converged, forming a wedge. Over an area of about 16 acres the roof came down gradually and bodily. The last time the Manager, the late Mr. Z. Rogers, visited the area, the roof was within four feet of the floor. Both faults were shedding water and the total amount let in by this fall was estimated at 20,000 gallons per hour, which quantity had not perceptibly abated when the mine closed down two years later.

The principal factors influencing the amount and the disposition of the underground water at Collie are the following:—

1. The rainfall.
2. The position of the Collie River.
3. The nature of the coal measures.

Rainfall.

The average rainfall at Collie is 38 to 40 inches, which spaced over the area of the coalfield, 76 square miles, amounts to approximately 43,000 million gallons per annum.

Position of the Collie River.

The north and south branches of the Collie River fed from the high ground surrounding Collie wind their way right across the Collie coal measures and a proportion of the river water no doubt sinks into the ground.

Nature of the Coal Measures.

The coal measures consist of alternating beds of porous and impervious strata inclined at an average angle of approximately 10° from the horizontal.

Bearing these facts in view and in addition the fact the coal measures occur in a relatively low lying area, it is not surprising that surface water is met with at a shallow depth and artesian water at a greater depth.

In connection with the latter, Mr. A. Gibb Maitland in evidence before the 1916 Royal Commission, stated that artesian water was flowing from No. 2 Diamond Drill Bore at the rate of 50,000 gallons a day and that in No. 4 Diamond Drill Bore the artesian water amounted to 15,000 gallons a day when the bore had a vertical depth of 634 feet, but that when the bore ceased at 900 feet, water was flowing at the rate of 25,000 gallons per hour.

The introduction of artesian water into this bore at different horizons was to be expected and artesian water is liable to find its way into mine workings both from the strata above and the strata below the coal seam being worked, when fissuring of the roof and floor occurs, as in the case of a fault.

I am indebted to Mr. J. Gillespie for the following information regarding artesian water at Collie:—

1. The municipal bore (No. 1) situated on the north side of the Collie River on Lease 88, used to flow at the rate of 20,000 gallons of water per hour, but that at present there are four bores in a trench well and the combined flow is only 11,000 gallons per hour.

2. At No. 9 Hand Bore (190 feet deep) on the south side of the river, water flowed from the casing some 15 to 20 feet above the ground. This height was sufficient to permit the water to run over the river into the trench well. This bore has now collapsed, but approximately 2,000 gallons of water per hour now come to the surface and flow into the river.

3. In 1934 at the Griffin Mine, a fault was met with in No. 64 bord, which gave off approximately 5,000 gallons of water per hour. On boring down into the fault, water spurted out. A pipe was put into the hole and a gauge put on registered a presure of 70 lbs. per square inch. As it was possible that this water might have come from the surface, samples were collected and tested by the late Mr. M. Limb, who determined the water as artesian and definitely not river water. The river was approximately 250 feet above this bord and three chains away from it.

The flow of water met with in No. 9 Hand Bore is interesting and suggests that this bore may have intersected a fault containing artesian water under pressure.

As we will see later when dealing with the method of mining, the mine managements at Collie have always realised that there are water zones between the deeper mine workings and the surface which are liable to introduce water troubles if any large falls of the roof occur. There are at present no known outlets to the artesian water, which would cause a circulation of the water except the bores which flow, and the operating mines. The possibility of underground circulation of water must, however, be borne in mind.

We have seen that certain more or less deep-seated beds contain water under sufficient pressure to force it to the surface if these beds are intersected by bore holes.

It seems reasonable to expect that the water would be similarly forced up fault planes if the beds were intersected by faults and that other circumstances would decide whether or not the water reached the surface.

When dealing with sag faults it will be suggested that local weaknesses may be due to such movements of water.

FAULTS.

The faults at Collie are both of geological interest and of great economic importance and for convenience will be discussed under three headings, viz.:

(1) Coalfield Boundary Faults.
(2) Mine Boundary Faults.
(3) Small Faults.

Coalfield Boundary Faults.

These faults can be regarded as the most important of all inasmuch as the coalfield owes its preservation to them.

The members of the 1916 Commission on the Collie Coal Industry, of which Professor Woolnough was Chairman, stated that the approximately rectilinear form of most of the boundaries is almost certain proof that the coalfield is limited in every direction by faults. (p. VII, par. 29). This statement seems certainly to be correct as far as the western and southern boundaries are concerned and probably as far as the eastern boundary is concerned, but there seems to be very little evidence of faulting along the northern boundary and no such fault is shown in the cross section accompanying this report.

The evidence points to hinge faulting along the western boundary of the coalfield, the greatest displacement occurring at the southern end of the field.

We have very little evidence regarding the eastern boundary fault but a fault of similar nature is indicated.

Additional information is also very desirable regarding the southern boundary of the coalfield. I have tentatively assumed it to be in the position shown by combining the information shown on the map submitted by Mr. T. Blatchford to the Herman Commission with that published by Mr. A. Gibb Maitland in the "Coal Deposits of W.A."

I feel that any uncertainty regarding the boundaries of the field could be cleared up at comparatively small cost by putting down hand bores on either side of the supposed boundary at intervals.

Mine Boundary Faults.

The faults so named are those which occur within the coalfield and displace the coal to such an extent that they terminate the mine workings in the particular direction in which they are encountered.

Such faults are unfortunately sufficiently common at Collie to make them an ever present danger and it is for this reason that development work ahead of the working faces is so essential.

When a large fault is met with the usual procedure is to ascertain by boring the amount of displacement and then decide if in the opinion of the management the circumstances warrant the expenditure necessary to make the coal on the other side of the fault available for mining.

If it is decided that the expenditure is not warranted, the fault becomes the boundary of the mine.

Brief details of three of the more important of these faults are as follows:—

Wallsend Fault.

This fault cut off the coal seam at the bottom of the old Wallsend Mine and a borehole known as the Wallsend Bore put down on the other side of the fault proved the fault to be a downthrow and the coal seam to have been displaced 320 feet.

In strike this fault is traceable for at least three miles. It extends in a north-westerly direction until it meets and cuts off the coal seam in a section of the Co-operative Mine and apparently carries on in that direction. In the opposite direction the fault continues on as far as the Proprietary Mine and possibly past it.

Stockton Mine Fault.

This begins at a point 8 chains on the Eastern side of the main tunnel and gradually increasing its displacement of the coal it continues for 38 chains to the bottom of the mine in a direction S.55°E, at which point the coal seam on the eastern side of the fault is 194 feet higher than that on the western side.

The effect of this fault is to divide the mine into two sections, one on each side of the fault.

Cardiff Mine Eastern Boundary Fault.

This fault forms the eastern boundary of the Cardiff Mine for a distance of 95 chains.

In the northern portion of the mine, the strike of the fault is S. 50° E. It does not remain in this direction, however, but becomes more southerly in strike until at the south end of the workings its strike is due south.

This fault, where it can be measured at Handbore No. 26 at the south end of the workings, is an upthrow fault, having a displacement of 150 feet.

It is thought that for most of the distance at least the coal seam does not exist on the eastern side of the fault, as this upthrow would bring the continuation of the coal seam above the present surface.

Many other faults of a similar nature occur intermediate in size between these three and those classed as small faults. They are shown on mine plans and are of considerable local interest on account of the bearing they have upon mine operations.

A peculiarity of some of the faults is that the drag in the country is in the opposite direction to that which might be expected. An instance of this occurs at the bottom of the main tunnel in the Co-operative Mine. The inclined coal seam flattens out as the fault is approached, thus suggesting an upthrow fault. Actually, however, the fault turned out to be a downthrow.

Small Faults.

Under the heading of small faults may be included all those faults of, say, 30ft. maximum displacement more or less, which cause some additional work underground without causing really serious trouble.

Most of these faults are the type known as "sag" faults. If followed horizontally from the point of maximum displacement, it will be found that the amount of displacement diminishes rapidly and often gives out entirely in a comparatively short horizontal distance.

Such faults would seem to have been formed as the result of a local weakness, which causes a small area of the coal measures to sag and rupture along what becomes the line of fault. Such sagging may be expected to continue until equilibrium is established. The local weaknesses might perhaps be caused by water movements through underlying previous strata.

Faults thus formed may be expected to have a limited vertical depth, as well as a limited horizontal length and their extension into the underlying granite is not therefore to be anticipated.

By reference to the model it will be noted that the displacement of the coal by such a sag fault forms a lens shaped figure on the plane of the fault.

When such a fault is met with underground in a tunnel, bord or heading, the common mining practice is to first ascertain the amount of displacement of the coal seam and then alter the inclination of the tunnel, bord or heading sufficiently to permit the displaced coal seam to be reached in as short a distance as the circumstances reasonably permit, having regard to haulage considerations.

HAULAGE.

It will be appreciated that in the case of relatively flat seams coal near the surface can be readily and without difficulty hauled to the surface by means of inclined tunnels, but that eventually the haulage will become so long that coal from the deeper portions of the seams must be hauled to the surface through vertical shafts.

Up to the present all coal has been hauled by means of inclined tunnels, but reference to the plan of the field and to the model will make it clear that a large proportion of the so called hard coal which outcrops at the northern end of the field has already been so extracted by means of tunnels and that the time is not very far distant when consideration will have to be given to the sinking of vertical shafts, with the attendant water troubles, for the purpose of hauling the deeper coal.

A similar position arose at Johannesburg, where a relatively flat conglomerate is mined. It was general practice to haul the outcrop ore, as it was called, by means of underlay shafts, but eventually the deeper ore was hauled and is still being hauled to the surface by means of vertical shafts, which in some instances are so deep that haulage has been done in stages, a depth of 3,000 feet being considered a convenient stage.

There is no indication at present that any of the coal at Collie will be deeper than about 2,000 feet and consequently it can be quite easily hauled in one stage.

THE MINES AND MINING METHODS.

No detailed description of the mines can be attempted in this address. Their position, the extent of their workings are, however, shown on the model. I would also refer those interested to the plans which accompany the report of the Royal Commission on Development (1940).

Attention should, however, be drawn to the extensive workings along the Co-operative horizon. From west to east the following mines have all worked the principal seam of this horizon:—Westralian Mine, Co-operative Mine, Proprietary Mine and Stockton Mine.

These mines have produced 11,000,000 tons of coal and as a result a limited amount of this hard coal seam is now available at shallow depths.

At the Collie-burn horizon the Griffin and Collie-burn No. 1 and Collie-burn No. 2 Mines have operated and produced 1,440,000 tons of coal. The Premier Mine, which I have tentatively included in this horizon, produced 486,000 tons of coal.

At the Cardiff horizon the Cardiff Mine only has operated and produced 2,755,000 tons of coal.

The workings of all the mines follow the same pattern both as regards haulage of the coal to the surface and as regards their general mining methods.

A few brief comments regarding these mining operations are made hereunder, followed by some suggestions for future operations.

Method of Mining.

The method of mining which has been universally adopted at Collie is that known as bord and pillar. An essential feature of this method is that the coal is extracted on all four sides of a square or oblong pillar by means of bords and cut-throughs and the pillars thus formed are left to support the over-lying strata.

The regulation width for pillars is 10 yards and a common length is about 18 yards.

Bords are 8 yards wide and cut-throughs 4 yards wide.

It is now fairly general practice in other parts of the world, where this method is adopted, to leave larger pillars for the first working and to extract the pillars at a later date.

No such subsequent extraction has, however, been attempted at Collie, except in rare instances, because of the fact that water zones exist between the deeper workings and the surface and it has been considered that to take out the pillars was to incur the risk of a heavy inflow of water and possible flooding of the mines.

In consequence it has been general practice to leave the pillars permanently.

This practice, which avoids the risk of flooding, has, however, introduced another real danger, namely, that of creep, and a number of creeps have actually occurred, brief particulars of which will be given later.

FUTURE OPERATIONS.

Future operations will be discussed under the following headings:—

(a) Lines on which development may proceed at the operating mines.

(b) Some proposals to increase production.

(c) A suggested site for a future deep colliery.

(a) *Lines on which development may proceed at the operating mines.*

Co-operative Mine.

The coal developed is approximately 339,000 tons, assuming a workable width of 7 feet, 50 per cent. of which is recoverable. The Main Dip can be increased in depth and there is scope for development, particularly on the east side, but sooner or later siderite coal is to be expected in that direction.

Proprietary Mine.

The coal developed is approximately 1,142,000 tons assuming a width of 7 feet, 50 per cent. of which is recoverable. As the bottom of the mine has been abandoned, lateral development only can be anticipated. Prospects of successful development are good, particularly on the eastern side between this mine and the Stockton.

Stockton Mine.

The coal actually developed is estimated at 249,000 tons assuming a workable width of 7 feet, 50 per cent. of which is recoverable. The bottom workings of this mine have been abandoned, but an unexpected occurrence has given the mine a new lease of life. The main coal seam on approaching the surface flattened out and a large area, estimated to contain 7,000,000 tons, has been proved by bore holes in a north-westerly direction from the pit mouth. See cross section.

Cardiff Mine.

The coal developed in this mine amounts to only approximately 108,000 tons, assuming a workable width of 7 feet, 50 per cent. of which is recoverable. On the eastern side of the mine the coal seam has been cut off by an up-throw fault and apparently the seam does not exist in the other side of the fault owing to denudation.

The future of this mine looks very unencouraging unless additional coal is developed on the west side of the mine.

GRIFFIN MINE.

Main Seam.

The coal developed is 278,000 tons, assuming the average width of the seam to be 7 ft. and that 50% of the coal is recoverable. Development is behindhand. Dip headings are proposed and will improve the position provided no faults are encountered.

New Twelve Feet Seam.

This important seam lies approximately 450 feet above the main seam. It has been intersected at shallow depths in three vertical shafts extending over a length of 1,000 ft. It has also been intersected in bore holes, which have proved that the coal extends, apparently unbroken, over a length of 2,000 feet and to the dip, which is approximately 1 in 4, for 900 feet.

As the coal seam is approximately 12 ft. in width, the total coal indicated in this area is 800,000 tons.

The Griffin Coal Mining Company Limited has just begun to operate this seam and intends to give the mine which is being opened up the name of Wyvern Colliery.

The proposed workings are shown at Figure 9.

Larger pillars than previous practice on the field are to be left. A smaller percentage of extraction will therefore be obtained in the first working, but an ultimate higher extraction is to be attempted by robbing the pillars.

The coal has not yet been thoroughly tested, but is considered to be of similar quality to that of the main seam.

The Griffin Coal Mining Company Limited anticipate that their output will be materially increased in the near future.

(b) *Proposals to Increase Production.*

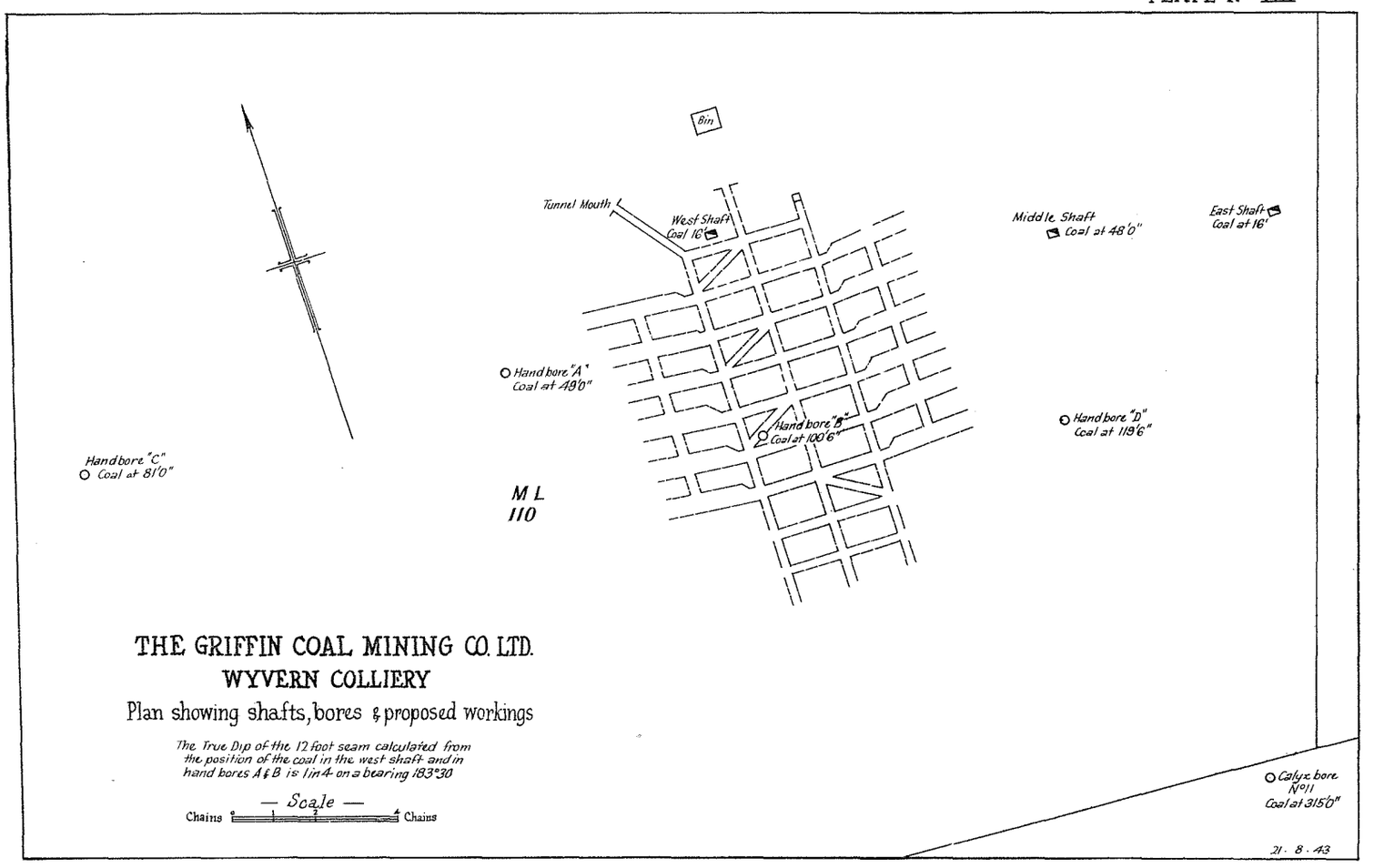
Production figures are as follows:—

Mine.	1942.			1943.
	Output.	Value.	Average Weekly Output.	Average Weekly Output. *
	Tons.	£	Tons.	Tons.
Proprietary	149,387	121,987	2,873	3,087
Co-operative	91,631	73,553	1,761	1,721
Stockton	135,032	106,181	2,597	2,313
Cardiff	96,405	73,957	1,854	1,337
Total, Amalgamated Collieries	472,455	375,678	9,085	8,458
Griffin Mine	108,721	85,817	2,091	1,876
Total	581,176	461,495	11,176	10,334

* For Half Year ended 30th June, 1943.

As the present urgent requirements are some 2,000 to 3,000 tons a week above the present production and additional labour most difficult to obtain, it has become necessary to evolve some schemes for increased production without additional manpower. A recent inspection of some well-equipped mines in New South Wales has convinced me that the weakest feature of the Collie mining practice is the filling of skips by hand shovelling.

PLATE No VIII



THE GRIFFIN COAL MINING CO. LTD.

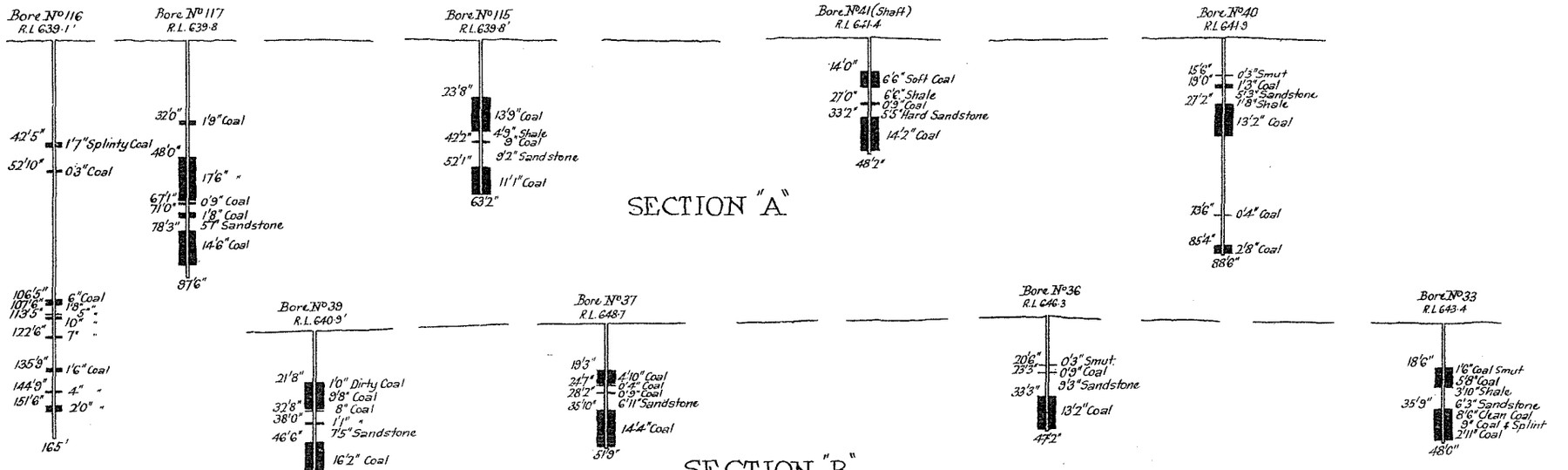
WYVERN COLLIERY

Plan showing shafts, bores & proposed workings

The True Dip of the 12 foot seam calculated from the position of the coal in the west shaft and in hand bores A & B is 1 in 4 on a bearing 183°30

— Scale —

Chains 0 1 2 4 Chains



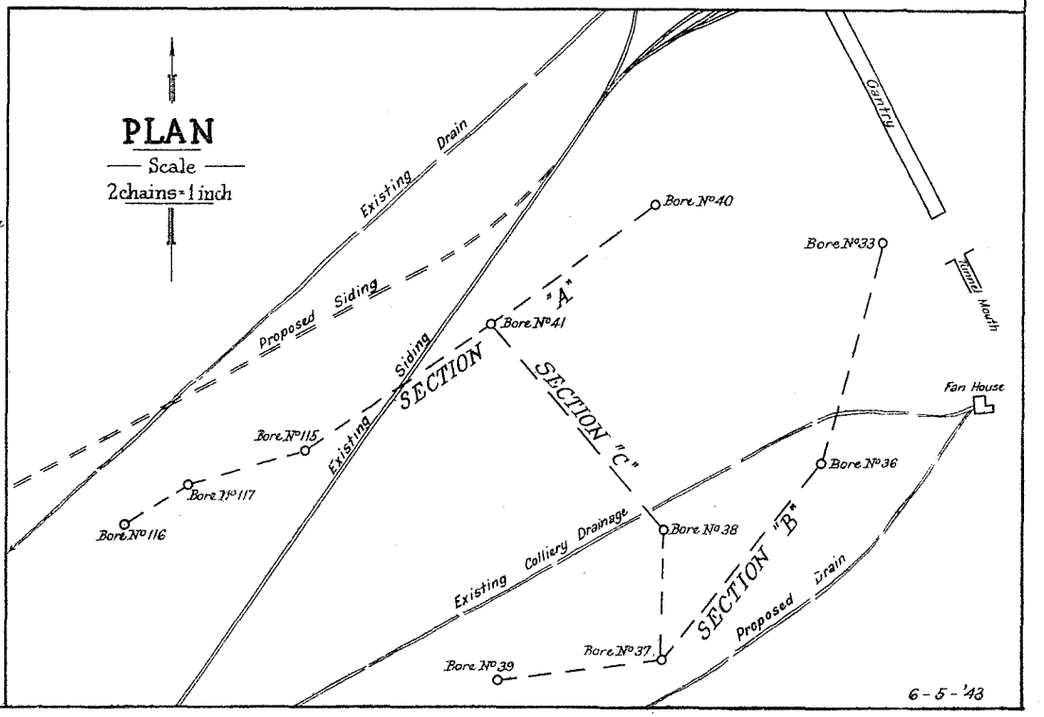
STOCKTON COLLIERY

Sections showing Seams disclosed by Handbores

Horizontal Scale: 0 ½ 1 2 Chains

Vertical Scale: 0 25 50 100 Links

Note: The coal in this Area is shallow and is to be mined by Open Cut method



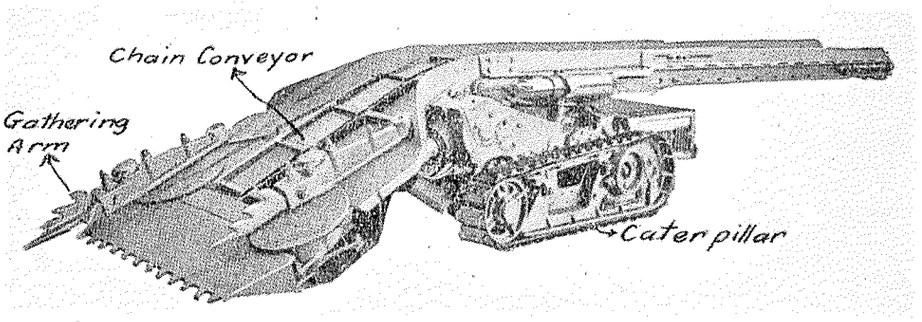


Plate IX.

Joy Loader, Type 8 B.U.

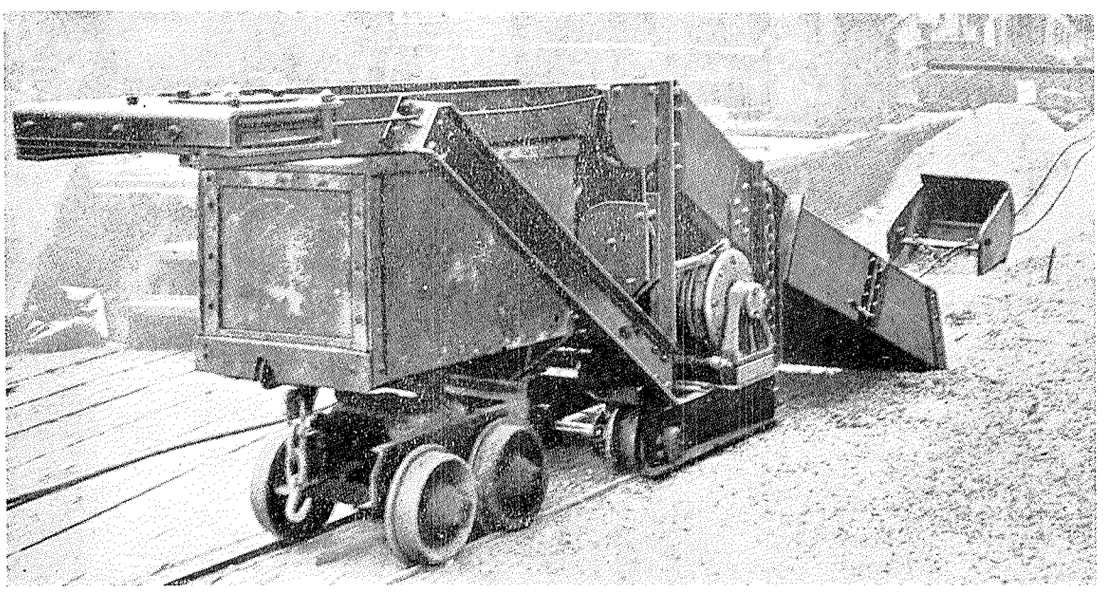


Plate X.

Scraper Loader.

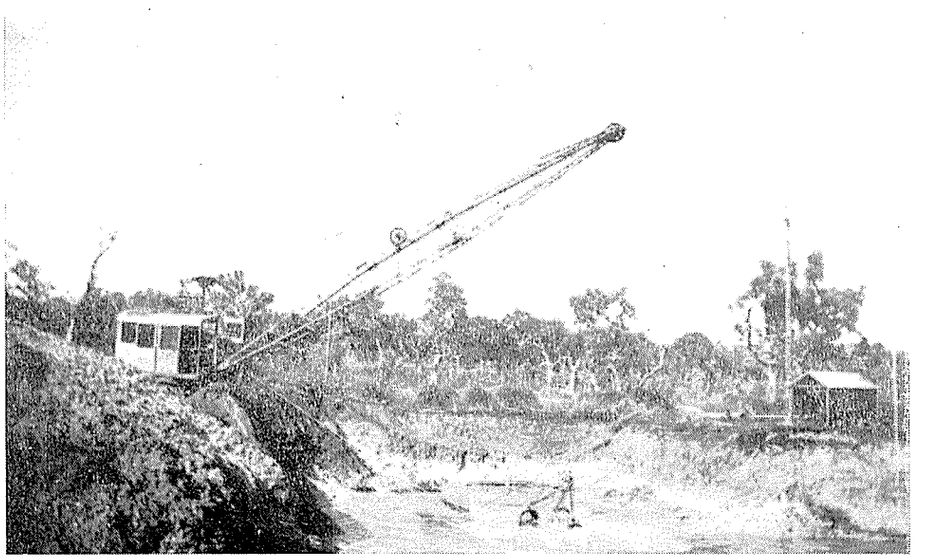


Plate XII.

Photograph of Ruston Bucyrus Dragline Excavator in operation.

I am pleased to be able to state that acting on the recommendation of Mr. R. P. Jack*, the Amalgamated Collieries of W.A. Limited have agreed to try out an 8 B.U. Joy Loader, which the Commission was fortunate enough to be able to make available. This will be tried out in the first place in the 21 Section of the Proprietary Mine.

Negotiations are also in hand for the introduction of three double drum Sullivan Scraper Loaders for the Griffin Mine and two three drum Sullivan Scraper Loaders for the Stockton Mine.

Joy Loaders.

Brief particulars of Joy Loaders are as follows.—

Type 8 B.U. Loader.	*Type 11 B.U. Loader.*
Capacity, 1½ to 2 tons per min.	Capacity, 4 to 8 tons per min.
Length, 20 ft. 5 in.	Length, 25 ft.
Width swept by gathering arms, 5 ft. 2 in.	Width swept by gathering arms, 7 ft. 8 in.
Height, 3 ft.	Height, 4 ft.
The 8 B.U. Joy Loader is designed for loading on to conveyor or small skips.	The 11 B.U. Joy Loader is designed for loading direct into large capacity skips or rubber tyred trailers.

In practice the speed of loading is limited by the rate at which skips can be kept up to the loader. At Nattai-Bulli Colliery at Burragarong Valley, which was visited by me in April last, two Joy Loaders working two shifts loaded 500 tons a day, or 125 tons per loader per shift, into small skips under conditions similar to those existing at Collie.

The benefit of the introduction of this loader at the Proprietary Mine may be somewhat as follows:—

The crew necessary to operate the loader will be:

2 machine men.
2 men on loader.
2 men shifting skips.
2 wheelers, perhaps 3, depending on the roads.
3 shiftmen, including the road layer.

11

The output may be reasonably anticipated to be at least 100 tons per shift.

Under existing conditions the men required to obtain an output of 100 tons a shift are as follows:—

12 miners (6 pairs).
3 wheelers.
2 machine men.
3 shiftmen, including the roadlayer.

20

It is therefore anticipated that the introduction of the Joy Loaders will make about 9 men available for other work.

Scraper Loaders.

Scraper loaders were seen in April last operating in the dip headings at Stanford Main No. 2 Mine in New South Wales. The average output per unit per shift was 35 tons, employing three men, or about twice the output obtained without the use of the scraper loader at Collie.

Open Cut Mining at Stockton Mine.

Another proposal to increase output is to start an open cut mine on an area of about 6 acres where boreholes indicate that the main seam (No. 15) is met with at an average depth of 37 feet and averages 13.4 ft. in width. In addition the top seam No. 14, is met with at an average depth of 19 feet and averages 5.3 feet† in width.

The coal from this top seam will be inferior in quality to the main seam, but will nevertheless be quite useful for some purposes.

The excavating machinery will consist of a 37B Ruston Bucyrus Dragline Excavator of 1½ yard capacity previously used at the Big Bell Mine, which it is estimated will remove 60 cubic yards per hour, and a smaller 10 R.B. Ruston Bucyrus Excavator of ⅜ yard capacity, previously utilised at the Great Victoria Mine, Burbidge, which may excavate at the rate of 35 cubic yards per hour.

This area should produce 130,000 tons of coal from the main seam and 50,000 tons from the top seam, and will require relatively few men to operate.

If anticipations are realised, other areas can also be worked in a similar manner.

(c) *Site for Future Deep Mine.*

After discussion with Mr. Gillespie, I am in agreement with him that an excellent place to start a new deep mine will be in close proximity to the old Collie-burn Mine.

Two vertical shafts can be sunk to intersect the Proprietary Seam at a depth of perhaps 1,200 feet and at the same time a tunnel can be driven following the Collie-burn Seam.

Such a mine provided with modern equipment should be quite capable of producing 1,500 tons of coal per day.

Preliminary boring operations would have to be undertaken to test the Proprietary Seam at depth and incidentally the other seams between the Collie-burn and the Proprietary Seam. The boreholes would be set out so as to prove the continuity or otherwise of the seams laterally and to the dip and the results obtained would help to decide the exact position of the two vertical shafts.

CREEPS AT COLLIE.

These are described in the 1940 Commission, but as the findings of this Commission have not been published, a few brief details seem to be of quite sufficient interest to be worth recording.

Creep at Old Co-operative Mine.—A creep in the old Co-operative Mine workings occurred in February, 1918, and extended over an area of 25 or 26 acres. The area, which had a cover of 400 to 600 feet, had been worked some eight years earlier. The creep gave little warning and once started, crossed the main tunnel, which collapsed, and died out without reaching any main fault or large block of coal.

The area is said to have been much faulted and some attributed weakness to this cause, while others blamed the smallness of the pillars and the inadequate timbering.

No further work was attempted in these workings and operations were transferred to the new Co-operative.

It is stated that a change-over would shortly have taken place in any case as the bottom of the mine was against a fault and faulting on the sides was also interfering with the working of the mine.

Creep at Co-operative Mine.—A creep occurred in this mine about 1924 or 1925. The area affected was 1½ to 2 acres only. A heaving up of the bottom is said to have occurred. Large slabs of rock are stated to have come up and undermined the pillars to some extent.

The pillars then crushed and large lumps of coal fell off them, accompanied by the noise known as "bumping."

The area was almost in line with a large fault and the depth of cover 460 to 470 feet.

Creep at Westralia Mine in 1929.—This subsidence, which was called a creep, has already been referred to under Underground Water. An additional item of information regarding this creep given at the Royal Commission was that the coal seam was 7 to 8 feet in thickness with a stone band about 2 feet thick in the middle. The first sign of trouble noted by Mr. Z. Rodgers was the squeezing out of this stone band around the pillars, indicating the pressure upon them.

Creep at Cardiff Mine.—Mr. T. Oxley, manager, gave evidence that between 1923 and 1926, in a place where no fretting had occurred in either pillars or roof, he saw pillars pushed into the floor until the floor and roof closed.

*Chief Executive Officer of Commonwealth Coal Commission.

†This seam seems to be of about the same thickness as the main seam, but portion of it has obviously been eroded.

Creep at Proprietary Mine.—This creep is the one which the author investigated personally in conjunction with Mr. F. G. Forman and Mr. J. S. Foxall.

Our conclusions were somewhat as follows:—

The creep occurred on the left-hand side of the Proprietary Mine. It commenced on the 5th February, 1940, in the pillars of No. 7 Bord between No. 2 and No. 3 Headings in section 18, and in a few days it had affected an area of 20 acres. The creep first of all spread rapidly in an easterly direction, but spent itself before reaching solid coal. The spread towards the dip in a direction south by east appears to have been arrested by two unworked blocks of coal, one at either end of No. 20 Main Haulage Road. A number of hastily erected chocks along this road appeared to stay the advance temporarily, but before many days the creep crushed this timber and advanced for a distance of 4 chains into No. 20 section.

The cause of the creep appears to have been the unequal distribution of pressure on certain pillars in an area where both floor and roof—particularly the floor—were weak, the weakness of the latter being probably accentuated by the action of water which found its way some twelve months previously through porous or fissured strata under the pillars, thus softening the clay floor of the seam.

Other contributory causes were:—

1. That the area supported on pillars was an extensive one;

2. That the pillars where the creep occurred were high;

3. That the pillars were "on end" in relation to the coal cleavage, a condition which tends towards fretting and consequent weakening of the pillars;

4. That the affected area was in line with a fault which is a position where the strata may be expected to be weakened.

Before any movement due to creep took place, the abnormal pressure on the pillars caused some heating, but did not at that time give rise to any fire. One result of the heating was the formation of carbon monoxide, which the researches of Messrs. Haldane and Magill have shown can take place at moderate temperatures, and unfortunately Andrew Irvine entered the area where the gas was present, was overcome by the fumes and lost his life. Gas analyses of air samples taken in this area on the 23rd February definitely established the presence of carbon monoxide.

Two fires subsequently broke out in the affected area, but the area was quickly effectively sealed off and the fires smothered.

Prevention of Creep.—The Commission made a number of recommendations for the prevention of creep, the principal one being as follows—that all future operations at the Collie mines should be conducted on a panel system, whereby each section of the workings is totally surrounded by a barrier of coal, the size of the panel and the width of the barrier to be approved by the Hon. Minister for Mines, with sufficient openings to allow for the proper working and ventilation of the mine. It was felt that any creep or fire which might occur would then be confined to one panel.

Other measures for the prevention of creep included a minimum size for pillars, a maximum width for bords and cut-throughs and a maximum height for pillars.

Comment.—The big drawback to the present system of working on the field is that approximately half the coal is left in the pillars as unrecoverable coal.

The whole of the coal could be taken out and thus save what is undoubtedly an economic waste, but, as already pointed out, much increased underground water might be introduced into the mines thereby and no company has so far felt inclined to take this risk, involving, as it would, increased pumping and consequently an increased cost of coal.

Increased cost of coal also means increased cost of production of all secondary products which rely on coal as a fuel for their manufacture.

Nevertheless, it is impossible to look complacently upon a vast economic waste and every encouragement should be given any company wishing to try out a method of mining which would avoid this loss of coal.

The two methods that suggest themselves are—

(1) The robbing of the pillars and allowing the roof to subside.

(2) The mining of the whole coal seam and replacing the coal won by hydraulic filling.

NATURE OF COAL.

The Collie coals are described by Gibb Maitland* as follows:—

> The coals of the Collie Coalfield are hydrous, semi-bituminous, non-coking coals, which approach very closely to lignite in some parts: between the various varieties the differences are only of degree. The coal is black, dirty to handle and partly composed of bright layers alternating with soft bands, which present the appearance of soft wood charcoal. The coal is singularly deficient in volatile materials: for this latter reason the coals are specially suited for use in suction gas plants. The coals appear to be mainly of drift origin and to have been deposed by current action on an extensive basin or river valley.

The proximate analyses of the coal from the principal coal mines are as follows:—

Name of Mine.	Thickness of Seam.	Fixed Carbon.	Volatile Hydrocarbons.	Ash.	Moisture.	Sulphur.	Nitrogen.	Calorific Value.	
								B.T.U.'s as received.	Ash and Moisture Free Basis.
Collie Coalfield.	ft.	%	%	%	%	%	%		
Co-operative	7	47·81	26·04	7·23	18·92	0·39	1·02	9,874	13,370
Westralian No. 1 ...	10	46·91	27·08	7·98	18·03	0·51	1·15	9,998	13,512
Proprietary	9	45·15	26·43	5·90	22·52	0·42	0·95	9,417	13,156
Premier	5½	34·25	39·94	2·44	23·37	0·60	1·00	9,670	13,034
Cardiff	7	38·35	32·03	4·32	25·30	0·53	0·93	8,800	12,504
Stockton	8	42·77	25·12	5·74	26·37	0·63	0·88	8,619	12,696
Westralian No. 2 ...	8	51·26	26·22	4·81	17·71	0·31	1·13	10,737	13,858
Griffin	8	42·60	34·06	4·56	18·78	0·90	0·96	9,956	13,006
Ewington (Hard Coals)	9	46·67	25·90	6·88	0·55	0·28	0·90	9,460	13,036

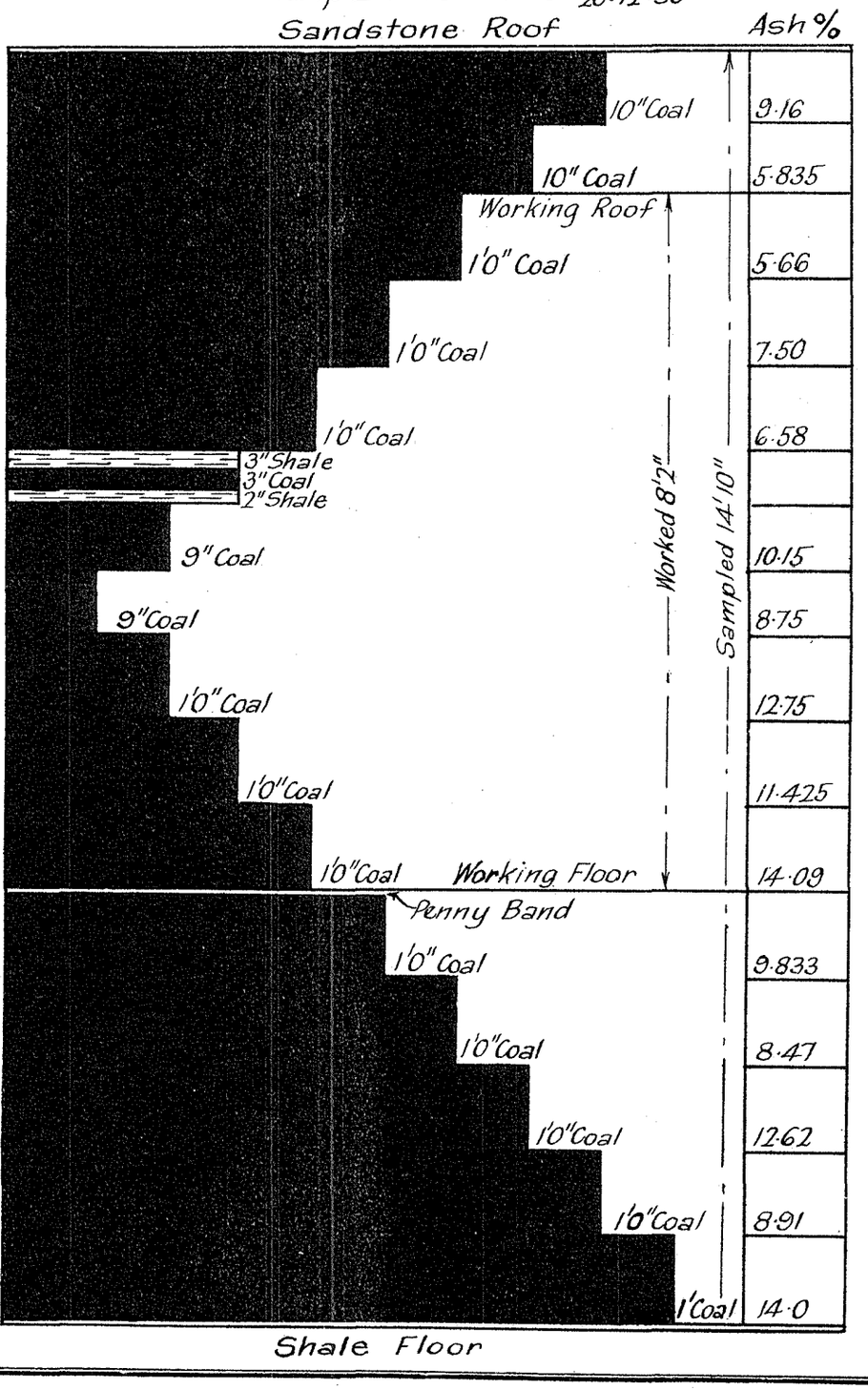
* Coal Deposits of Western Australia. Chapter 2, Mining Handbook.

PLATE No V

COOPERATIVE COLLIERY

— ASH TESTS —

No 1 Dip East Bord 18 20.12.30



The following additional analyses taken from the Annual Report of the Chemical Branch of the Mines Department for the year 1933, are especially reliable in as much as the samples were, by special arrangement, taken by the District Inspector of Mines at Collie and placed in hermetically sealed jars:—

No.	1242	1243	1244	1245	1246	1786
Colliery	Proprietary	Griffin	Stockton	Cardiff	Co-operative	Co-operative
Bord	No. 2	No. 2 Left	No. 8	No. 43	Right Hand	Between 43 and 44
Section	No. 17 Flat	No. 4 East	No. 2 Left	No. 5	...	...
Thickness of Seam	8 ft 6 in.	7 ft. 6 in.	7 ft. 6 in.	6 ft.	Top 3 ft. Bottom 2 ft. 3 in.	Top 3 ft. 6in. Bottom 2 ft. 6 in.
Vertical Depth	470 ft.	260 ft.	109 ft.	212 ft.	70 ft.	700 ft.
Proximate Analysis—	%	%	%	%	%	%
Moisture	22·29	19·74	24·61	26·67	21·14	18·74
Volatile hydrocarbons	25·86	34·00	26·15	30·74	24·75	25·49
Fixed carbon	46·37	41·85	43·88	38·48	48·57	48·36
Ash	5·48	4·41	5·36	4·11	5·54	7·41
	100·00	100·00	100·00	100·00	100·00	100·00
Water lost on air drying for 24 hours (in lump form)	2·81	2·31	2·88	3·06	2·68	3·81
Additional water lost at 105° C. (in coarse powder)	19·48	17·43	21·73	23·61	18·46	14·93
Calorific Value (by bomb calorimeter), B.T.U.—						
Original moist coal	9,412	10,017	8,805	8,486	9,773	9,689
After 24 hours air drying	9,684	10,254	9,066	8,754	10,042	10,073
Ash and moisture-free	13,031	13,206	12,573	12,259	13,333	13,120
Ultimate Analysis—						
Carbon	77·45	74·44	76·44	73·11	79·36	79·93
Hydrogen	4·12	4·80	3·87	4·44	4·27	4·25
Oxygen	16·82	18·12	17·53	20·48	14·40	14·02
Nitrogen	1·25	1·24	1·26	1·13	1·30	1·30
Sulphur	·36	1·40	·90	·84	·67	·50
	100·00	100·00	100·00	100·00	100·00	100·00

Samples of coal received from three different seams on P.A. 45, Collie, gave the following figures on analysis:—

1. 10 ft. 2 in. seam in shaft. Depth to top, 37 feet.
2. 7 ft. seam.
3. 8 ft. seam separated by 19 inches of shale.
   A top, B bottom.

PROXIMATE ANALYSIS.

	1.	2.	3. A.	3. B.
	%	%	%	%
Moisture	24·76	14·90	14·79	15·92
Volatile hydrocarbons	23·51	26·70	31·77	27·60
Fixed carbon	45·33	51·45	46·30	50·40
Ash	6·40	6·95	7·14	6·08
	100·00	100·00	100·00	100·00
Ratio F.C. to V.H.C.	1·93	1·93	1·46	1·83
Calorific Value—				
B.T.U. (By bomb calorimeter)	....	....	....	....
Original moist coal	8,906	10,176	....	10,360
Ash and moisture-free coal	12,937	13,021	....	13,282

This information set out in the same form as that of the Regnault-Gruner Classification is as follows:—

Mine.	Percentage Composition. C.	H.	O. + N. + S.	Volatiles.	Fixed Carbon.	Remarks.
				%	%	
Cardiff	73·11	4·44	22·45	44·4	55·6	Soft Coal.
Griffin	74·44	4·80	20·76	44·8	55·2	Soft Coal.
Stockton	76·44	3·87	19·69	37·3	62·7	Hard Coal.
Proprietary	77·45	4·12	18·43	35·8	64·2	Hard Coal.
Co-operative	79·64	4·26	16·05	34·2	65·8	Hard Coal (mean of two samples).

*Geological Survey Bulletin No. 48, pp. 67, 70.

TYPES OF COAL.

The Railway Department, noting certain differences in the physical characteristics of the Collie coals, divided them into two types, called respectively "hard" and "soft" coals.

This classification does not appear to have met with general approval, but it has nevertheless persisted. It appears to have originally been based on the following facts:—

(1) The "hard" coals resist heat better and do not disintegrate to the same extent in the firebox of a locomotive boiler.

(2) The "hard" coals do not spark to the same extent.

(3) A greater proportion of their calorific value is utilised in a locomotive boiler. In other words, a hard coal gives more ton-miles than a soft coal of equal calorific value.

The late Dr. E. S. Simpson, after a detailed study of coals*, also divided them into the same two types, but called them respectively—

1. Proprietary type.
2. Collie-burn type.

He pointed out that they differed essentially in age, the Collie-burn type being the younger, in physical characteristics and in chemical composition.

The late J. M. Limb also drew special attention to the chemical differences of the two types of coal, thereby placing the classification on a more scientific basis. He pointed out the following difference:—

In the case of hard coals, the ratio of volatile hydrocarbons to fixed carbons varies from 1 : 1.87 to 1: 1.63.

In the case of soft coals this ratio is from 1 : 1·12 down to 1 : 0·863.

By way of illustration he quoted the following figures:—

Mine.	Ratio V.H.C. to F.C.		Type of Coal.
	Gov. Lab.	Boas.	
Co-operative	1 : 1·87	1 : 1·769	Hard
Westralian	1 : 1·83	1 : 1·7	Hard
Proprietary	1 : 1·77	1 : 1·63	Hard
Stockton	1 : 1·67	....	Hard
Cardiff	1 : 1·2	1 : 1·193	Soft
Griffin	1 : 1·2	....	
Scottish	....	1 : 0·863	
Premier	....	....	Softest coal used.

He also quoted the following analyses to illustrate the difference in ultimate chemical composition.

ULTIMATE ANALYSES OF COLLIE COALS ASH AND MOISTURE FREE.

Mine.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Type of Coal.
Co-operative	79·5	4·12	14·7	1·54	Hard
Westralia	78·05	4·35	16·0	1·57	Hard
Proprietary	77·8	4·09	16·4	1·68	Hard
Stockton	(a)	(a)	(a)	(a)	(a)
Cardiff	73·0	4·49	21·1	1·32	Soft
Scottish	73·3	4·81	20·3	1·47	Soft
Griffin	72·27	4·81	21·64	1·27	Soft
Mean for Hard Coals	78·45	4·19	15·37	1·59	
Mean for Soft Coals....	72·83	4·7	21·04	1·35	

(a) No figures available.

A series of tests* quoted by the Herman Commission gave the quantities of coal equal for Railway purposes to 100 tons of New South Wales coal as follows:—

	Mean Values.	
N.S.W. Coal	100.000	(Best Maitland)
Co-operative Coal	140.747	
Westralian	138.196	
Proprietary	150.268	
Cardiff	168.810	
Stockton	146.433	
Griffin	155.383	

It should be rather stressed that these figures apply only to the conditions under which the coal was burnt in Western Australian locomotives during the tests.

The locomotive fireboxes are small and the coal is burnt under a forced draught.

Mr. A. M. Howe in a report to the Herman Commission pointed out that in a large water tube boiler the coal was not burnt under such forced conditions and in consequence so-called soft coals do better work in the large furnaces of stationary boilers, especially those worked under normal conditions and not forced, than they can possibly do in a locomotive firebox.

As a matter of fact, many consumers use Griffin coal in preference to any other coal and pay as high a price for it as that obtained for the best hard coal.

It should also be mentioned that Collie coals are being successfully burnt in pulverised form and when used in this form the value of the coals appears to be directly proportional to their calorific values as fired.

STORAGE OF COLLIE COAL.

The storage of Collie coal presents considerable difficulties and has rarely been attempted.

Bearing in mind how important this matter is, it is a matter for regret that comparatively little experimental work has been carried out to ascertain just what can be done in the way of storage and what can not be done.

Instead of attempting storage, the Railway Department has in the past always been able to obtain freshly broken Collie coal and to make up any shortages in supply from a reserve of Newcastle coal kept for the purpose.

*Statements 9 and 11, pages 151 and 153, Royal Commission.

This policy is quite understandable, but under war conditions, when shipping is precarious, it has become most difficult to build up a reserve of Newcastle coal and a reserve of Collie coal successfully stored would be of the greatest value.

The two principal difficulties attending storage are the following:—

(a) Deterioration when exposed to the weather.

(b) Risk of spontaneous combustion.

(a) *Deterioration.*

The principal deterioration which occurs is size deterioration or disintegration. This is most rapid when the coal is exposed to sun and air in summer.

This disintegration results from the loss of moisture, which increases the calorific value of the coal, but according to Dr. Kent some loss in heating value of the coal also occurs although of minor importance.

As far as railway locomotives are concerned, the formation of fines is attended by a marked decrease in burning qualities.

Too much slack coal prevents the free passage of air and fine coal is also wasted by falling through the firebars.

For consumption as pulverised coal, on the other hand, size deterioration is an advantage.

(b) *Risk of Spontaneous Combustion.*

The Woolnough Commission, after sifting all the evidence, expressed the opinion that while fires do break out in Collie coal in stores and in ships' bunkers, their own observations and experiments convinced them that the liability of the coal to ignition had been exaggerated.

In support of this view they made the following statement:—

> We have had coals stored in bins for a period of over 100 days to depths much greater than the critical depth of eight feet mentioned in Mr. Hume's evidence. So far from the coal having heated under these conditions, temperature readings taken daily during the earlier portion of the investigation and at longer periods during the investigation and at longer periods during the latter portion have shown that the coal has cooled down below air temperature instead of heating. It is only fair to state that these tests were carried out during the winter months with coal fresh from the mine, not with material that had suffered considerably during long railway transport in the scorching sun of the Westralian summer.

It should be explained that Mr. E. S. Hume, Chief Mechanical Engineer for Railways, in evidence, mentioned that Newcastle coal had been stored in a dump at Midland Junction for 6 or 7 years, the dump sometimes being 30 feet high and containing 20,000 tons of this coal. It had never given any evidence of spontaneous combustion.

On the other hand, he said, spontaneous combustion would occur in Collie coal if stacked higher than 8 feet. It had done so repeatedly at the Power House.

This experience of Mr. Hume has also been the experience at the Power House in recent years.

In this connection it is interesting to record that there is at present a dump of small Griffin coal at Nestles Milk Factory at Waroona which has been stored for over two years.

This dump, which has a maximum depth of 8 feet, was inspected by the author, who was assured by the manager that it had given little or no trouble and had not depreciated materially.

The plain fact seems to be that no one is in a position to lay down with any precision that conditions under which spontaneous combustion of the various Collie coals will occur, or, what is more important, those under which it will not occur.

Professor Wilsmore, in evidence before the Woolnough Commission, expressed the opinion that spontaneous combustion was probably due to oxidation in the first

place of unsaturated hydro carbons in the coal and that the exclusion of air would also exclude the chance of spontaneous combustion.

The concensus of opinion seems to be that the presence of oxygen and the presence of inflammable fine coal dust are important factors in causing spontaneous combustion.

As far as Collie is concerned, the presence or absence of pyrites is not thought to be of importance, but slight dampness is thought to be a favourable condition.

A thorough investigation into the whole question of storage seems very desirable.

COMMERCIAL UTILITY OF COLLIE COAL.

A classification of coals, taken from "Coal and Its Scientific Uses" by William A. Bone, is set out hereunder:—

THE REGNAULT-GRUNER CLASSIFICATION OF COALS (AS REVISED BY THE AUTHOR).

Genus.	Class.	Chief Uses.	Percentage Composition.			Volatiles at 900° C.	Fixed Carbon.	Character of Carbonaceous Residue.
			C.	H.	O + N + S.			
A. Lignites ...	Non-caking ...	... ...	% 60 to 75	% about 5·0	% 20 to 35	% above 45	% below 55	Non-coherent.
B. Bituminous	(1) Non-caking Long Flame	Reverbatory Furnaces	75 to 80	4·5 to 5·5	15 to 20	40 to 45	55 to 60	Non-coherent.
	(2) Caking Long Flame	Gas-making ...	80 to 85	about 5·6	10 to 15	32 to 40	60 to 68	Very Porous Coke.
	(3) Hard Coking	Coke Manufacture	84 to 89	5·0 to 5·6	5·5 to 11·0	26 to 32	68 to 74	Dense Coke.
	(4) Hard Coking Short Flame	Coke Manufacture and Steam Raising	88 to 90	4·5 to 5·5	5·5 to 6·5	18 to 26	74 to 82	Very Dense Coke.
B.–C. Semi-Bituminous	Non-Caking Short Flame	Steam Raising ...	90 to 92	4·0 to 4·5	4·0 to 5·5	15 to 20	80 to 85	Weakly Caking or Non-coherent.
C. Anthracitic and Anthracites	(1) Anthracitic Non-caking	Steam Raising ...	92 to 94	3·0 to 4·0	3·0 to 4·5	8 to 15	85 to 92	Pulverulent.
	(2) Anthracites Non-caking	Domestic and Central Heating; Malting Kilns	92 to 94	3·0 to 4·0	3·0 to 4·5	below 8	above 92	Pulverulent.

All the numerical data in the above table refer to the dry ashless coal.

The Collie coals fit into this classification near the dividing line between Lignites and Bituminous coals, the soft coals on the Lignite side of the dividing line and the hard coals on the Bituminous side.

As such they are not given any great commercial utility. It will be noted that they are outside the range of gas and coke making coals. Our experience, unfortunately, confirms the classification in this regard, and all gas works use imported coal exclusively.

Nevertheless, Collie coal is a satisfactory coal for steam production and for heating purposes and for such uses there is an ever increasing demand.

The bulk of the coal is screened over 1½ inch mesh screens. Approximately 70 per cent. of the coal passes over the screen and is sold as large coal. The remaining 30 per cent. of the coal passes through the screen and is sold as small coal. A relatively small amount of unscreened coal is also sold.

Until recent years there was little demand for small coal and large quantities were dumped at Collie.

Large coal is still used exclusively in our railway locomotives. Owners of boilers with widely spaced firebars also prefer it.

The demand for small coal is, however, steadily increasing. It is used in boilers fitted with chain grate feeds and is also used in pulverised form.

The Collie Power House and the Swan Portland Cement Company use pulverised coal exclusively and the new Station B of the East Perth Power House uses it with great advantage. This station produces a kilowatt hour from 1.38 lbs. of coal, whereas Station A uses 4.03 lbs. of small coal to produce a kilowatt hour.

At present coal is rationed and only made available to those whose operations are considered essential and who furthermore are unable to utilise an alternative fuel.

The following table gives an indication of the present consumers and the amounts of coal allotted to them:—

Consumer.	Coal Allotted Per Month. Large. Tons	Small. Tons.
W.A. Government Railways ..	32,300	—
East Perth Power Station	—	12,750
Swan Portland Cement Co.	60	1,700
Colonial Sugar Refinery	700	—
W.A. Meat Exports	120	—
State Engineering Works	275	—
Nestle and Anglo Swiss Condensed Milk Co.	—	225
Plaistowe and Co., Ltd.	130	—
Yarloop Foundry	100	—
Emu Brewery	—	225
State Brickworks	—	180
Collie Power Co., Ltd.	—	1,400
Swan Brewery, Ltd.	—	270
*Fremantle Harbour Works ..	1,300	—
Fremantle Harbour Trust	87	—
Ammunition Factory	—	150
Commonwealth Egg Drying Plant	—	80
Hadfields, Ltd.	100	—
Brisbane, Wunderlich, Ltd. ..	120	—
Hollywood Military Hospital ..	250	—
Metropolitan Water Supply ..	—	200
Other small Essential Undertakings	631	147
	36,173	17,327

* Temporarily using mostly Newcastle coal.

It is not an easy matter to gauge just how much additional coal would be consumed if it were available, but probably at least another 10,000 tons of coal a month.

At present many undertakings which, owing to shortage of coal, have to use wood, would prefer to have coal, and none is available for hotels, boarding houses, laundries or private homes.

VALUE OF COLLIE COAL TO WESTERN AUSTRALIA.

It has fortunately been the policy of successive governments for many years to utilise Collie coal for railways and electricity supply. The Government order for these purposes has absorbed over 80 per cent. of the total consumption of local coal and has permitted the coal mining industry to become firmly established.

Coal to the value of £10,700,000 has been produced, but this does not adequately express the real value of the industry to the State to-day. Of far greater importance is the fact that Collie coal is fortunately now available when the shipping problem prevents any large importation of coal.

We are at present dependent on Collie coal for the operation of our railways, our electric light supply and our electric power.

Bearing in mind also the important part Collie coal is playing in the development of our primary and secondary industries, it is not too much to say that Western Australia would be in a condition little short of disastrous without it.

ACKNOWLEDGMENTS.

I am indebted to the Under Secretary for Mines for kindly consenting to have the model of the field prepared at Departmental expense and to Mr. Berry and his assistants for the time and thought given by them to the details connected with its preparation.

Mr. F. G. Forman brought under my notice an old model that had been started at Collie on somewhat similar lines.

Mr. Clay Duke, Surveyor to Amalgamated Collieries of W.A., Ltd., is responsible for all recent survey work involved and for the collection of much of the borehole data.

I have freely made use of all published reports of the Geological Survey and of the Government Mineralogist and Analyst.

I have also utilised the reports and the evidence given before the Royal Commissions on the Collie Coalfield.

I have received much assistance from the managements of the Amalgamated Collieries of W.A. Limited and the Griffin Coal Mining Company, Limited.

Dr. Kent has kindly made available to me a quantity of valuable analytical data which, with his consent, I propose to publish as an appendix to this address.

Mr. H. Bowley, Government Mineralogist and Analyst lent me relevant literature.

Mr. J. S. Foxall, Assistant State Mining Engineer, has kindly perused my manuscript and checked computations.

Mr. J. Gillespie, Inspector of Mines, Collie, has supplied information regarding artesian water and faults, particularly at the Griffin Mine.

Other acknowledgments are made in the body of the address and I sincerely trust that none has been omitted.

FINAL WORD.

Our knowledge of the Collie Coalfield is far from complete. Much investigation requires to be done before a satisfactory correlation of the coal seams can be made.

Experiments to determine the conditions under which Collie coal can be safely stored are also very desirable.

Estimates of available coal in the field must be regarded as being tentative only and should be revised from time to time as fresh data becomes available.

Nevertheless, everything points to the fact that Collie coal will continue to play a very important part indeed in the development of the State for many years to come.

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ADDENDUM.

Dr. Kent's views on Correlation of the Working Seams at Collie.

This addition to my address is made as the result of some correspondence between Dr. Kent, Chemist to the Railway Department, and myself.

He has kindly made available to me, and has given me permission to publish, some views he has formed regarding correlation together with a quantity of most valuable analytical data.

His correlation, based largely on the chemical composition of the coals, is most interesting, and differs only from the correlation suggested in my address in that he does not consider the Westralia Co-operative seam to be the same as the Proprietary-Stockton seam.

This view opens up important possibilities and the following questions immediately suggest themselves:—

1. Does not Proprietary-Stockton seam exist above that worked in the Westralia and Co-operative mines?

2. Does the Westralia-Co-operative seam exist below that worked in the Proprietary and Stockton mines?

Regarding question 1, it may be pointed out that neither Westralia Calyx Bore No. 1, which intersected the seam worked at 262ft. 3in., or the Westralia Calyx Bore No. 2, which intersected the seam worked at 353ft. 6in., passed through any other seam which seems likely to be the western continuation of the Proprietary-Stockton seam.

Regarding question 2, it should be pointed out that little or no boring has been carried out below that worked in the Proprietary and Stockton Mines and that quite apart from the view expressed by Dr. Kent, a bore to test this ground is quite justifiable.

Personally I feel that the evidence supporting the one seam theory is stronger than the evidence submitted by Dr. Kent against this view. I would, therefore, suggest that the difference in the chemical composition of the coal worked in the Westralia and Co-operative Mines from that worked in the Proprietary and Stockton Mines may perhaps be due to the fact that the portion of the seam on the western side of the Wallsend Fault has occupied a lower horizon ever since that fault occurred and has thereby been subjected to different conditions.

I have no suggestion to offer concerning the difference in the ash except to point out that variations do occur and that the ash from the siderite coal probably differs considerably from that of the same seam in its vicinity.

Whichever view eventually turns out to be the correct one I would like to record my appreciation of the fact that Dr. Kent has begun to make analyses of the coals met with in all bore holes.

I sincerely hope that he will be able to continue to do so, as I feel that with the aid of this information, not only may correlation be assisted, but it will be possible in the future to make estimates showing the quality as well as the quantity of coal available in each of the seams of the coalfield.

Close co-operation between the Railway Department, the Mines Department and the operating companies is urged so that all aspects of each problem can be considered by the technical officers attempting its solution.

Dr. Kent's contribution to the question of correlation and the analytical data made available are set out hereunder.

Correlation of Working Seams at Collie.

Various opinions have been expressed from time to time concerning correlation of the working Collie coal seams. In particular, there is a belief that the Westralian, Co-operative, Proprietary and Stockton collieries have all worked the same seam. Blatchford and Forman in the 1930 Royal Commission Report supported this idea and suggested further the possibility that the Premier colliery might be on a continuation of the same seam.

It is my belief that this idea is erroneous, at least in part. The evidence in favour of the Westralian and Co-operative seams being the same is strong; that in favour of Proprietary and Stockton being one seam is equally good; but there is evidence considered equally convincing that Westralian-Co-operative and Proprietary-Stockton are two different seams, albeit fairly closely related geologically.

The evidence of dissimilarity is mainly chemical:—

(1) The calculated dry, ash-free calorific values of the two series are typical but different. Thus, Westralian-Co-operative gives figures from about 13,250 to 13,550 B.Th.U. per pound, increasing with depth below the surface, whereas Proprietary-Stockton gives figures from about 12,900 to 13,200 B.Th.U. per pound, also increasing with depth. Figures outside these ranges are met with: for instance, coal near the surface and affected by surface influences is usually lower; and much of the coal mined at Stockton is of this type. The lower workings of the Stockton mine yield figures from 13,000 to 13,100 B.Th.U. per pound, and compare well with coal at similar depths from the Proprietary mine.

(2) The ash from Westralian or Co-operative coal is pale in colour: greyish-pink to pale brown. It consists principally of alumina and silica with some iron oxide (rarely above 15 per cent.) with smaller amounts of other oxides. The Proprietary or Stockton ash is almost invariably a deep brownish-red due to a high content of iron oxide in the neighbourhood of 35 per cent. Most of the remainder is silica and alumina with small quantities of other oxides. Analyses of ashes are not numerous; but long experience with these coals has shown the appearance and colour of these ashes to be remarkably constant and to divide them quite sharply into the two types indicated.

(3) Ultimate analyses of the coals supply further evidence that two distinct types of coal are to be considered. This evidence alone would be insufficient to form a definite opinion, but taken in conjunction with (1) and (2), above, is useful confirmation.

Changes can and do occur in coal seams so as to alter their characteristics from mine to mine, but these changes are normally gradual. Marked changes over short distances are usually associated with intrusions which are not known to occur in the Collie field; moreover, they are localised in effect. It is understood that one reason underlying the single-seam opinion is the belief that the character of the coal shows a gradual improvement from east to west. As indicated under (1) above, however, this is more apparent than real; and a true consideration of this circumstance must take into account the depths at which the coal was mined.

The relationship between the Westralian and Co-operative collieries appears at first sight to be simple, and to be satisfactorily met by saying that the same seam is worked in the two mines. There is, however, some evidence to suggest that different levels of what appears to be the one seam may have been worked in the two mines. This evidence is meagre and depends mainly upon the ash content of coal above and below the shale band which characterises the coal worked in both collieries. In the lower workings of the Co-operative colliery, below a fairly large fault, where the seam is about 18 feet thick, there are two shale bands in the seam. It is tentatively suggested that the upper portion of this 18 feet, with one shale band, corresponds to the portion which supplied most of the Co-operative colliery coal; and that the lower portion with the other shale band corresponds to the portion that was mined in the Westralian colliery. To prove this, if it is so, would entail a fair amount of work; to disprove it might be easier.

That the Proprietary and Stockton collieries are working on the one seam is strongly supported by all the evidence available.

As a matter of interest in its bearing on the question of correlation, the results from the examination of samples from Bore 7, site K, at Ewington, may be quoted. A 9 foot seam having the characteristics of Proprietary-Stockton coal was found at 172 ft. 6 in. from the surface. At 307 feet, that is 125 ft. 6in. below the 9-ft. seam, a 4-ft. seam of coal was found with properties similar to Co-operative coal. The analyses of coal from these seams was not so full as desirable to characterise them with complete satisfaction. The results, however, do serve to suggest the order of depth that may separate the Westralian-Co-operative from the Proprietary-Stockton seams.

From what is known of the properties of Premier coal, this is considered more akin to the Collieburn or Griffin series of coals than to those discussed above.

C. R. KENT,
Chief Chemist,
W.A. Government Railways.

22nd June, 1943.

TESTS OF SAMPLES FROM BORES, COLLIE COALFIELD, DONE IN W.A. GOVERNMENT RAILWAYS LABORATORY.

Bore.	Date.	Depth to Top of Seam.	Seam Thickness.	Analysis (Corr'd).			Analysis (Dry, ash-free basis).								Remarks.
				Moisture.	Ash.	Cal. Val. BTU.	Cal. Val. BTU.	Volatiles.	Fixed C.	C.	H.	N.	S.	O.	
		ft. in.	ft. in.	%	%					%	%	%	%	%	
West Collie Calyx No. 3	1937	718 0 765 0	4 6 2 0	17·50 17·50	9·31 12·90	9,870 9,320	13,485 13,380	....	....	....	....	....	....	....	Both seams of Co-operative (or Westralian) type.
Co-operative Calyx Bore	1937	682 0	3 0	17·50	4·76	10,485	13,485	....	....	....	....	....	....	....	do. do. do.
"Proprietary New Bore"	1936	?	13 0	21·50	6·77	9,260	12,905	....	....	....	....	....	....	....	Proprietary (Stockton) type.
Stockton Hand Bores—															
No. 27	1938	71 0 91 3	6 9 11 4	22·50 22·50	8·63 7·18	8,835 9,065	12,830 12,890	....	....	....	....	....	....	....	Stockton No. 1 seam. Stockton No. 2 (working) seam.
No. 28	1938	87 11 109 6	9 0 13 0	22·50 22·50	9·51 5·49	8,710 9,320	12,810 12,940	....	....	....	....	....	....	....	Stockton No. 1 seam. Stockton No. 2 (working) seam.
No. 29	1938	131 9	13 5	22·50	5·84	9,325	13,010	....	....	....	....	....	....	....	Stockton No. 2 (working) seam.
No. 40	1938	86 2	1 10	22·50	9·55	8,740	12,865	....	....	....	....	....	....	....	45 ft. 10 in. below working seam.
No. 45	1938	105 10	10 6	22·50	5·75	9,340	13,010	....	....	....	....	....	....	....	Stockton No. 2 (working) seam.
No. 49	1938	247 6	9 8	22·50	5·84	9,385	13,105	....	....	....	....	....	....	....	Stockton No. 2 (working) seam.
No. 52	1939	45 0	4 0	22·50	5·64	9,155	12,745	....	....	....	....	....	....	....	Stockton (proprietary) type.
No. 58	1939	189 6 245 10	9 8 8 6	22·50 22·50	11·12 5·56	8,510 9,505	12,880 13,215	....	....	77·15 77·85	3·90 4·10	1·3 1·4	0·25 0·35	17·40 16·30	Stockton No. 1 seam. Stockton No. 2 (working) seam.
No. 59	1939	254 2	12 8	22·50	5·98	9,270	12,960	....	....	77·50	3·95	1·3	0·25	17·00	Stockton working seam ?.
No. 61	1940	226 0	12 3	22·50	8·31	8,885	12,840	....	....	....	....	....	....	....	Stockton working seam ?.
No. 64	1940	330 0	12 0	22·50	13·81	8,035	12,615	....	....	....	....	....	....	....	Stockton working seam ?.
No. 67	1940	312 8	11 0	22·50	6·16	9,305	13,045	....	....	....	....	....	....	....	Stockton working seam ?.
No. 68	1941	364 0	11 0	22·50	6·46	9,295	13,080	....	....	....	....	....	....	....	Stockton working seam ?.
No. 69	1941	241 10	12 10	22·50	6·80	9,155	12,945	....	....	....	....	....	....	....	Stockton working seam ?.
No. 71	1941	186 10	5 0	22·50	4·03	9,650	13,135	....	....	....	....	....	....	....	Stockton (proprietary) type.
No. 77	1941	77 6	9 8	22·50	7·35	9,230	13,025	....	....	77·70	4·20	....	....	....	Stockton No. 2 (working) seam.
No. 78	1941	93 6	8 6	22·50	5·43	9,310	12,925	....	....	78·20	4·00	....	....	....	Stockton No. 2 (working) seam.
No. 90	1942	38 3	9 6	22·50	4·27	9,635	13,160	....	....	77·15	4·35	1·4	0·30	16·80	Stockton No. 2 (working) seam.
No. 91	1942	26 0 47 8	10 3 8 2	22·50 22·50	7·49 4·38	9,015 9,595	12,880 13,120	....	....	76·20 78·05	3·95 4·05	1·4 1·3	0·35 0·25	18·10 16·35	Stockton No. 1 seam. Stockton No. 2 (working) seam.
Cardiff Hand Bores—															
No. 11	1937	67 0	7 0	23·00	3·46	9,290	12,635	....	....	....	....	....	....	....	Cardiff type coal.
No. 12	1937	76 3	13 4	23·00	6·12	8,930	12,600	....	....	....	....	....	....	....	Working seam probably.
No. 13	1937	66 3	12 11	23·00	3·22	9,290	12,590	....	....	....	....	....	....	....	Working seam probably.
No. 14	1937	? 148 8	? 7 2	23·00 23·00	3·52 3·34	9,235 9,145	12,570 12,415	....	....	....	....	....	....	....	Working seam ?. Cardiff No. 2 seam ?.
No. 15	1937	62 6 130 8	4 0 13 1	23·00 23·00	5·46 4·28	8,980 9,160	12,550 12,595	....	....	....	....	....	....	....	Cardiff type coal. Probably working seam (No. 1).

* Analytical figures calculated to moisture contents characteristic of associated working seams or of working seams most closely resembled.

TESTS OF SAMPLES FROM BORES, COLLIE COALFIELD, DONE IN W.A. GOVERNMENT RAILWAYS LABORATORY—*continued.*

Bore.	Date.	Depth to Top of Seam.	Seam Thickness.	Analysis (Corr'd).			Analysis (Dry, ash-free basis).								Remarks.
				Moisture.	Ash.	Cal. Val. BTU.	Cal. Val. BTU.	Volatiles.	Fixed. C.	C.	H.	N.	S.	O.	
Cardiff Hand Bores—*continued.*		ft. in.	ft. in.	%	%					%	%	%	%	%	
No. 16	1937	97 8	13 3	23·00	5·01	9,035	12,550	....	....	....	....	....	....	....	Probably working seam (No. 1).
		140 4	7 7	23·00	5·38	9,015	12,585	....	....	....	....	....	....	....	Cardiff No. 2 seam ?.
No. 17	1937	35 6	11 7	23·00	9·19	8,455	12,470	....	....	....	....	....	....	....	Probably working seam (No. 1).
		77 1	7 5	23·00	9·85	8,355	12,440	....	....	....	....	....	....	....	Cardiff No. 2 seam ?.
No. 18	1937	66 3	12 11	23·00	5·33	8,930	12,460	....	....	....	....	....	....	....	Probably working seam (No. 1).
No. 19	1937	56 10	5 6	23·00	4·28	9,100	12,510	....	....	....	....	....	....	....	Cardiff type coal.
		98 8	4 6	23·00	3·28	9,295	12,605	....	....	....	....	....	....	....	Cardiff type coal.
No. 20	1937	77 10	12 2	23·00	5·83	8,815	12,385	....	....	....	....	....	....	....	Probably working seam (No. 1).
		111 5	6 8	23·00	5·59	8,785	12,305	....	....	....	....	....	....	....	Cardiff No. 2 seam ?.
"Scottish New Seam" Bore	1934	?	?	23·00	3·57	9,575	13,040	45·1	54·9	....	....	....	....	....	Reported to be of Scottish (Collieburn) type.
East Collie Bore	1936	?	?	23·00	5·48	9,350	13,075	42·5	57·5	....	....	....	....	....	Reported to be of Scottish (Collieburn) type.
Bore ?	1936	?	?	23·00	3·30	9,525	12,920	46·0	54·0	....	....	....	....	....	Reported to be of Scottish (Collieburn) type.
Elias' H.B. 34 near Collie Boulder	1937	156 6	0 8	23·00	38·52	4,550	11,820	....	....	....	....	....	....	....	Reported to be of Scottish (Collieburn) type.
Calyx 2		157 2	2 10	23·00	17·22	7,635	12,770	....	....	....	....	....	....	....	Reported to be of Scottish (Collieburn) type.
Griffin Bore north of Collie River	1935	?	6 9	18·00	3·05	10,415	13,190	....	....	....	....	....	....	....	Griffin type coal.
Griffin Bore, new 12 ft. Seam	1935	?	12 0	18·00	4·95	10,135	13,155	....	....	....	....	....	....	....	Griffin type coal.
Hard Coals, Ltd. (Ewington)	July,	60 2	10 6	21·50	7·43	9,255	13,020	....	....	....	....	....	....	....	Proprietary (Stockton) type.
Bore ?	1937	103 5	7 0	21·50	6·08	9,490	13,105	....	....	....	....	....	....	....	Proprietary (Stockton) type.
Bore 5, Site I	1937	47 5	9 1	17·50	8·25	9,945	13,395	....	....	....	....	....	....	....	Co-operative type coal.
Bore ? (May be No. 6, Site J)	1937	55 7	2 7	21·50	7·32	9,370	13,160	....	....	....	....	....	....	....	Proprietary (Stockton) type.
		58 2	1 0	Black shale between the two seams.											
		59 2	8 3	21·50	5·61	9,585	13,150	....	....	....	....	....	....	....	Proprietary (Stockton) type.
Bore 7, Site K (Granite at 448 ft.)	1937	164 2	0 10	21·50	5·55	9,595	13,155	....	....	....	....	....	....	....	Proprietary (Stockton) type.
		165 9	0 2	21·50	3·38	9,875	13,150	....	....	....	....	....	....	....	Proprietary (Stockton) type.
		172 6	9 0	21·50	7·08	9,255	12,955	....	....	....	....	....	....	....	Proprietary (Stockton) type.
		212 ft. to 222 ft.	0 6	21·50	20·91	6,995	12,150	....	....	....	....	....	....	....	Proprietary (Stockton) type.
			1 0	21·50	6 12	9,480	13,095	....	....	....	....	....	....	....	Proprietary (Stockton) type.
		307 0	4 0	17·50	7·37	10,060	13,390	....	....	....	....	....	....	....	Co-operative type coal.
Bore 8, Site L	1938	162 6	10 0	21·50	9·91	....	....	....	....	....	....	....	....	....	Proprietary (Stockton) type ?.
		202 6	10 6	21·50	6·52	9,335	12,965	....	....	....	....	....	....	....	Proprietary (Stockton) type.
Bore 9, Site M....	1938	280 0	10 0	21·50	7·04	9,320	13,065	....	....	....	....	....	....	....	Proprietary (Stockton) type.
SEAMS EXAMINED FROM SHAFTS OR DRIVES.															
Hard Coals, Ltd. (Ewington) Average of four tests from seam	1933 and 1934	? shallow	app. 9 ft.	21·50	5·93	9,490	13,075	32·6	67·4	79·55	4·08	1·40	1·18	13·78	Proprietary (Stockton) type.
"New Griffin" Seam, estimated to overlie working seam by 300 ft.	1932	app. 40 ft.	6 6	18·00	7·10	9,920	13,242	42·7	57·3	....	....	....	....	....	Griffin or Collieburn type of coal. Samples examined included a 6-9 in. dirty band at bottom of the seam: 30% ash at 18% moist.
Griffin 12 ft., average of four tests from seam	1935	app. 50 ft.	app. 12 ft.	18·00	4·18	10,195	13,105	....	....	....	....	....	....	....	Griffin or Collieburn type of coal.
Stockton No. 1 Seam (app. 15 ft. above working seam), average of five tests from seam	1943	variable	app. 9 ft.	22·50	9·93	8,650	12,800	....	....	....	....	....	....	....	Stockton (proprietary) type.

27th May, 1943.

C. R. KENT, Chief Chemist,
W.A. Government Railways.

COLLIE COALS.

AVERAGE ANALYSES FOR THE WORKING SEAMS.

Large Coal.—Screened over an inch-and-a-half screen. Averages for the ten years ending June, 1942.

Colliery.	Analysis (Corrected).			Dry, ash-free Calorific Value.
	Moisture.	Ash.	Calorific Value.	
	%	%	BTU/lb.	BTU/lb.
Co-operative....	17·50	6·7	10,195	13,455
Proprietary	21·50	6·25	9,515	13,165
Stockton	22·50	6·2	9,250	12,965
Cardiff	23·00	4·75	9,050	12,530
Griffin	18·00	4·35	10,235	13,185
Westralian*	17·50	7·9	9,950	13,340
Premier†	23·00	2·35	9,655	12,935

Run-of-Mine Coal.—Calculated on the assumption that Run-of-Mine consists of 70 per cent. large coal (as above) and 30 per cent. of smalls, the quality of the latter being determined from coal supplied for Power House fuel.

Colliery.	Analysis (Corrected).			Dry, ash-free Calorific Value.
	Moisture.	Ash.	Calorific Value.	
	%	%	BTU/lb.	BTU/lb.
Co-operative....	17·50	8·6	9,895	13,385
Proprietary	21·50	7·25	9,365	13,140
Stockton‡	22·50	7·1	9,115	12,950
Cardiff	23·00	5·15	8,995	12,515
Griffin	18·00	5·15	10,120	13,170
Westralian*	17·50	9·75	9,660	13,280
Premier†	23·00	3·75	9,425	12,875

* Average for the nine years ending November, 1931.
† Average for the five years ending July, 1927.
‡ Stockton Lower Workings, 13,000 to 13,100 B.T.U., *see* page 37

C. R. KENT,
Chief Chemist, W.A. Government Railways.

27th May, 1943.

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Tables.

Division III.

Report of the Superintendent of State Batteries.

THE UNDER SECRETARY FOR MINES:

I have the honour to report for the information of the Hon. Minister on the operations at State Batteries for the year ending 31st December, 1944.

The tonnage milled dropped from 19,074 in 1943 to 18,261.75 tons but the result can be considered satisfactory when the ever-increasing manpower difficulty is taken into consideration.

Tailing treatment which is the profitable side of our operations showed a steep decline from 27,577 tons in 1943 to 17,267 tons mainly due to the difficulty of obtaining suitable labour, notwithstanding very considerable increases in the piece work rates and the installation of portable conveyors to assist in the heavier work of emptying the vats.

At our Kalgoorlie plant, which normally has a capacity of 18,000 tons per annum, eighteen different men were employed in treating only 2,219 tons. The continued effort to carry on treatment is only justified by the necessity of keeping our very much reduced staff employed against the time when the cessation of hostilities will call for the treatment of largely increased tonnages and the fact that prospectors can only be paid the final instalment of their tailing money after the completion of treatment.

Every effort has been made to keep the industry alive in the outback centres by making all our batteries available to customers and transferring the necessary staff and employees from place to place. Skilled employees such as engine drivers are at a premium, especially with competition from established mines where positions are permanent, and leading hands have had to fill the breach.

The cost of such transfers, including travelling and away-from-home allowances, apart from that incurred in starting up of plants after long periods of idleness has resulted in a heavy financial loss on working.

Every effort has been made to keep the plants in good condition against the day when it is hoped they will be again fully occupied and repairs and renewals, particulars of which are shown later on in this report, have been relatively heavy.

Some consolation can be taken by the fact that some centres have shown signs of revival.

I might mention Sandstone, a district of great post war possibilities.

To convenience owners and business people of the district, who almost wholly depend on the State Battery, three small runs were arranged at considerable cost and 913 tons were crushed as against 642 tons in the previous year.

The approximate value of the bullion recovered by amalgamation only was £14,000.

Increases and decreases in tonnage crushed at different centres are shown under milling.

The average value of the ore crushed remained high at 18 dwts. 10 grs. per ton, as against 19 dwts. 4 grs. per ton in 1943 and 14 dwts. 21.4 grs. in 1942.

DETAILS OF PRODUCTION.

	Fine ozs.	Value. (£4 4s. 11½d.)	Premium.	Total.
		£	£	£
By Amalgamation	12,103·20	51,442·20	67,201·10	118,682
,, Cyanidation	3,482·48	14,793·90	19,194·20	33,988
	15,585·78	66,236·10	86,434·30	152,670

VALUE PER TON.

The estimated average fine gold per ton recovered by amalgamation was 13 dwts. 6.11 grs., and the average value of the tailing produced was 5 dwts. 4 grs. giving a total head value of 18 dwts. 10.1 grs.

Returns of over 1 oz. per ton were: Sandstone, 913.75 tons at 39 dwts. 19 grs., Coolgardie 2,075.75 tons at 25 dwts. 12 grs., Marble Bar 940.50 tons at 23 dwts. 19 grs., Peak Hill 158.5 tons at 22 dwts. 13 grs. and Cue 3,662.25 tons at 21 dwts. 17 grs.

Meekatharra return was just below an ounce with 1,893.5 tons for 19 dwts. 11 grs. per ton.

Details of individual batteries are shown in Schedule 2 attached to this report.

ESTIMATED PERCENTAGE RECOVERY.

The whole of the tailing was not treated and a small percentage of copper tailing was segregated at Marble Bar as untreatable but applying the average extraction of 77 per cent. obtained in our tailing treatment plants to the average value of tailing produced, the estimated percentage recovery would be as follows:—

Head Value	18 dwts.	10·1 grs.	% Rec.
Recovery by Amalgamation	13 ,,	6·1 ,,	71·95
Recovery by tailing treatment 77% of 5 dwts. 4 grs.	3 ,,	23·48 ,,	21·59
	17 dwts.	5·58 grs.	93·54

RECEIPTS AND EXPENDITURE.

Receipts from all sources totalled £22,025 11s. 4d. and expenditure £37,867, showing a working loss of £15,850 12s. 8d.

Milling costs per ton rose from 22s. 4.7d. to 25s. 4.6d. and tailing treatment from 14s. 4d. to 16s. 11.7d.

A comparison synopsis of the cost and revenue per ton with the figures for 1943 is given later in this report.

OUTPUT SINCE INCEPTION.

	£
Production at par.	
By amalgamation	7,392,721.660
By tailing treatment	1,821,070.584
	9,213,792.244
Gold Premium.	
By amalgamation	2,326,306.470
By tailing treatment	739,465.867
	3,065,772.337
Total Australian Currency	12,279,564.581
Estimated value of tin produced ..	94,455.160
	£12,374,019.741

MILLING.

Excluding the leased batteries at Darlot, Linden and Mt. Sir Samuel, one 20 stamp, seven 10 stamp, and nine 5 stamp mills were available for public crushing, but no ore was crushed at Laverton, Mt. Ida, Ora Banda, Wiluna, Yarri, Warriedar or Yalgoo.

Arrangements were made with Mr. L. C. Hawley to treat a few small parcels of Wiluna ore at his Coolgardie Brilliant Battery. Twelve batteries crushed 317 parcels averaging 57.60 tons, aggregating 18,261.75 tons against 334 parcels of 57.11 tons each in 1943.

The yield by amalgamation showed a satisfactory recovery of 13 dwts. 6.1 grs. per ton or 71.95 per cent. of the total value of the ore.

Boogardie, Coolgardie, Cue and Sandstone showed substantial increases in the tonnage crushed but our main battery at Kalgoorlie, and the consistent producer, Payne's Find, lagged further behind.

Towards the end of the year, renewed activity was noticeable at Yarri and Ora Banda and a small round was put through at the former battery early this year, the first since 1942.

Ora Banda is running on a round of 800 tons at the moment; also the first since 1942.

Some of the tonnages crushed, with the previous year's figures in brackets are:—

Increases.—Boogardie, 1,294 (381); Coolgardie, 2,075 (1,843); Cue, 3,662 (2,239); Sandstone, 913 (642).

Decreases.—Kalgoorlie, 3,037 (4,145); Marble Bar, 940 (1,387); Payne's Find, 1,443 (2,601).

During the year, the leased battery at Linden was taken over by the Department for a short period and extensive repairs were undertaken, and again leased to a new lessee. 778 tons were crushed by our staff.

Little activity was shown at Darlot and Mt. Sir Samuel.

Repairs and renewals were heavy, due to frequent stopping and starting of plants and relacement of tanks, pipes and other items which deteriorate rapidly whether in use or not.

A comparison of the cost, under separate headings, of the year under review and 1940 is as follows:—

	1944.	1940.
Tons crushed	18,261 75	100,454.75
	Shillings.	Shillings.
Management	4.06 }	6.76
Wages	7.44 }	
Stores	4.22	2.62
Fuel	1.66	.82
Renewals and Repairs	2.98	1.37
Sundries	5.00	1.66
	25.36	13.23

ORES OTHER THAN GOLD.

Only one parcel each of scheelite and tin ore was treated at our Coolgardie plant, with the following result:—

Scheelite.

Tenement.	Tons crushed.	Concentrate.	WO_3.	Estimated value.
P.A. 5641 Coolgardie	12	642 lbs.	436 lbs.	£109

Tin.

Tenement.	Tons crushed.	Concentrate.	Sn.	Estimated value.
1 Kathleen Valley	24	560 lbs.	389 lbs.	£25

TAILING TREATMENT.

Nine tailing plants handled 17,267 tons for a recovery of 3,482.58 fine ozs. valued at £33,988 17s. 1d. (A). The cost of treatment was 16s. 11.7d. as against 14s. 4d. in 1943.

Revenue amounted to 14s. 9.6d. as against 17s. 0.8d. and 15s. 4.8d. in 1942.

As pointed out earlier, the rise in cost is mainly due to the small tonnage handled and the continued hang-ups caused by difficulty in obtaining suitable men and holding them.

For the first time this treatment shows a loss.

The revenue was below normal on account of the treatment of material at some batteries being lower in value than the remaining accumulations, and deduction of 11.8d. per ton interest paid to the Treasury for funds supplied to purchase tailing.

As a comparison, some details of the cost for 1944 and 1940 are as follows:—

	1944.	1940.
Tons treated	17,267	93,537
	Shillings.	Shillings.
Management and wages	7.66	5.29
Stores and General Expenses	8.21	3.65
Renewals and Repairs	1.10	.26
	16.97	9.20

COMPARATIVE SYNOPSIS AND RESULTS AT STATE BATTERIES.

For 12 months ending December 31st, 1943 and 1944.

	1943.			1944.		
	Tons.	Expenditure.	Revenue per ton.	Tons.	Expenditure.	Revenue per ton.
		s. d.	s. d.		s. d.	s. d.
Milling	19,074·0	22 4·7	9 9·7	18,261·75	25 4·6	10 11·7
Tailing	27,577·0	14 4·0	17 0·8	17,267·00	16 11·7	14 9·6

RECEIPTS AND EXPENDITURE.

	Tons.	Expenditure.	Revenue.	Loss.
		£ s. d.	£ s. d.	£ s. d.
Milling	18,261·75	23,179 8 0	9,221 7 6	13,958 0 6
Tailing	17,267·00	14,658 5 6	12,780 9 1	1,877 16 5
Ore Dressing	56·50	38 16 6	24 0 9	14 15 9
Total	35,585·25	37,876 10 0	22,025 17 4	15,850 12 8

GENERAL LOAN FUND EXPENDITURE.

	£ s. d.
Portable Conveyor, Kalgoorlie ..	88 18 10
Portable Conveyor, Meekatharra ..	84 8 10
	£173 7 8

CARTAGE AND SUBSIDIES.

Subsidies amounting to £1,461 7s. 5d. were paid on 3,686¾ tons of ore crushed at State Batteries, as against £983 1s. 9d. and 2,302 tons respectively for 1943. At privately run plants only £85 0s. 3d. was paid on 195 tons claiming subsidy.

HEAD OFFICE EXPENDITURE.

	1943.	1944.
	£ s. d.	£ s. d.
Salaries	2,764 2 11	2,764 13 6
Pay Roll Tax ..	606 3 5	553 18 4
War Damage Insurance	530 0 0	
Workers' Compensation	1,062 9 8	663 9 0
Postage	14 4 6	21 9 8
Travelling Expenses	97 4 7	126 4 1
Sundries	49 1 7	146 15 8
	£5,123 6 8	£4,276 10 3

STAFF.

No staff alterations were made but Manager E. Speering and Assayer A. Mileson retired early this year, the Goldfields staff now consisting of eight managers and one assayer.

GENERAL REMARKS.

In the concluding portion of my report for 1943, I drew attention to the increasing difficulties with the manpower situation and there has been no alleviation during the year under review.

The outstanding high prices given for firewood in the Metropolitan Area has at last been reflected in the increased demand by contractors on the Fields and a recent quote for supplies for one of our larger and less remote batteries was 57s. per cord against a previous price of 32s. 6d.

If these high prices are maintained after the war, and it is considered advisable for our Batteries to produce sufficient revenue to at least offset the working expenses, the raising of the charges will have to be seriously considered.

Judging from the small amount of cartage subsidies paid on ore crushed at other batteries, public crushing by private owners has practically ceased, although their charges are considerably higher than those charged by our State Batteries.

The closing down of most privately owned plants suggests that a policy of leasing State Batteries crushing little ore would not be successful at the moment.

Three of our plants are to all intents closed down for the duration as the districts are deserted, but they could be restarted quickly if occasion warranted.

It would appear that no improvement in the position can be looked for until the cessation of hostilities.

D. F. BROWNE,
Superintendent of State Batteries.

4th May, 1945.

SCHEDULE No. 1.

Return showing Tons Crushed, Gold Yield by Amalgamation, Average per Ton in Shillings, and Total Value without Premium for Year ended 31st December, 1944.

Battery.	Tons Crushed.	Gold Yield Bullion.	Value per Ton in Shillings and Pence.	Total Value without Premium.
		ozs.	s. d.	£
Bamboo Creek	689·5	67·70	7 0·8	243·72
Boogardie	1,294·25	658·40	36 7·4	2,370·24
Coolgardie	2,075·75	1,639·15	56 10·3	5,900·94
Cue	3,662·25	4,102·60	80 7·9	14,769·36
Kalgoorlie	3,037·75	1,410·25	33 5·1	5,076·90
Linden	778·00	592·00	54 9·4	2,131·20
Marble Bar	940·50	785·55	60 1·6	2,827·98
Meekatharra	1,893·50	1,465·50	55 8·6	5,275·80
Norseman	1,375·00	1,216·10	63 8·1	4,377·96
Payne's Find	1,443·00	485·90	24 2·9	1,749·24
Peak Hill	158·50	160·60	72 11·4	578·16
Sandstone	913·75	1,705·75	134 4·8	6,140·70
	18,261·75	14,289·50	56 4·1	51,442·20

SCHEDULE No. 2.

Number of Parcels Treated, Tons Crushed, and Head Value for the Year ended the 31st December, 1944.

No. of Parcels Treated.	Battery.	Tons. Crushed.	Yield by Amalgamation, Bullion.	Yield by Amalgamation, Fine Gold.	Gross Contents of Tailings on 100% (including refractory.)	Total Contents of Ore, Fine Gold.	Average per ton, Fine Gold.	Gross Value per ton, at £4 4s. 11½d. per oz.
			ozs. dwts.	ozs. dwts.	ozs. dwts.	ozs. dwts.	dwts. grs.	£ s. d.
11	Bamboo Creek	689·5	67 14	57 7	159 8	216 15	6 4	1 6 2
29	Boogardie	1,294·25	658 8	557 13	175 7	733 0	11 8	2 8 2
37	Coolgardie	2,075·75	1,639 3	1,388 7	1,261 5	2,649 12	25 12	5 8 4
46	Cue	3,662·25	4,102 12	3,474 18	497 3	3,972 1	21 17	4 12 3
67	Kalgoorlie	3,037·75	1,410 5	1,194 10	793 17	1,988 7	13 2	2 15 7
13	Linden	778·00	592 0	501 8	108 12	610 0	15 16	3 6 7
19	Marble Bar	940·50	785 11	665 7	444 10	1,109 17	23 19	5 1 1
18	Meekatharra	1,893·50	1,465 10	1,241 5	601 6	1,842 11	19 11	4 2 8
44	Norseman	1,375·00	1,216 2	1,030 1	148 6	1,178 7	17 3	3 12 9
15	Payne's Find	1,443·00	485 18	411 11	114 0	525 11	7 5	1 10 7
5	Peak Hill	158·50	160 12	136 0	42 5	178 5	22 13	4 15 9
13	Sandstone	913·75	1,705 15	1,444 15	372 8	1,817 3	39 19	8 9 0
317		18,261·75	14,289 10	12,103 2	4,718 7	16,821 9	18 10	3 18 3

Average tons per parcel .... 57·60
Average yield by amalgamation per ton (fine gold) .... 13 dwts. 6·1 grs.
Average value by amalgamation per ton .... £2 16s. 3d.—Australian, £6 9s. 9d.
Average head value of tailings per ton (fine gold) .... 5 dwts. 4 grs.
Average value of tailings per ton .... £1 1s. 11d.—Australian, £2 10s. 7d.

SCHEDULE No. 3.

Direct Purchase of Tailings.

YEAR ENDED 31ST DECEMBER, 1944.

Battery.	Tons Purchased.	Amount Paid for Tailings.	Amount Paid A/c. Premium.
		£ s. d.	£ s. d.
Bamboo Creek	234·50	324 17 6	447 5 9
Boogardie	653·50	165 17 8	267 14 6
Coolgardie	1,695·50	2,459 17 2	2,623 10 7
Cue	1,042·50	363 3 7	735 19 5
Kalgoorlie	1,916·00	1,431 8 1	1,272 19 1
Linden	395·75	106 10 9	137 7 7
Marble Bar	515·00	979 13 7	136 1 11
Meekatharra	929·25	827 5 3	2,396 10 4
Norseman	416·25	110 16 1	71 15 7
Ora Banda	300·75	606 8 6	1,463 6 10
Payne's Find	70·00	63 3 9	91 16 11
Peak Hill	147·50	111 12 9	297 17 0
Sandstone	660·75	691 14 1	715 2 0
	8,977·25	8,242 8 9	10,657 7 6

SCHEDULE No. 4.

Tailings Treatment for 1944.

Battery.	Tonnage.	Yield.	Value.	Premium.	Total.
		fine ozs.	£	£	£
Bamboo Creek	364	109·00	463·058	600·517	1,063·575
Boogardie	948	132·57	563·396	736·024	1,299·420
Coolgardie	3,699	988·37	4,198·469	5,442·271	9,640·740
Cue	2,904	326·41	1,386·526	1,790·209	3,176·735
Kalgoorlie	2,220	276·71	1,175·491	1,525·919	2,701·410
Meekatharra	3,480	769·03	3,266·623	4,230·748	7,497·371
Ora Banda	1,038	445·31	1,891·542	2,464·229	4,355·771
Payne's Find	1,372	107·01	454·816	588·788	1,043·604
Sandstone	1,242	323·97	1,376·146	1,792·516	3,168·662
Yarri	...	2·48	10·516	13·613	24·129
Slags	...	1·72	7·321	9·433	16·754
	17,267	3,482·58	14,793·904	19,194·267	33,988·171

SCHEDULE No. 5—Milling and Tin.

Statement of Receipts and Expenditure for the Year ended 31st December, 1944.

Battery.	Tonnage Crushed.	Expenditure.									Receipts.		Profit.	Loss.
		Management.	Wages.	Stores.	Total Working Expenditure.	Cost per Ton.	Renewals and Repairs.	Sundries.	Gross Expenditure.	Cost per Ton.	Receipts.	Receipts per Ton.		
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.
Bamboo Creek	689·50	178 12 0	463 6 1	292 2 0	934 0 1	27 1·1	164 15 8	191 3 0	1,289 18 9	37 4·9	364 3 8	10 6·7	....	925 15 1
Boogardie	1,294·25	78 5 10	323 19 9	143 14 11	546 0 6	8 5·2	53 11 2	213 2 6	812 14 2	12 6·7	520 6 1	8 4·8	....	292 8 1
Coolgardie	2,075·75	593 0 7	670 1 3	640 8 3	1,903 10 1	18 4·0	399 10 9	727 2 2	3,030 3 0	29 2·3	1,018 10 10	9 9·7	....	2,011 12 2
Cue	3,662·25	191 10 6	795 1 11	854 18 2	1,841 10 7	10 0·4	378 14 9	737 14 0	2,957 19 4	16 1·8	1,925 3 6	10 6·2	....	1,032 15 10
Darlot	....	....	....	....	....	....	....	....	....	....	1 12 6	....	1 12 6	....
Kalgoorlie	3,037·75	645 10 1	841 8 4	830 11 1	2,317 9 6	15 3·1	250 18 10	608 6 4	3,176 14 8	20 10·9	1,337 15 2	8 9·7	....	1,838 19 6
Laverton	....	....	58 0 0	....	58 0 0	....	....	Cr. 11 0	57 9 0	....	....	....	....	57 9 0
Linden	778·00	144 9 6	345 12 6	236 14 10	726 16 10	18 8·2	136 1 11	140 16 1	1,003 14 10	25 9·6	597 2 11	15 4·2	....	406 11 11
Marble Bar	940·50	200 18 6	377 12 4	330 14 7	909 5 5	19 4·0	212 17 3	329 0 6	1,451 3 2	30 10·3	489 16 11	10 5·0	....	961 6 3
Meekatharra	1,893·50	260 0 11	780 0 10	663 14 1	1,703 15 10	17 11·9	79 13 6	405 0 10	2,188 10 2	23 1·4	906 2 1	9 6·8	....	1,282 8 1
Mt. Ida	....	....	5 8 7	....	5 8 7	....	....	....	5 8 7	....	....	....	....	5 8 7
Mt. Sir Samuel	....	....	....	4 6 8	4 6 8	....	....	19 16 3	24 2 11	....	....	....	....	24 2 11
Norseman	1,375·00	593 12 1	741 14 4	558 13 11	1,894 0 4	27 6·6	209 7 5	381 10 2	2,484 17 11	36 1·7	659 9 10	9 9·6	....	1,825 8 1
Ora Banda	....	306 1 3	21 9 6	33 2 4	360 13 1	....	20 14 6	67 5 7	448 13 2	....	7 10 6	....	....	441 2 8
Payne's Find	1,443·00	218 1 10	694 14 7	354 18 8	1,267 15 1	17 6·8	428 17 1	344 6 7	2,040 18 9	28 3·4	747 3 8	10 4·3	....	1,293 15 1
Peak Hill	158·50	21 13 5	123 4 4	77 12 10	222 10 7	28 0·9	44 13 10	49 2 7	316 7 0	39 11·0	54 3 8	6 10·1	....	262 3 4
Pinjin	....	....	....	....	....	....	....	....	....	....	2 10 0	....	2 10 0	....
Sandstone	913·75	277 17 8	488 5 7	333 12 2	1,099 15 5	24 0·8	327 17 2	337 16 11	1,765 9 6	38 7·7	505 1 6	11 6·4	....	1,260 8 0
Warriedar	....	....	....	15 7 1	15 7 1	....	....	2 18 0	18 5 1	....	6 8 6	....	....	11 16 7
Wiluna	....	....	2 0 0	....	2 0 0	....	....	1 16 4	3 16 4	....	78 6 2	....	74 9 10	....
Yalgoo	....	....	35 0 0	....	35 0 0	....	....	4 11 0	39 11 0	....	....	....	....	39 11 0
Yarri	....	....	33 0 0	....	33 0 0	....	12 17 9	3 11 0	49 8 9	....	....	....	....	49 8 9
Youanmi	....	....	1 7 0	....	1 7 0	....	8 15 11	3 19 0	14 1 11	....	....	....	....	14 1 11
	18,261·75	3,709 14 2	6,801 6 11	5,370 11 7	15,881 12 8	17 4·7	2,729 7 6	4,568 7 10	23,179 8 0	25 4·6	9,221 7 6	10 11·7	78 12 4	14,036 12 10
Coolgardie Treatment Plant	56·50	....	38 16 6	....	....	13 8·9	....	....	38 16 6	13 8·9	24 0 9	8 6·1	....	14 15 9
Total	18,318·25	3,709 14 2	6,840 3 5	5,370 11 7	15,881 12 8	....	2,729 7 6	4,568 7 10	23,218 4 6	....	9,245 8 3	....	....	14,051 8 7
														78 12 4
Total Loss	....	....	....	....	....	....	....	....	....	....	....	....	....	13,972 16 3

SCHEDULE No. 6—Tailing Treatment.

Statement of Receipts and Expenditure for the Year ended 31st December, 1944.

Battery.	Tonnage Treated.	Expenditure.									Receipts.		Profit.	Loss.
		Management.	Wages.	Stores.	Total Working Expenses.	Cost per Ton.	Repairs. and Renewals.	Sundries.	Gross Expenditure.	Cost per Ton.	Receipts.	Receipts per Ton.		
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.
Bamboo Creek	364	100 9 3	250 14 5	260 10 7	611 14 3	33 7·3	192 12 11	98 2 6	902 9 8	49 7·0	180 13 6	9 11·1	....	721 16 2
Boogardie	948	116 9 0	241 8 7	172 3 5	530 1 0	11 2·2	26 14 8	149 8 10	706 4 6	14 10·7	699 3 4	14 9·0	....	7 1 2
Coolgardie	3,699	331 4 6	981 2 0	775 13 2	2,087 19 8	11 3·4	245 7 1	658 5 8	2,991 12 5	16 2·1	3,261 19 3	17 7·6	270 6 10	....
Cue	2,904	231 13 4	632 5 5	455 6 10	1,319 5 7	9 1·0	239 13 10	428 2 0	1,987 1 5	13 8·2	1,792 0 2	12 4·1	....	195 1 3
Kalgoorlie	2,220	167 19 8	781 2 11	483 10 5	1,432 13 0	12 10·8	64 10 10	541 4 4	2,038 8 2	18 4·3	1,379 17 7	12 5·2	....	658 10 7
Marble Bar	....	55 16 3	....	....	55 16 3	....	....	0 11 9	56 8 0	....	....	....	....	56 8 0
Meekatharra	3,480	169 16 0	1,118 5 0	734 9 4	2,022 10 4	12 9·2	48 8 6	628 15 5	2,699 14 3	15 6·2	2,608 15 10	14 11·6	....	90 18 5
Norseman	....	23 14 1	2 1 3	....	25 15 4	....	....	25 11 1	51 6 5	....	....	....	....	51 6 5
Ora Banda	1,038	89 0 0	312 19 7	245 18 4	647 17 11	12 5·8	46 10 6	269 8 3	963 16 8	18 6·8	559 18 0	10 9·4	....	403 18 8
Payne's Find	1,372	138 8 9	292 12 4	347 18 8	778 19 9	11 4·2	56 17 6	240 16 8	1,076 13 11	15 8·3	917 15 3	13 4·5	....	158 18 8
Peak Hill	....	....	....	....	....	....	....	0 3 11	0 3 11	....	....	....	....	0 3 11
Sandstone	1,242	294 2 10	303 8 11	301 18 4	899 10 1	14 5·8	37 4 10	244 15 0	1,181 9 11	19 0·3	1,346 11 4	21 8·2	165 1 5	....
Warriedar	....	....	....	2 16 3	2 16 3	....	....	....	2 16 3	....	....	....	....	2 16 3
Yarri	....	....	....	....	....	....	....	....	....	....	33 14 10	....	33 14 10	....
Total	17,267	1,718 13 8	4,916 0 5	3,780 5 4	10,414 19 5	12 0·7	958 0 8	3,285 5 5	14,658 5 6	16 11·7	12,780 9 1	14 9·6	469 3 1	2,346 19 6
		....	....	....	....	....	....	....	....	....	....	....	....	469 3 1
Total Loss	....	....	....	....	....	....	....	....	....	....	....	....	....	£1,877 16 5

GENERAL WORKING ACCOUNT.

General Working Account for the Year Ended 31st December, 1944.

	Milling. £ s. d.	Cyaniding. £ s. d.	Total. £ s. d.		Milling. £ s. d.	Cyaniding. £ s. d.	Total. £ s. d.
To Wages	13,087 19 2	7,554 19 4	20,642 18 6	By Revenue	9,245 8 3	12,780 9 1	22,025 17 4
,, Stores	5,604 9 8	3,677 1 3	9,281 10 11	,, Loss Carried Down	11,767 14 6	....	11,767 14 6
,, Battery Spares	393 17 1	....	393 17 1				
,, Water	1,424 10 11	436 11 11	1,861 2 10				
,, General Expenses	502 5 11	918 4 6	1,420 10 5				
,, Profit Carried Down	....	193 12 1	193 12 1				
	21,013 2 9	12,780 9 1	33,793 11 10		£21,013 2 9	£12,780 9 1	£33,793 11 10

Profit and Loss Account.

	Milling. £ s. d.	Cyaniding. £ s. d.	Total. £ s. d.		Milling. £ s. d.	Cyaniding. £ s. d.	Total. £ s. d.
To Loss Brought Down	11,767 14 6	....	11,767 14 6	By Profit Brought Down	....	193 12 1	193 12 1
,, Administration	2,205 1 9	2,071 8 6	4,276 10 3	,, Gross Loss Carried Down	13,972 16 3	1,877 16 5	15,850 12 8
	£13,972 16 3	£2,071 8 6	£16,044 4 9		£13,972 16 3	£2,071 8 6	£16,044 4 9

General Profit and Loss Account.

	£ s. d.	£ s. d.		£ s. d.
To Gross Loss	15,850 12 8		By Net Loss Carried Down	46,378 19 0
,, Interest	20,282 0 0			
,, Sinking Fund	1,413 0 0			
,, Depreciation	8,579 7 8			
,, Superannuation	253 18 8			
		46,378 19 0		£46,378 19 0
,, Balance Brought Forward		1,313,006 10 11		
,, Balance Brought Down		46,378 19 0	,, Balance Carried Down	£1,359,385 9 11
		£1,359,385 9 11		£1,359,385 9 11

STATE BATTERIES.

Balance Sheet as at 31st December, 1944.

LIABILITIES.	£ s. d.	£ s. d.	ASSETS.	£ s. d.	£ s. d.
Capital Expenditure—			Plant and Buildings	85,983 7 8	
General Loan Fund	406,069 14 1		*Less* Depreciation	8,579 7 8	
Revenue	93,726 4 5				77,404 0 0
Assistance to Gold Mining Industry	28,621 13 5		*Stores Account*—		
Commonwealth Assistance....	13,786 8 0		Outstations	....	15,607 0 8
Sundry Creditors—			Suspense	....	800 5 7
Cash Orders	810 4 0		Sundry Debtors	....	1,463 19 10
Other	2,083 16 2		Battery Spares	....	707 0 3
Treasury Account	118,351 13 2		Profit and Loss Account	....	1,359,385 9 11
Superannuation	968 8 6				1,455,367 16 3
Interest	656,346 0 0		Amount Paid for Tailings not Treated (including Premium Advance)	10,908 18 6	
Sinking Fund	134,603 14 6		Amount Due but not Paid for Tailings Untreated (including Premium Advance)	1,462 12 6	
		1,455,367 16 3			12,371 11 0
Purchase of Tailings Advance Account	....	13,000 0 0	Estimated Gold Premium	....	585 2 11
Sundry Creditors for Tailings Payment	887 11 11		Interest on Purchase of Tailings Advance	....	51 0 0
Advance of Premium	575 0 7		Purchase of Tailings Cash Account	....	2,040 1 6
Balance of Premium (Estimated)..	585 2 11				
		2,047 15 5			
		£1,470,415 11 8			£1,470,415 11 8

Table of Contents.

Plates.

Division IV.

Annual Progress Report of the Geological Survey of Western Australia for the Year Ended 31st December, 1944.

The Under Secretary for Mines.

I have the honour to submit, for the information of the Honourable the Minister for Mines, my report on the progress of the Geological Survey for the year ended 31st December, 1944.

STAFF.

Dr. K. R. Miles resigned on the 26th October to accept a position with the South Australian Public Service. Immediate steps were taken to fill this staff vacancy, but no finality had been reached by the end of the year owing to difficulties encountered in obtaining the release of the selected applicant from one of the Armed Services.

There were no other staff changes during the year.

ACTIVITIES OF PROFESSIONAL OFFICERS.

The conduct of regional geological surveys continued to be suspended owing to wartime conditions and the necessity for concentrating the efforts of the whole of the small staff on urgent mineral investigations and special work for various Government Departments.

F. G. Forman, B.Sc., Government Geologist.

Five visits were paid to Greenbushes during the year to investigate geological problems arising in the production of tin and tantalite at that centre. I also made a number of short field trips in the company of a representative of the American Foreign Economic Administration to investigate the possible production of lepidolite-mica, tantalite, beryl and spodumene.

Other investigations made during the year included the kyanite deposit at Yanmah, near Bridgetown, South-West Division; the geological features of a dam site on the Ord River, Kimberley Division; and the structural features of the ore body in the Blue Spec Mine near Nullagine, Pilbara District.

The time spent at head office on administrative duties and in dealing with local enquiries continued to be greater than usual owing mainly to numerous requests for information received from industrial sources, and continual requests for information received from Allied Military Bureaux.

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

Mr. Ellis' principal field activity was the detailed examination of tantalite deposits at Wodgina, Tabba Tabba, Strelley and Pilgangoora in the Pilbara Goldfield. This work occupied his time from March to June, inclusive. Towards the end of the year, Mr. Ellis made a brief examination of alleged phosphate deposits at Bidaminna Lakes, north-west of Gin Gin in the South-West Division.

The remainder of Mr. Ellis' time was spent at head office in the preparation of reports for publication; these included reports on field work done at the end of 1943, the report on his tantalite investigations in the Pilbara District, and reports supplementary to those appearing in the 1943 Annual Report, on graphite at Munglinup and Donnelly River, and vermiculite at the Young River.

R. A. Hobson, B.Sc. (Hons.), Geologist.

The only field work performed by Mr. Hobson during the year was the supervision of boring to test building foundations at a site being investigated by the Commonwealth Works Branch. This work occupied the whole of December and involved a careful check of the strata passed through and a collection of test samples.

Mr. Hobson's principal activities at head office were the preparation of outstanding reports on his field work. Reports on the Greenbushes tinfield and the Mt. Margaret goldfield required the detailed study and analysis of production statistics for a long period of years.

Mr. Hobson was also engaged in investigating a proposed scheme to index the Geological Survey publications, there being no published consolidated index of Bulletins and Annual Reports issued later than 1910. Owing to staff difficulties, this scheme has unfortunately had to be suspended.

R. S. Matheson, B.Sc., Geologist.

Mr. Matheson's field work included a re-examination of the Yellowdine Gold Mine at Mt. Palmer, prior to the suspension of mining operations when the workings were allowed to fill with water.

In the company of Mr. H. B. Owen of the Commonwealth Mineral Resources Survey, he investigated the geological features of the Yinnietharra Mica Project, North-West Division, and the ochre deposits of the Ophthalmia Range, North-West Division.

Mr. Matheson also made examinations of a talc deposit near Three Springs and a soap stone deposit near Moora, and in connection with a proposal to re-sample some of the coal seams, he paid a short visit to the Irwin River, east of Mingenew. All the above localities are in the North-West Division.

Mr. Matheson also supervised boring and collected test samples at the proposed site for the new Government buildings in St. George's terrace, Perth. This work was undertaken at the request of the Principal Architect, Public Works Department.

In the periods between field work, Mr. Matheson was engaged at head office in the preparation of reports on his field observations and in the preparation of Bulletins on the Greenbushes tinfield and the mining centres in the northern portion of the Yilgarn Goldfield.

K. R. Miles, D.Sc., F.G.S., Geologist.

Dr. Miles' field work included the investigation of quartz crystal occurrences at Goomalling and Morawa, South-West Division, and Payne's Find, Yalgoo Goldfield; the examination of moulding sand deposits close to the Perth metropolitan area, and at Kalgoorlie and Collie, and the examination of limestone deposits in the Cockburn Sound area, south of Fremantle.

Whilst at head office, Dr. Miles, in addition to the preparation of reports and plans covering his field activities, made numerous petrographical examinations for other members of the field staff.

Dr. Miles' resignation in October has left a gap which will be extremely difficult to fill. His petrographic work over the past seven years has been of an extremely high standard, and during his association with the Survey, he was able greatly to advance our knowledge of Western Australian rocks, particularly in regard to the constitution of the banded iron formations or Jasper bars of the pre-Cambrian series.

TRANSPORT.

The field work of the Geological Survey is increasingly hampered by poor transport facilities. The Survey is at present dependent on two utility motor trucks which were both purchased in 1934, and whose condition has now become critical under the arduous conditions imposed by field work on the various mineral fields of the State, where travelling is usually over rough bush tracks and often over country with no roads at all. It is anticipated that the position will soon be temporarily relieved by the addition of a third utility truck, but the time is fast approaching when the two trucks at present in use will be no longer serviceable.

PUBLICATIONS.

Mr. R. S. Matheson completed early in the year a review of the available information concerning the mica deposits of the State. The central office of the Mines Department, having decided to publish a series of Mineral Resources Bulletins dealing with individual minerals, this review was published during the year as Bulletin No. 2.

Part 1 of a similar Bulletin dealing with tantalum and niobium was prepared during the year by Dr. K. R. Miles. This Bulletin was compiled in collaboration with Dr. Dorothy Carroll and Mr. H. B. Rowledge of the Government Chemical Laboratory, and is now in the press. It will appear as Bulletin 3 of the series.

Geological Survey Bulletin 101, "The Mining Groups of the Yilgarn Goldfield north of the Great Eastern Railway," by Mr. R. S. Matheson, B.Sc., is now in the press and is expected to be published early in 1945.

My thanks are due to all members of the staff of the Geological Survey for loyal co-operation and hard work throughout the year. Without close team work and full co-operation of all officers, the work accomplished during the year would not have been possible.

F. G. FORMAN, Government Geologist.

26th March, 1945.

A KYANITE DEPOSIT NEAR YANMAH, NELSON DISTRICT, S.W. DIVISION.

By F. G. Forman, B.Sc., Government Geologist.

Attention was first drawn to the deposit by Mr. J. H. Smith of Bridgetown, who in January, 1944, applied for a 30-acre mineral claim, M.C. 287H. The area was examined in February of this year by Mr. J. S. Foxall, Assistant State Mining Engineer, who obtained samples for analysis and subsequently brought the occurrence to the notice of the Geological Survey.

Location and Access.

The deposit is located on Nelson Locations 9621 and 9622 (Long. 115° 59'.5, Lat. 34° 8'.6) approximately 10 miles west-north-west of Palgarup Siding on the Bridgetown-Manjimup Railway. It is five miles south-south-west of the detrital kyanite deposit described by H. A. Ellis in the Annual Progress Report of the Geological Survey of Western Australia for 1939, page 9. Easiest access is by a gravel road, the road distance from Palgarup Siding being 11.9 miles.

Topography and Geology.

The deposit is situated on the right bank of Manjimup Brook in moderately hilly country thickly covered by karri timber.

The area is almost completely covered by a buff coloured clay loam and with the exception of the kyanite rock, which is extremely resistant to weathering and forms strong outcrops, rock outcrops are very difficult to find. Two outcrops, one a fine grained garnetiferous quartzite, the other a soft kyanite-quartz-schist containing about 60 per cent. kyanite, were the only definite ones observed during the present inspection, but a number of floaters of kyanite-quartz-schist and various types of quartzite were seen to be widely scattered all over the area; which suggests that bed rock in the vicinity belongs to a series of metamorphosed sediments. The impression gained during this examination was that the kyanite rock occurs as lenticular segregations in the sediments. Similar metamorphic rocks can be observed in places between here and Bridgetown, as noted by Ellis.* The poor nature of the outcrops made it impossible to obtain reliable strike and dip measurements, but in one place it appeared clear that the rocks are traversed by a steeply dipping schistosity.

The Kyanite Rock.

The kyanite rock is a light grey medium grained rock which weathers into rounded boulders. Its approximate mineral composition, as determined by the Government Mineralogist and Analyst, from a sample consisting of chips broken from a large number of boulders, is as follows:—

Kyanite	90%
Limonite	4%
Rutile	3%
Other Minerals (corundum, kaolin, hornblende, zircon)	4%

The specific gravity of three lumps chosen at random from the main lens was found to be 3.36, 3.54 and 3.45. For the purpose of tonnage estimates, a figure of 3.4 for the specific gravity has been assumed in this report.

The distribution of the kyanite rock is shown on the accompanying plan. The most important body is a lens shaped mass about 600 feet long and varying in width from 15 feet at its north-western end to 70 feet at its south-eastern extremity.

Although in the absence of any excavation it is impossible to be certain, the massive character of the outcrop and its continuity strongly suggest that this is a solid body which should have a considerable vertical extent. A planimeter measurement of this lens gives an outcrop area of 28,500 square feet. Assuming a specific gravity of 3.4, equal to 10.5 cubic feet to the ton, and a depth of only 3 feet, this represents over 8,000 tons of kyanite rock.

Other smaller lenses of kyanite rock whose outline it was impracticable to map because of poor outcrops, and loose boulders of kyanite rock are widely scattered over an area of about eight acres, as shown by the broken line on the accompanying plan. The tonnage represented by these boulders and the outcrops of the various lenses was not estimated, but it is thought almost certainly to be at least another 1,000 tons.

Heat Tests.

Three boulders of kyanite rock chosen at random from widely separated places on the outcrop of the main lens were submitted to the Government Mineralogist and Analyst for heat tests and he reports as follows:—

Lab. No. 1660/44.

Description:

Three small boulders of kyanite with smooth surfaces. They are marked A, B, C for further reference.

A. Coarse grained, fairly porous material impregnated with considerable red and some yellow limonite, somewhat friable on freshly broken surfaces.

B. Finer grained, more compact material impregnated with considerable yellow and a little red limonite, not friable on freshly broken surfaces.

C. Very coarse grained slightly porous material impregnated with much red and a small amount of yellow limonite, somewhat friable on freshly broken surfaces.

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* Op. cit.

Heat Tests:

A representative piece of each boulder about one inch thick was heated throughout to 1350° C in an electric furnace with access of air.

The grain structure of all three pieces was unaltered. Friability was slightly and brittleness appreciably increased in each case.

A. The red and yellow colour of the limonite was reduced by about half.

B. The colour of limonite was almost eliminated.

C. Only a small amount of the limonite colour remained.

The Government Mineralogist advises that facilities were not available for taking the tests to higher temperatures, which would have been desirable, but that as things stand the results may be considered satisfactory and as indicating a high grade material.

Conclusions.

The Yanmah kyanite deposit can be considered as a potential source of large tonnages of high grade refractory material. Assuming that the main lens extends in depth to only 3 feet and considering only the exposed outcrops of minor lenses and widely scattered boulders there are at least 9,000 tons of kyanite rock available. This figure can be considered extremely conservative as there is little doubt that excavation would reveal greater extension in depth than that assumed for the main lens, and the underground content of minor lenses has not been included at all.

If the future demand for kyanite should warrant further search, excellent prospecting chances lie in the surrounding country and particularly in a north-easterly direction towards the detrital kyanite deposit near Smithfield. Because of its resistance to weathering, kyanite would probably form the most conspicuous outcrops in an area underlain by the meta sediments with which it is associated, and further discoveries, therefore, will depend mainly on the recognition of the mineral. This should not be a difficult matter because the high specific gravity of kyanite immediately distinguishes it from a rock such as granite of nearly the same colour and outward texture.

It has not been possible to obtain a firm quote for kyanite from local users, but some idea of the price likely to be obtained can be gathered from the latest quotation available from the Department of Supply and Shipping of the Commonwealth Government. This department advises that the price of imported Indian kyanite in 1943 was £9 18s. 2d. per ton C.I.F., Newcastle.

NOTES ON THE STRUCTURAL FEATURES OF THE BLUE SPEC GOLD-ANTIMONY MINE, MIDDLE CREEK, NULLAGINE DISTRICT, PILBARA GOLDFIELD.

By F. G. Forman, B.Sc., Government Geologist.

Following a request from the Deputy Director of Mineral Production, Mr. G. Lindsay Clark, for structural information on the Blue Spec, a brief visit was made to the mine from the 12th to 15th September, 1944.

Opportunity for inspection underground was limited by the following circumstances:—Inaccessibility of the old workings in the vicinity of old No. 1 Shaft above No. 1 Level; an extensive fall of ground in No. 1 Level surrounding the position of old No. 2 Shaft; absence of vertical connections between Nos. 1 and 2 Levels and the very limited development of the ore bodies in the new main shaft workings. No inspection of the workings on Gold Mining Lease 196 was possible as the shaft was totally inaccessible. The present remarks on the structural features of the mine are therefore only tentative and amplification must await further development of the ore bodies and consequent increased opportunity for accurate measurement.

The Blue Spec Mine was inspected by Mr. K. J. Finucane, then Senior Geologist in Western Australia for the Aerial, Geological, and Geophysical Survey of Northern Australia during 1935. An account of the geology in the vicinity of the mine, and a description of the workings as they existed at the time, are given by him in A.G.G.S. of N.A. report No. 7. "The Blue Spec Gold-Antimony Quartz Veins." Finucane's observations were checked wherever possible during the present visit and were found to be in full agreement with my own.

The relevant section of Finucane's report reads as follows.—

I. Introduction.

"The Blue Spec gold-antimony veins are located 16 miles to the east-north-east of Nullagine. They form part of a long line of sporadic outcrops, trending east and west, which may be traced over a distance of at least 10 miles. It was not possible to investigate the whole of this line during the 1935 field season but the Blue Spec deposits were studied in detail and a brief visit was made to the Billjim mine, which is situated approximately 8 miles further to the east. A gold-antimony quartz reef, similar to those of the Blue Spec, has been located recently on P.A. 217L, midway between the Blue Spec and the Billjim, but owing to lack of time it was not visited.

II. Geology.

Details of the various rock structures along the Blue Spec line are shown on plate 1 (sheets 1, and 2). Despite the hilly nature of the country, the percentage of outcrop is not great and the whole of the structure could not be delineated. On the plan the actual exposures are shown in full black lines and the interpretations of them in dotted lines.

The rocks consist entirely of slates, quartzites and grits of the Mosquito Creek series. These are tightly folded into a number of anticlines and synclines whose axes trend at 70° to 80°. A number of the folds are overturned, the axial planes dipping south at 60° to 70°. On G.M.L. 231 the folds pitch steeply west; further to the west on P.A. 196, they are more or less horizontal but again pitch to the west near the south-west corner peg. It is probable that the pitch of the folds along the line may undulate from east to west.

A comparison of the rock structures with the occurrences of reef quartz indicates that there is no close relationship between the two. That is to say, the veins do not follow the folding but extend along a relatively straight line, trending at 80° which appears to be a major fault. In a few places the veins do follow minor crenulations in the slates, but such occurrences are relatively unimportant. The immediate walls of the veins consist mainly of highly cleaved slates and only a few small veinlets occur in quartzites.

III. The Gold-Antimony Quartz Veins.

These are quartz veins containing stibnite, pyrite, and gold, and generally some carbonates of calcium and iron. Their general strike is 80° and the dip is practically vertical. From the Blue Spec westwards, outcrops and scattered fragments of reef quartz extend over a total length of 6,000 feet, but it is only at the western and eastern ends of the line that the veins attain any appreciable size, that is on the Blue Spec itself and on P.A. 196. The larger quartz outcrops usually show small crystals or granular aggregates of stibnite when broken, and occasionally, massive stibnite and/or cervantite (yellow antimony oxide) occurs.

A. The Blue Spec Mine, G.M.L. 231.

Two principal lines of reef occur on this lease, viz.:—the south reef and the north reef. The surface and underground workings on these, the extent of the veins, the production statistics and the sampling results are shown on Plate 2.

(1) *The South Reef* strikes 80° and is vertical. The workings comprise a number of costeans and shallow pits and a shaft 73 feet deep. At the surface a main body of quartz veins extends for a length of 250 feet and varies in width from 3 feet to 20 feet. Individual veins comprising this formation range in thickness from a few inches up to 4 feet, and are separated by thin partings and bands of slate. At a depth of 63·5 feet in the shaft a cross-cut has been extended 21

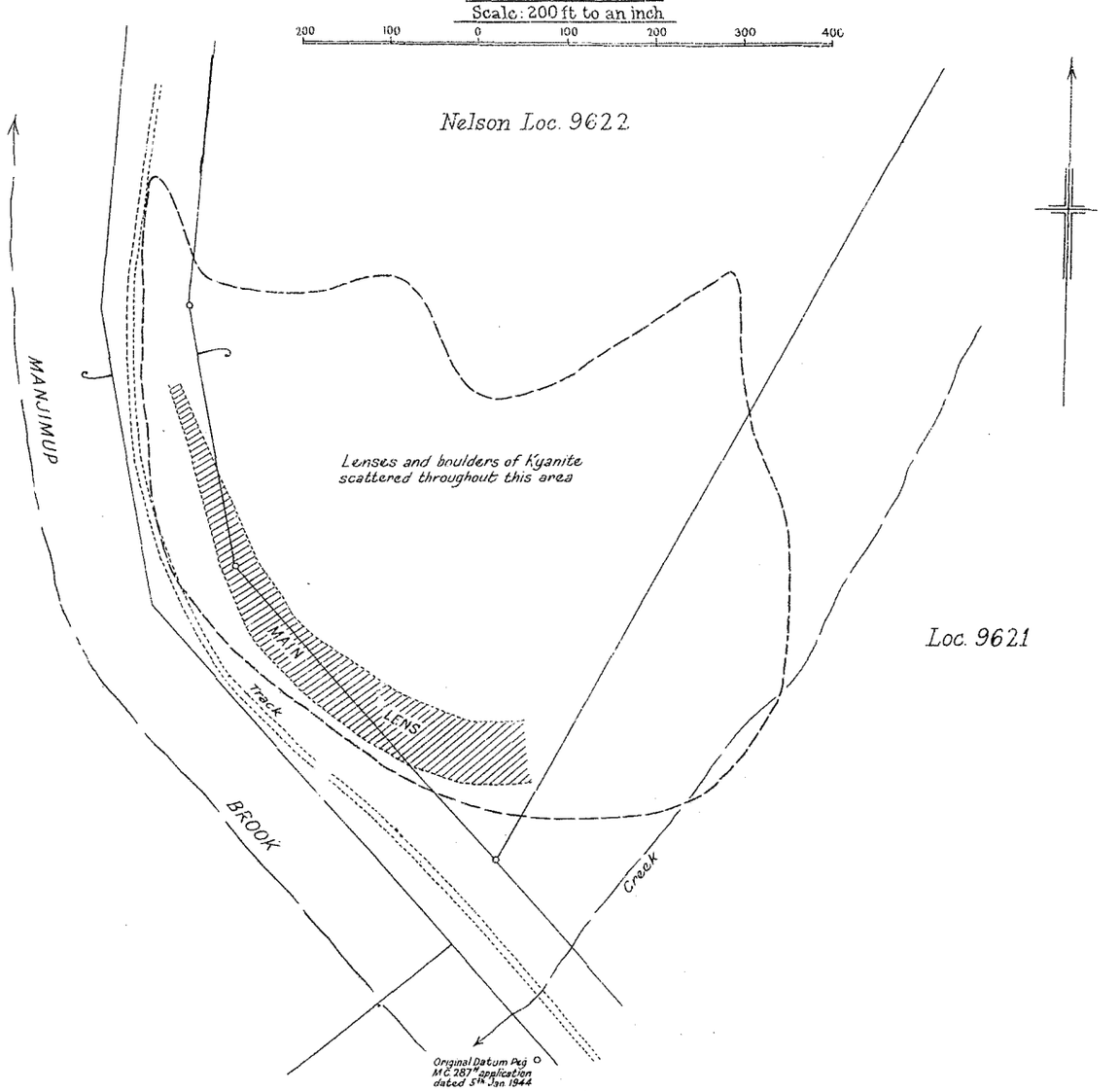
PLATE I

— PLAN OF —

KYANITE DEPOSIT NEAR YANMAH

11·9 Miles W. of Palgarup Siding
Manjimup-Bridgetown Rly
NELSON DISTRICT
Scale: 200 ft to an inch

200 100 0 100 200 300 400



JMCL 19·5·44

feet south, and drives for 22 feet west and 18 feet east from the shaft. Quartz veins, varying in thickness from 2 to 12 inches and containing small granular aggregates of stibnite, occur over the full width of the cross-cut. The east drive follows a vein from 12 to 18 inches thick but in the face the upper portion of it is truncated by a south dipping fault. The back of the west drive shows veins and bunches of quartz over a width of 42 inches, but the face consists of slate containing only a few small leaders. The inset on plate 2 illustrates the occurrence of the veins at the 63.5 feet level. In the face of the cross-cut there is a well-defined plane dipping to the north at 85°, but it is not known for certain whether this marks the southern limit of the formation; as a general rule the northern and southern limits are not well defined but appear to merge gradually into the country, and small stringers persist for some distance in the walls. In sampling this reef the sample cuts were extended both north and south beyond the apparent limits of the quartz, but values were found to peter out rapidly in both directions. A study of the assay plan shows that the higher values are associated with the larger quartz bodies. The eastern and western extensions of the South reef are exposed in two costeans located at 230 feet west and 220 feet east of the Main Shaft, respectively. They consist of small quartz veins in quartzite and contain only minor quantities of gold, the assay returns being less than 1dwt. per ton. Owing to the small amount of driving, it is not known to what extent individual veins within the main ore-body may persist, but it is probable that even if they are short, then others will rapidly replace them. The averages of the effective samples taken from the South reef are as follow, viz:—

Workings.	Width inches.	Assay Value. Au. dwts.	Sb. %	No. of Samples.
Surface	75	10.8	—	5
Cross-cut	174	14.58	—	3
Cross-cut (check) .	174	14.86	1.38	4
East and West Drives	44	6.59	—	5
Bottom of Shaft .	60	3.97	0.69	2

Combining the results of the surface samples with the average for the crosscut and the drives (218 inches for 13.08 dwt.), the average grade of the south reef is 11.76 dwt. for an average width of 103 inches, and if it be assumed that the whole formation was mined it would yield 150 tons of ore per vertical foot.

The antimony content of the south reef ranges between 1.38 and 2.80 per cent., but the number of determinations made was insufficient to arrive at an average figure. By hand-picking and knapping small parcels of high-grade antimony ore can be produced.

(2) The north reef strikes 65° and dips vertically. The workings consist of a shaft 36 feet deep and four shallow costeans. The shaft has been sunk on a vein, 12 to 18 inches wide, which is rich in both gold and antimony. Small quartz stringers occur on either side of the vein. Samples broken from the eastern and western ends of the shaft at a depth of 33 feet gave results of 15.12 dwt. over 24 inches, and 58.25 dwt. over 36 inches. A parcel of approximately 8 tons of stibnite ore broken from this vein is stated to contain from 5 oz. to 10 oz. of gold per ton and 40 per cent. of antimony, and a trial parcel of 11.5 tons of quartz comparatively free from antimony yielded 9.97 oz. of gold, i.e., an average of 17.34 dwt. per ton. A sample broken from a costean to the east of this shaft returned only 1.25 dwt.

B. P.A. 196.

Old workings on the eastern portion of this P.A. extend for a length of 340 feet on a vein varying in thickness from 12 to 36 inches. The strike is 80° and the dip vertical. Owing to the state of the workings very little can be seen of the vein itself and only one sample could be taken. This was cut from a shallow shaft near the western end and gave a return of 17.75 dwt., the width being 16 inches. Four hundred feet further to the west there is a prominent quartz outcrop from 3 to 6 feet wide, which may be traced over a length of 450 feet. Apart from a few shallow pits no work has been done on it. A sample broken over a width of 3 feet gave a return of 7.0 dwt. per ton.

C.

Between G.M.L. 231 and P.A. 196 there are only a few small veins and scattered fragments of quartz. No work has been done along this section.

D.

At a point 630 feet east of the eastern boundary of G.M.L. 231 there is an outcrop of massive cervanite (antimony oxide) 48 inches wide. This has been uncovered only recently."

The present development workings are shown on the accompanying plan. The south reef shaft, referred to in Finucane's report being situated about 50 feet west of the old No. 1 Main Shaft. The new main shaft on which the present development is proceeding is connected to two levels, one of vertical depth of 127 feet, the other 277 feet.

At the No. 1 level (127 feet), the main or south lode has been driven on for a distance of 280 feet east of the crosscut, the drives connecting to the old Nos. 1 and 2 shafts. The main lode west drive at this level extends for about 25 feet west of the crosscut and is on the north side of the main lode channel, which has been located in a south horizontal diamond drill hole in a position directly in line with the lode as exposed in the east drive. The north lode fault at the No. 1 level has been driven on for a distance of about 25 feet on the west side of the crosscut but has not been explored to the east.

At the No. 2 level (277 feet), no development has been done on the north lode. The main lode has been explored by driving for a distance of 124 feet east and 60 feet west of the crosscut, both faces being in high-grade ore.

Pitch of Ore Sheets.

In AG.G. S. of N.A., Report No. 19, Mr. Finucane, in a generalised description of the economic geology of the mining centres east of Nullagine, comments as follows:—

> "The ore-shoots in most lines of reef were found to occur along fault planes which intersect the bedding. Moreover, it was found that in most cases the pitch of individual ore-shoots corresponds to the pitch of the intersection of the fault planes with bedding or cleavage planes. This control appears to hold almost throughout the whole of the region under review."

The pitch control due to intersection of bedding planes and the fault surface, whether due to variations in the chemical nature or physical conditions of the wall rock or simply to the provision of channel-ways along the bedding planes, would, with the conditions existing in the main workings, produce easterly pitches.

The strike of the Main lode and fault plane observed in the new shaft workings is constant at 80° and the dip is practically vertical. The strike and dip of the bedding planes observed in the same workings vary, the strike from 60 to 65° and the dip from 60 to 70°. The extreme values of the pitches of the intersection of the fault and the bedding planes under these conditions is from 105 feet in 100 feet to 210 feet in 100 feet to the east.

I am confident that further development will indicate that the ore shoots in the mine have an easterly pitch within the limits just stated. Under these conditions, the rich ore now being developed in the west drive at the 277ft. level represents an ore shoot which has not previously been found and if it extends westward for any reasonable distance, it represents an extremely valuable addition to the ore reserves. The presence of an easterly pitch also augurs well for the development at depth of further ore below the shoots already developed above No. 1 Level at the eastern end of the mine.

Fault Intersections.

In the event of the present west drive development passing into a poorer zone, the drives at both levels should be continued until they reach a distance of at least 200 feet west of the main crosscut. At this posi-

tion, it is anticipated that the intersections of the main lode fault and the north lode fault will be found with a consequent increase in shattering of the country which in all probability would create ideal conditions for the easy circulation of ore-bearing solutions.

GENERAL.

It was noticed during the present inspection that those in charge of development on the mine had repeatedly lost the lode through following the bedding planes of the country instead of the track of the fault plane. In future development the fault plane should be followed with care as by this means the ore shoots will be picked up with certainty. The development of the drives will be straighter and repeated stripping of the right hand wall of the drives will become unnecessary. Bulges in the ore shoots, due to gold and antimony values following out along the bedding planes can easily be picked up and their dimensions determined by short lateral drill holes.

SUMMARY REPORT ON THE PRINCIPAL TANTALUM-BEARING DEPOSITS OF THE PILBARA GOLDFIELD, NORTH-WEST DIVISION, WESTERN AUSTRALIA.

Between Latitudes 20°-11′ S. and 20°-32′ S. and Longitudes 118°-41′ E. and 119°-01′ E.

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

INTRODUCTION.

During the months March-June (incl.), 1944, the writer was engaged in an attempt to obtain quantitative data on the commercial availability of tantalum-bearing minerals at Wodgina, Lat. 21°-11′ S., Long. 118°-41′ E., Tabba-Tabba, Lat. 20°-40′ S., Long. 118°-57′ E., Strelley, Lat. 20°-32′ S., Long. 119°-01′ E., and Pilgangoora, Lat. 21°-02′ S., Long. 118°-53′ E.

A considerable number of lode, eluvial and alluvial samples were taken, and sample plans of the deposits at Tabba-Tabba, Strelley and Pilgangoora have been prepared.

The investigation was primarily of an economic quantitative nature, but in the course of sampling operations, observations were made concerning geological structure, mode of occurrence of the tantalum-bearing minerals and mineral associations. The commercial availability of associated minerals of potential economic value, namely, muscovite mica, lepidolite mica, felspar, beryl, cassiterite and spodumene was also investigated. A detailed report illustrated by three text figures and nine plans has been prepared for publication in the Mineral Resource Series, published by the W.A. Department of Mines.

The immediate value of the investigation has been greatly lessened by the notification in October, 1944, of the termination of the purchasing agreement between buyer and producer as at 31st December, 1944, and by the long delay in the receipt of qualitative and quantitative results from samples submitted to the Government Chemical Laboratory, Perth. Had this latter information been available while the demand for tantalite was still keen, increased production would have been possible.

A summary of the more important results obtained is set out below, but it should be borne in mind by those interested in these deposits, that many important details have of necessity to be omitted in presenting information in this manner.

SUMMARY.

The results of this attempt to assess the quantities of tantalum-bearing minerals at the various centres, are outlined here, together with a short digest of the salient structural and mineralogical characteristics of the ore-bodies. The commercial availability of muscovite mica, lepidolite mica, felspar, beryl, cassiterite and spodumene are also discussed.

Most of this basic information will be found on the various plans accompanying this report.*

* Plans not published.

To those conversant with the manner of occurrence of tantalum ores in pegmatite dykes, it is obvious that in order to be able to arrive at any figures for the grade of ore in situ, it is essential that it be blocked out on all four sides and sampled at five feet intervals, and even then, one would hesitate to place any great reliance on the result. *No* such ore was exposed at any of the centres examined:—

WODGINA.

Tantalum-bearing Minerals.

(a) *Lode.*—Not practical to assess—insufficient development—numerous exposures of ore containing from traces up to 50 lbs. of concentrates per cubic yard. The average grade of material treated since milling operations commenced early in May, 1944, to September, 1944, is 3·0 lbs. per ton. This includes lode matter mined from shallow lode workings, open cuts, and eluvium, and must be regarded as selected ore.

(b) *Eluvial.*—Main deposits worked out. This has been the main source of supply since mining of the deposits first commenced in 1905—a small quantity of eluvial tantalite could be obtained by stripping the remaining surfaces of the decomposed pegmatite dyke to a depth of one foot.

(c) *Alluvial.*—A minor source of supply—main deposits, never extensive, now worked out.

Beryl.—785 short tons, containing between 11 and 12 per cent. BeO from masses in situ and from eluvium in close proximity to the pegmatite, produced up to September, 1944. Principal masses mined in situ worked out as at June 30th, 1944, production then chiefly from hand picking eluvial material. Open cut mining is in progress in the vicinity of the original principal concentration, and further masses of beryl are likely to be discovered.

It is not possible to predict future quantities.

Cassiterite.—None of any commercial importance in the main tantalite-bearing pegmatite.

Muscovite Mica.—None seen of commercial grade—comparatively scarce. Massive green finely granular to cryptocrystalline mica suitable for carving into ornaments occurs in fairly large concentrations—masses containing up to 10 tons were seen at the north end—might be useful as an insulator.

Lepidolite Mica.—None seen of commercial grade—large lens at north end contains only from 0·63 to 1·77 per cent. Li_2O. (Assays by Government Chemical Laboratory.) No flake or sheet lepidolite mica seen.

Felspar.—Large quantities of soda-bearing albite felspar available in dumps—potash bearing microcline present but not in large easily mined masses—albite felspar, both pure and containing quartz and muscovite inclusions abundant at south end in situ.

Spodumene.—No concentrations seen.

STRELLEY.

Tantalum-bearing Minerals.

(a) *Lode.*—Not practical to assess—insufficient development—numerous exposures of ore containing from traces up to 3·25 lbs. of concentrates per cubic yard in situ.

(b) *Eluvial.*—Pit sampled on a 100ft. grid—24·6 acres estimated to contain 71,393 cubic yards in situ in two areas:—

(a) 19,530 cubic yards, average value per cubic yard in situ 0·92 lbs., concentrates containing 5 per cent. of free cassiterite;

(b) 51,863 cubic yards, average value per cubic yard in situ 1·30 lbs., concentrates containing 9 per cent. of free cassiterite.

Estimated total content, 38·1 long tons of high grade tantalite concentrates.

(c) *Alluvial.*—None of commercial importance.

Beryl.—Five short tons of eluvial Beryl collected by the writer in April, 1944, contained 11.36 per cent BeO —none seen in situ or remaining on surface (June, 1944)—more may be uncovered in scooping operations

at present in progress (September, 1944). Production to September, 1944, five short tons. It is impossible to predict future quantities.

Cassiterite.—Several short shoots in coarse grained greisen located on eastern side of main pegmatite dyke on M.C. 106.

Eluvial concentrates on eastern side contain an average of 9 per cent. cassiterite.

Potential source of small quantity of cassiterite in the cassiterite-bearing greisen lenses of the pegmatite.

M.L. 346, two miles north of M.C. 106. Small patch of cassiterite-bearing eluvium here—also two short narrow shoots, carrying cassiterite associated with pegmatite dyke. Only small quantities could be mined here.

Muscovite Mica.—None seen of commercial grade, book mica conspicuously absent. Occasional small lenses of green and pale purple, fine granular, to cryptocrystalline muscovite; would carve to ornaments—none seen large enough for insulating blocks.

Lepidolite Mica.—Some small masses of lepidolite containing 0.06 per cent Li_2O; not of commercial grade or size (assay by Government Chemical Laboratory).

Felspar.—Much microcline, some intergrown with quartz—no large conspicuous unaltered masses—considerable quantities available if hand-picked after breaking. Albite mostly associated with tantalite deposition and not plentiful.

Spodumene.—No concentrations seen.

TABBA TABBA.

Tantalum-bearing Minerals.

(a) *Lode.*—Not practicable to assess—insufficient development—numerous exposures of ore containing from traces up to 48 lbs. of concentrates per cubic yard in situ. A guess at the ore reserves in the "Simpsonite" lode is 680 cubic yards of probable ore, only partially exposed, containing 6.25 lbs. of concentrates per cubic yard in situ. The concentrates consist of tantalite, simpsonite and microlite and contain approximately 2 per cent. of free cassiterite.

(b) *Eluvial.*—Two areas pit sampled for the following estimated values:—

Area A.—2.6 acres containing 7,700 cubic yards in situ. Average value, lbs. clean concentrate per cubic yard, 3.05.

Average composition of concentrates:—
94.3% Tantalum-bearing minerals.
5.7% Cassiterite.

Approx. quantity of tantalite in ground 9.9 long tons.

Average grade of concentrates:
47.2% Ta_2O_5 (Assay by Govt. Chem. Laboratory)
4.1% Nb_2O_5
12.1% SnO_2
9.7% TiO_2

Area B.—0.9 acres containing 2,430 cubic yards in situ.

Average value, lbs. clean concentrates per cubic yard, 2.88.

Average composition of concentrates:
92% Tantalum-bearing minerals.
8% Cassiterite.

Approx. quantity of tantalite in ground 2.8 long tons.

Average grade of concentrates:
54.9% Ta_2O_5
3.3% Nb_2O_5 (Assay by Government Chemical Laboratory).
17.8% SnO_2
4.1% TiO_2

(c) *Alluvial.*—None of importance.

Beryl.—Comparatively small quantity closely associated with tantalite deposition—no large masses seen or reported from this locality.

About 40 tons of beryl pegmatite containing beryl as crystals up to 2 inches long by 1½ inches between parallel prism faces seen as an outcrop near main south workings—may contain up to four tons of beryl—would need hand picking after breaking to recover. Some small beryl crystals in alluvium—impossible to predict future quantities.

Cassiterite.—Rather plentiful in eluvium and pegmatite dyke lode matter in western part of M.L. 313 and M.L. 362 on south-western side of main tantalite-bearing portion of dyke system. Natives still able to "yandie" payable quantities from decomposed kaolinitic portion of dyke outcrop.

Muscovite Mica.—None seen in book form—rather scarce in any but fine scaly form.

Lepidolite Mica.—One lens on M.L. 313 is approximately 66ft. long by 10ft. wide and contains 2.47% of Li_2O. No large quantities seen.

Felspar.—Microline felspar common in pegmatite dyke—no large easily mined masses seen. Albite felspar confined to mineralised zones and usually fine granular and partially decomposed—no large masses as at Wodgina.

Spodumene.—No concentrations seen.

PILGANGOORA.

Tantalum-bearing Minerals (Columbite).

(a) *Lode.*—Very few of the workings show tantalum-bearing minerals—development confined to shallow excavations on originally small patches of mineralised pegmatite dyke—no outcrops seen worth sampling.

(b) *Eluvial.*—No areas of workable extent.

(c) *Alluvial.*—Four areas scout sampled—pits.

(1) Webster's Gully, M.C. 132.
Approximate quantity in situ, 5,100 cubic yards.
Average value, lbs. clean concentrates per cubic yard, 9.35.
Average composition of concentrates, 90% columbite, 10% cassiterite.
Approximate quantity of columbite in ground, 19 long tons.
Average grade of columbite, 44% Ta_2O_5, 39% Nb_2O_5.

(2) "Wagon Wheel" Patch, M.C. 131.
Approximate quantity in situ, 11,300 cubic yards.
Average value, lbs. clean concentrates per cubic yard, 1.97.
Average composition of concentrates, 92% tantalite, 8% cassiterite.
Approximate quantity of tantalite in ground, 9 long tons.
Average grade of tantalite, 62% Ta_2O_5, 22% Nb_2O_5.

(3) Pilgangoora Creek, M.Cs. 132, 133.
Alluvium on banks and in creek bed sampled at intervals over a length of 4,620 feet (70 chains).
Highest result, 6.47 lbs. of clean concentrate per cubic yard in situ over six inches.
Composition of concentrates, 93% columbite, 7% cassiterite.
Grade of columbite, 33.5% Ta_2O_5, 48.5% Nb_2O_5.
Lowest result, 0.18 lbs. of clean concentrates per cubic yard in situ over 36 inches.
Composition of concentrates, 99% columbite, 1% cassiterite.
Average grade too low to warrant close sampling.

(4) Houston Creek, M.C. 131.
Alluvium on banks and in creek bed sampled at intervals over a length of 2,310 feet (35 chains).
Highest result, 6.16 lbs. of concentrates per cubic yard in situ over 24 inches.
Composition of concentrates, 95% tantalite, 5% cassiterite.
Grade of tantalite, 61.5% Ta_2O_5, 22.5% Nb_2O_5.
Lowest result, trace only over 33 inches.

Average grade too low to warrant close sampling, though small areas could be located by intensive prospecting, which might prove payable to work.

Beryl.—About 6 lbs. of eluvial beryl found on M.C. 132 in the vicinity of No. 4 workings. None seen elsewhere either in eluvium or lode—contains 12.27% BeO.

Cassiterite.—Occurs as short narrow shoots in mineralised portions of pegmatite dykes at Nos. 1 to 4 workings —also in alluvium in Pilgangoora Creek, Webster's Gully, Houston Creek and at "Wagon Wheel" Patch. (See under tantalum bearing minerals.)

Muscovite Mica.—None seen of commercial grade. Small flakes only.

Lepidolite Mica.—Numerous small concentrations seen at the various workings—no large concentrations—no sheet lepidolite, all fine granular or scaly, and of pale colour. Li_2O content 0.5%.

Felspar.—Microcline plentiful, albite much less plentiful—neither present as large, clean, easily mined masses.

Spodumene.—Occurs rather plentifully as grey to pale violet, flat tabular crystals with albite felspar and quartz, associated with the mineralised portion of the pegmatite dykes at Nos. 1, 2, 3 and 4 workings, and also with a cassiterite bearing pegmatite on the northern slope of a prominent nest of hills at the south end of M.C. 132 where some of it is pale green in colour.

Concentrations at and near Nos. 1, 2 and 3 workings would be worthy of consideration as possible sources of lithia if at any time the market price for lithia made it economically possible to mine deposits so remotely situated. Li_2O content 5.60 to 7.08%.

Salient Structural and Mineralogical Characteristics of the Pegmatite Dykes.

WODGINA.

The strike and dip of the dyke are not co-incident with the strike and dip of the enclosing massive and schistose amphibolites. The composite fine to medium grained granite dyke with a strong development of a pegmatitic facies has been intruded into a pre-existing, rather intricate fracture system.

The margins of the dyke where visible are sharply defined and there is no suggestion of replacement of country rock by the dyke.

The dyke before mineralisation would appear to have been composed largely of microcline felspar, quartz and muscovite mica in varying grain size requisite to form normal granitic and pegmatitic structures. Large scale pegmatitic structure is confined to the northern portion of the dyke and granitic structures prevail in the central and southern portions.

In these latter portions, a fracture pattern appears to have been developed in the dyke either as the result of cooling, or pre-mineralisation movement of the enclosing country rock—the writer is unable to decide which. Portions of the hanging-wall and foot-wall sides of the dyke and the connecting fractures are now occupied by almost pure albite felspar veins carrying tantalite irregularly distributed through them, as fine grains or masses up to 90 lbs. in weight. The writer was unable to detect any definite structural control of the deposition of tantalite in the albite itself.

There is no tantalite in the fine granitic material, and it can be said that for this part of the dyke there is at least some guide to the occurrence of more tantalite and that "Follow the albite" is a sound maxim in mining operations in this locality.

Towards the northern end of the dyke, quartz, fine grained green massive muscovite mica, and lepidolite mica low in lithia content, occur as large masses either at the margins or in the body of the dyke, with tantalite occurring in a very fine form frequently in intimate association with pale green apatite and spessartite garnet in massive bodies composed of intimate mixtures of a fine granular albite, granular dark coloured quartz and green, massive, extremely finely crystalline muscovite mica. The tantalite here occurs in all three minerals mentioned, but the writer could not detect any structural or mineralogical control other than that no tantalite was noticed in the large quartz, lepidolite and green muscovite mica masses.

An albite vein has recently been reported by the manager as occurring at the northern end in association with the mineral assemblages quoted above, and the tantalite in this vein is also stated to be of specimen size—similar to that in the albite veins at the southern end of the dyke.

There is no prominent central quartz core in this dyke, nor is tantalite deposition confined to the margin of uni-mineral masses. Available evidence suggests that the tantalite shoots may have a horizontal disposition, and there is ample evidence available establishing the relationship between albitisation and tantalite deposition.

Spessartite garnet (manganese aluminium garnet) is a common accessory mineral in the albite-tantalite association, and what are locally termed "Cats' Eyes," strikingly shaped yellow, brown and black stainings of albite felspar, thought to be alteration products of lithiophilite or some uranium bearing mineral, are usually regarded as indications of the presence of tantalite in the albite. There is no obvious tendency to the formation of tabular, uni-mineral masses arranged more or less as horizontal or gently inclined layers as at Tabba Tabba (Layer structure) nor is there any obvious indication of "pipe" structure.

Beryl deposition at the northern end may be associated with the hanging wall portion of the dyke in the vicinity of a steeply pitching intersection plane of two faults.

Strelley:

The strike and dip of the dyke is mainly coincident with that of the enclosing amphibolite schists, quartzites, etc., which here strike N. 30° E. and dip mostly vertically. There is strong evidence of replacement of the country rock near the margins of the dyke in a manner similar to that of granitisation. The dyke itself contains remnants of biotite schist and is strongly schistose in places, the planes of schistosity being co-incident with those of the enclosing country rock. The dyke before mineralisation consisted of microcline felspar, quartz and a small quantity of muscovite mica, with a strong tendency towards development of large felspar and quartz masses, not prominently confined to any particular portion of the dyke. There is a slight tendency for the quartz masses to be concentrated either near the centre or towards the eastern margin of the dyke. Tantalite occurs in the dyke in two ways:

(a) In short, narrow, shallow lived lenses of greisen containing tantalite varying in size from dust to pea size, either marginal to or penetrating the quartz masses. These lenses frequently dip eastwards at from low angles up to 45°, though their orientation is not regular.

(b) Associated with material consisting of fine granular albite felspar, fine scaly muscovite mica, fine to medium grained broken bluish coloured quartz and red loam, near the surface, in what is best described as a "stockworks." These occurrences are not specifically confined to quartz mass margins, and occur in quite fresh masses of the original pegmatite dyke which consist predominantly of microcline felspar and quartz. They constitute what the writer refers to as "kindly" pegmatite, analagous to the "kindly" country of the gold prospector.

It is obvious that a fracturing of the dyke has occurred and that tantalite deposition is intimately associated with *fine* greisen and albite felspar.

All microcline felspar in the vicinity of tantalite deposition shows microscopic replacement by albite.

The western portion of the dyke is relatively free from cassiterite, while towards the eastern margin cassiterite is of frequent occurrence in *coarse* greisen patches. When cassiterite and tantalite occur in the same dyke it is not uncommon to find the main concentrations occurring in separate places.

When the tantalite occurs in the greisen it appears to be confined to the type in which the green muscovite scales are not larger than ¼ inch and are frequently much smaller, while that in which the scales are in excess of this size is either barren or contains cassiterite.

The writer could not detect any regularity in the fracture pattern in different parts of the dyke, though when it is known that the deepest workings are only 20 feet vertical depth, and the surface is covered with eluvium, this is not surprising.

The only prospecting guides which can be offered are to search on the surface for indications of *fine* greisen lenses near the margins of quartz or felspar lenses or elsewhere in the dyke, and to watch for the softer patches of "kindly" pegmatite in the otherwise hard fresh pegmatite *anywhere* in the dyke. Spessartite garnet is universally present in the mineralised zones, and microlite is of frequent occurrence replacing tantalite.

Tabba Tabba:

This dyke has been intruded into blocky and partially sheared amphibolites in a complicated fault pattern, the main strike and dip of which is not coincident with the strike and dip of the enclosing rocks.

The bulk of the dyke is composed of coarse microcline felspar and quartz with numerous granitic and aplitic phases, mica being comparatively rare in large flake form.

There is a prominent development of a quartz core which is more or less centrally situated but which is characterized by having a "layer" structure, that is, the large quartz masses occur as more or less tabular bodies distributed at irregular intervals in a roughly horizontal attitude along the strike of the dyke. They form the resistant masses at the margins of which subsequent movement has taken place and in which tantalite deposition has occurred.

These masses do not persist in depth below about 30 feet, and in several places the ore has been mined from the ends, sides and bases of the tabular bodies.

There is a very close association between beryl and tantalite in this dyke, the beryl frequently occurring as crystals up to 4 inches wide between parallel prism faces, though more commonly of smaller dimensions, deposited on the margins of the quartz masses with tantalite deposited as fine aggregates on the beryl and quartz.

The relative age is (1) massive quartz, (2) beryl, then tantalite. Beryl and tantalite also occur as small crystals in the soft, partially decomposed material forming a zone up to 3 feet wide round the margins of the quartz masses. This material consists predominantly of fine granular albite felspar, broken bluish coloured quartz, fine green scaly muscovite mica, and red clay loam. It passes into a less altered and barren aplitic phase away from the mineralised zone—the felspar of the aplite being albite.

The "Simpsonite" deposit (calcium aluminium tantalite) occurs at the margins and base of a tabular quartz mass some 200 feet long by 45 feet wide by 15 feet (max.) thick dipping flatly to the N.E. situated more or less centrally in the main tantalite-bearing pegmatite, at its junction with another strong cassiterite bearing pegmatite which meets it nearly at right angles.

The main simpsonite deposition is confined to the immediate 2 to 3 inches below or at the sides of the massive quartz, though it does extend to greater distances (up to 3 feet at least).

In other parts of the main tantalite-bearing dyke, beryl has the same manner of occurrence in the same fine granular albite, broken blue quartz and fine scaly green muscovite mica and red clay loam as is associated with the simpsonite.

There is a remarkable similarity between the crystal size, shape and habit of the simpsonite and the small beryl crystals; both belong to the Hexagonal Division of the Hexagonal System of crystallography, and it is here suggested that simpsonite may be a pseudomorphous replacement of beryl.

Towards the north-western end of the dyke greisen lenses containing mostly cassiterite and a small proportion of tantalite are associated with the flatly dipping quartz masses.

Fracturing of the dyke in places other than marginal to the quartz masses is shown in at least one observed instance at the south-eastern end of the dyke, where in a shallow shaft an open fracture some 6 inches wide occurs in an aplitic phase of the dyke and tantalite has been deposited along with some beryl on the walls of the open fracture.

Generally speaking, however, previous mining operations demonstrate the close relationship between quartz masses and tantalite and beryl deposition at Tabba Tabba, and the obvious place in which to search for fresh deposits is marginal to these quartz masses.

The "layer" structure may be repeated in depth, in which case, tantalite and beryl would almost surely be associated with quartz masses, but the writer is unable to account structurally for the presence of the quartz masses, and offers the suggestion of a repetition in depth as a guess only, but one well worth testing by the diamond drill. Spessartite garnet is everywhere associated with mineral deposition.

Pilgangoora:

In this area a large number of granitic dykes of varying length and width showing varying degrees of pegmatitic development and equally variable mineralised portions of the pegmatitic facies, occur occupying well defined fault systems whose strike and dip is not coincident with that of the enclosing amphibolite schists, quartzites, phyllites, etc.

There is no marked tendency to the formation of prominent quartz concentrations, but in many instances sheet jointed quartz lenses occur in the mineralised portions of the microcline pegmatite at or near either the hanging wall or footwall. There is a suggestion that columbite, always associated with albite, and sometimes with grey to lilac coloured spodumene and a dark coloured glassy quartz, occurs more frequently on the footwall side of the dykes, while cassiterite, always associated with some albite and nearly always occurring in greisen lenses with accompanying grey to lilac coloured spodumene and glassy quartz is more frequently found at or near the hanging wall of the dykes.

Spodumene has a wide distribution, and occurs wherever columbite and cassiterite have been found in situ.

Spessartite garnet is common in the mineralised zones of the pegmatites.

No well defined fracture pattern could be discerned, but the strong tendency to the localisation of ore deposition at or near the hanging wall or footwall sides of the dykes, suggests movement along these walls subsequent to the formation of the pegmatite and prior to mineralisation.

REPORT ON QUARTZ CRYSTAL DEPOSITS ON P.A. 2096, PILBARA GOLDFIELD.

KANGAN STATION, NORTH-WEST DIVISION, WEST AUST.

Approx. Lat. 21° 06′ S.

Approx. Long. 118° 30′ E.

(*By H. A. Ellis, B.Sc., A.O.S.M.*)

Locality:

"Kangan" Station Homestead is situated in approximate Lat. 21° 06′ S. and approximate Long. 118° 30′ E., about 14 miles by road N.-W. by W. from the principal tantalite workings at Wodgina. It would be about 75 miles by road to "Kangan" Homestead in a general southerly direction from Port Hedland via the main Port Hedland-Wodgina Road.

The quartz crystal deposits are situated about 1 mile by track on a bearing of 300° from the homestead, on Prospecting Area 2096, Pilbara Goldfield. The locality was first visited by the writer in March, and again in May, 1944.

Geology:

The crystal deposits are associated with pegmatite dykes and quartz reefs transgressively intrusive into a series of quartzites and schistose amphibolites—regional strike N. 30° E., dip 50° W. These rocks form a belt of low foothills to a prominent north-easterly trending line of hills situated a short distance to the west of the deposits.

The several dykes and quartz reefs strike S. 70° W. and where exposed in shallow workings or at the surface dip vertically. Two separate deposits about 8 chains apart had been located and opened up to shallow depths only (3 feet) when the locality was last seen by the writer (May, 1944).

The Quartz Crystal Deposits:

In the more westerly of the two occurrences, the crystals were located from the surface to a depth of about 3 feet, over a width of about 2 feet, at odd intervals on either side of a narrow central quartz core over a length of about 3 chains in a decomposed pegmatite dyke outcrop from which eluvial tantalite was being obtained. The matrix containing the crystals was a red clay loam, apparently filling the open spaces in which the crystals had originally formed.

Some hundreds of crystals showing all forms of development occurred here. Flat tabular forms, hexagonal prismatic crystals with one or both ends terminated by hexagonal pyramids; intergrown crystals of varying perfection being common. Some crystals up to 12 inches long, terminating at one end in a hexagonal pyramid but badly flawed, were obtained.

The crystals varied in size from ¼ inch between parallel faces and 1 inch long, up to 4 inches between parallel faces and 12 inches long. Most crystals showed interpenetration or normal twinning and contained numerous ghost-like inclusion patches. (Some specimens from this deposit were donated to the mineral collection of the Mineral Section, Government Chemical Laboratory, Perth.)

Some of these crystals were submitted to Amalgamated Wireless (Australasia), Ltd., 47 York Street, Sydney, by the Government Mineralogist, and were found to possess peizoelectric properties, making them suitable for use in wireless and telegraphic equipment. (See under heading ''Production''.)

The second occurrence of quartz crystals is situated about 8 chains in an easterly direction from that described above, and is associated with a separate pegmatite dyke of small extent. The pegmatite here contains a short narrow shoot of tantalite at its eastern end, the western end of the short dyke exposure being composed of quartz. The pegmatite is transgressively intrusive into the same quartzite and schistose amphibolite series associated with the more westerly deposit.

At the extreme westerly termination of the predominantly quartz portion of the pegmatite dyke, a prolific development of quartz crystals was located in a shallow surface excavation in decomposed felspar and kaolin, forming a narrow lens some 12 feet long by 3 feet deep, varying in width from 2 feet to 2 feet 6 inches. This extensive development of quartz with minor amounts of kaolin and decomposed felspar appears to have been formed in an original open space at the extreme end of the pegmatite dyke. Decomposed wall rock (schist) occurs in very close proximity to the edge of the workings as seen in May, 1944.

Many hundreds of quartz crystals in a wide range of crystalline development and varying in size from ¼ inch between parallel prism faces and ½ inch long, up to 11 inches between parallel prism faces and 20 inches long, had been dug from the shallow excavation mentioned above at the time of inspection.

Many of the crystals, both large and small, show strong pyramidal development, and a few have the hexagonal pyramids developed at both ends. All crystals show extensive twinning, intergrowth, and cloudy inclusions and flaws, except some of the smaller ones (less than ¾ inch diameter) which are clear, glassy and free from flaws. (Specimens from this deposit are numbered 2/2896 in the Geological Survey Collection.)

The crystals from this deposit differ slightly in tint from those of the more westerly occurrence and may well prove to be different in peizoelectric properties.

Dr. Dorothy Carroll of the Mineral Section, Government Chemical Laboratory, has drawn the writer's attention to the marked difference in the physical properties of quartz crystals from widely separated localities, and in the case of the ''Kangan'' crystals this slight difference in general appearance noticeable in the tint and intensity and shape of the inclusions, can be detected in two deposits only about 8 chains apart.

Production.

No crystals had been tested for their commercial value up to March, 1944. In this month, the writer dispatched on behalf of the owners, a selection of crystals weighing about 31 lbs. to the Government Mineralogist for examination as to their commercial value. This parcel was from the western deposit, and to date (September, 1944) 3½ lbs. of these crystals have been bought by Amalgamated Wireless (Australasia), Ltd., Sydney, for commercial use, the price paid being £A3 per lb.

Additional material from this parcel has been despatched by the Government Mineralogist at the request of Amalgamated Wireless (Australasia), Ltd., but tht result of the examination of this material is not yet to hand (September, 1944).

Details of material already forwarded by the Government Mineralogist and accepted by Amalgamated Wireless (Australasia), Ltd., are as follows:—

Crystal No. (Chem. Lab.).	Gross Weight.	Weight of usable portion.	Dimension of Crystal.	Value.
6A	1 lb.	1 lb.	Length 4½ in., 1·7 in. between parallel prism faces	£A3 per lb.
11A	2 lb.	¾ lb.	Length 5½ in., 2·2 in. between parallel prism faces	
7B	1 lb.	½ lb.	Fragment—showing one prism and one pyramid face	
5B	2 lb.	1 lb.	Composite growth, flat plate-like fragment, two wide parallel prism faces developed (3 in. ± wide)	
1B	1½ lb.	½ lb.	Length 5½ in., 1·8 in. between parallel prism faces	

During April, the owners despatched two cases each 20 inches long by 14 inches deep by 10 inches wide of packed quartz crystals (weight unknown to writer), obtained from the more easterly of the two deposits to Amalgamated Wireless (Australasia) Ltd., Sydney. These were assorted crystals of which no particulars are at present available (Sept. 1944). It is hoped to obtain further information about the value of this consignment at a later date.

Since the above was written, the owners of this deposit, the Rogers Brothers, ''Kangan'' Station, in a personal communication to the writer, have kindly supplied the following information:—

Case No. 1 from the Eastern Deposit.

Crystal No. (Owners').	Gross Weight.	Weight of Usable Portion.	Remarks.	Value.
1	60 lbs.	*Nil*	Flawed excessively and full of fine bubbles	*Nil*
2, 3, and 4	Each weighing between 10 and 20 lbs.	*Nil*	do. do.	*Nil*
5	10 ozs.	*Nil*	Flawed and twinned	*Nil*
6	3½ lbs.	1 lb.	....	£A3
7	8 lbs.	3 lbs.	....	£A9
Total		4 lbs.	....	£12

Case No. 2 from the Eastern Deposit.

Case contained 37 pieces weighing 97½ lbs. Most of the crystals were well shaped, but there were only small patches free from bubbles.

Only 2¼ lbs. of usable material could be obtained from this shipment. Value £A6 15s. 0d. (= £A3 per lb.)

The results of the sale of quartz crystals from these deposits up to October 16th, 1944, may be summarised as follows:—

Purchaser:—Amalgamated Wireless (Australasia) Ltd., 47 York Street, Sydney.

From the western deposit, 3¼ lbs. at £A3 per lb. = £A9 15s. 0d.

From the eastern deposit, 6¼ lbs. at £3 per lb. = £A18 15s. 0d.

Total, 9½ lbs. valued at £28 10s. 0d.

Future Prospects.

Neither prospect had been fully developed, and it is quite impossible to predict either the quality of the crystals likely to be found in future exploitation, or the downward extent of the deposits. It would be unusual for either of the deposits to be very extensive, since they were both formed in open spaces in the original pegmatite during consolidation, and although the existence of open spaces in consolidated pegmatites appears to be widespread, none are known possessing large dimensions.

The occurrences are perhaps the most prolific yet known in this State.

REPORT ON BERYL AND TANTALITE OCCURRENCES ON P.A. 2096 AND 818H, PILBARA GOLDFIELD.

"KANGAN" STATION, N.-W. DIVISION, W.A.

Approx. Lat. 21°-06′ S.

Approx. Long. 118°-30′ E.

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

Locality.

"Kangan" Station Homestead is situated in approximately Lat. 21°-06′ S., and approximately Long. 118°-30′ E., about 14 miles by road N.-W. by W. from the principal tantalite workings at Wodgina. It would be about 75 miles by road to "Kangan" Homestead in a general southerly direction from Port Hedland via the main Port Hedland-Wodgina Road.

Beryl tantalite and columbite occur on P.A. 2096, situated about one mile by track on a bearing of 300° from the Homestead, and tantalite, microlite, tapiolite and columbite have been found on P.A. 818H situated about ¾ of a mile N.-E. of P.A. 2096, or about 1·1 miles N.-W. of the Homestead by track.

The deposits were first inspected in March and again in May, 1944.

Geology.

The beryl and tantalite deposits are associated with pegmatite dykes and quartz reefs transgressively intrusive into a series of quartzite and schistose amphibolites—regional strike N. 30° E., dip 50° W. These rocks form a belt of low foothills to a prominent north-easterly trending line of hills situated a short distance to the west of the deposits.

The Deposits.

(1) *P.A.* 2096.—On this, the more southerly of the two prospecting areas, beryl, manganocolumbite and manganotantalite occur in association with pegmatite dykes of small dimensions. Work done up to the time of inspection (May, 1944) had failed to reveal any noteworthy concentrations of beryl, manganocolumbite, or manganotantalite, though the deepest workings were only down 10 feet.

Beryl.

The beryl occurs as scattered concentrations in the felspar of the pegmatite dykes, in quartz concentrations, and also at the margins of quartz reefs associated with the pegmatites, the largest mass seen being about 3ft. x 3ft x 2ft. Mr. H. P. Rowledge, Mineralogist of the Mineral Section, Govt. Chem. Lab. has informed the writer (verbal communication) that some of this beryl collected by him towards the end of 1943 contained 13% of Beo; a surprisingly high value for the apparently impure, decomposing brownish coloured mineral characteristic of this locality.

About three tons of beryl were seen lying on the ground and in situ at the time of inspection, and it is not possible to form any estimate of the quantity of the beryl likely to be contained in the dykes and quartz reefs.*

An unusual conical development of beryl prisms terminating in an angle of 30°, some crystals weighing up to 18 lbs., were seen here. This type of crystal growth is not uncommon in beryl, having been noticed by the writer in the Mt. Francisco locality (south of Wodgina), at Strelley, and in some specimens of beryl collected by the Government Geologist at Poona west of Cue, on the Murchison Goldfield.

Manganotantalite and Manganocolumbite.

These minerals occur in eluvium and mineralised portions of pegmatite dykes in arrow head, rosette and rectangular forms; the specific gravity of the arrow head forms being as low as 5·8, while the rosette and the rectangular forms have specific gravities varying from 6 to 6·8 (H. P. Rowledge, personal communication Mineral Section, Govt. Chem. Lab.).

These gravities show an approximate range of from 26% to 59% of Ta_2O_5.

An interesting point in connection with these figures is the low specific gravity of the arrow head forms of the black mineral, indicating a low Ta_2O_5 content, whereas in the Wodgina district the arrow head formation is usually associated with a high grade tantalite.

The principal workings from which moderately good grade manganotantalite had been produced are situated at the eastern end of one of the several pegmatites and quartz reefs outcropping in the area.

Here a composite quartz and pegmatite structure up to 15 feet wide, faulted in places and some 12 chains long strikes S. 70° W. and dips vertically. At the eastern end of the outcrop, a prominent central quartz reef had been opened up in the excavation about 15 feet long and 3 feet wide to a maximum depth of 10 feet at its western end. The quartz is here revealed as a capping only, persisting to a depth of from 2 to 3 feet from the surface, and is an excellent example of "layer structure" not uncommon in pegmatite dykes. The tantalite bearing portion of the dyke is an 8 inch seam of green muscovite mica, fine granular quartz and albite parallel to the general trend of the dyke and dipping nearly vertically. The north wall is massive fine grained albite and quartz, and the south wall is coarse grained albite and fine muscovite mica.

The occurrence appears to be a short, nearly vertical shoot of unknown depth (tantalite could still be seen in very small quantities at the bottom of the excavation), in a more or less centrally situated mineralised zone of the pegmatite dyke.

Microcline felspar and quartz forms the mass of the pegmatite with mica present to a very small extent only.

Further west on the western side of a shallow south trending dry gully, more pegmatites outcrop, with associated strong quartz reef development, and the lower grade manganocolumbite occurs in the eluvium associated with these occurrences.

The tantalite in the eastern workings is intimately inter-grown with albite, and was roughly dollied out of the matrix before selling to Tantalite Mine, Wodgina.

Production.

Up to May, 1944, about 90 lbs. of eluvial and lode tantalite had been obtained from this P.A., and at

*Since compiling this report, the owners, in a personal communication have informed the writer that three tons of beryl were obtained and sold to the tantalite project, Wodgina.

this date work on the tantalite occurrences had ceased in favour of the quartz crystal deposits (see separate report).

(2) *P.A.* 818H.—In this area the tantalite-bearing pegmatite strikes N. 65° W. dips vertically, and is transgressively intrusive into the quartzites and schists which here strike N. 40° E. and dip at 45° W.

Here again is a central quartz core exposed for part of the distance in a pegmatite dyke which outcrops for some 170 feet and is about 12 feet wide. The workings consist of two parallel excavations about 15 feet long by 2 feet wide with a maximum depth of 8 feet, on both sides of a central quartz core of irregular shape, but attaining a maximum width of three feet and still persisting at the bottom of the excavation (8 feet).

Tapiolite and Tapiolite altering to Microlite (both high-grade tantalite bearing minerals) occurred sparingly in partially decomposed finely granular albite and green muscovite mica over a width of 12 inches adjacent to the central quartz core, but occasionally it was noted adhering to the quartz wall as small crystals.

The walls adjacent to the mineralised zone consist of albite, quartz, and green muscovite mica, and microcline felspar was noticed in parts of the dyke remote from the actual workings. This type of mineralisation is very similar to that noted in the Tabba Tabba tantalite deposits. Some small crystals of beryl up to 1½ inches between parallel prism faces and two inches long were seen associated with the felspathic portion of the dyke, but no quantity of this mineral had been located. About ½ lb. of yellow bismuth carbonate was obtained along with some eluvial microlite close to the pegmatite.

A lens of barite (white barium sulphate) about 3 feet long and 3 inches wide occurs in the amphibolite schist 1½ chains north of the workings.

Production.

Up to May, 1944, some 25 lbs. of lode and eluvial tapiolite and microlite had been obtained from this deposit and was sold to Tantalite Mine, Wodgina.

Occasional crystals of Manganocolumbite have been found in the eluvium in the area surrounding this deposit.

Remarks:

Very little mining work had been done on either of these tantalite deposits up to the time of inspection (May, 1944) and results to that date showed the tantalite shoots to be short and narrow. Both deposits are sufficiently attractive to warrant further prospecting by sinking on the shoots, but the writer is not prepared to offer any opinion as to the results of any development work undertaken, having in mind the unpredictable nature of mineral deposition in pegmatite dykes.

REPORT ON THE DONNELLY RIVER GRAPHITE DEPOSITS OF W.A.

South-West Division.

Approx. Lat. 34°—13′ S.

Approx. Long. 115°—55′ E.

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

In the Annual Report of the Geological Survey for 1943 the writer contributed a general report on the above deposits, but was unable to give any estimate as to possible ore reserves or quality of the ore.

A representative sample of the ore from the upper seam was taken at the time of inspection (Dec. 1943) and subsequently submitted to the Kalgoorlie School of Mines for treatment.

The results of tests carried out on this material appear under Series 5 in Appendix I to the report on The Munglinup Graphite Deposits, appearing elsewhere in this annual report.

Hereunder is a summary of the quantity and quality data concerning the graphitic content of this sample, originally about 80 lbs. in weight when broken over a true width of 5 feet of ore and subsequently further broken and quartered down to 20 lbs.

Locality of Sample.

Donnelly River, M.C. 281H, 5 feet of graphite ore from upper seam.

Head Value of Sample—carbon content as % by weight of sample, = 28.

Extractable Graphite using Method described in Investigation No. 266, Kalgoorlie Metallurgical Laboratory 1944—4 tests. (See Munglinup Graphite Report. Appendix I.)

Flake (+ 80 mesh I.M.M.) Quantity—as % by weight of sample—NIL.

"*Amorphous* (— 80 mesh I.M.M.)

Quantity :— as % by weight of sample.	Quality :— as % of Carbon in the Graphite.
25·0	80·0
22·5	77·8
19·0	87·5
18·0	89·3

This type of ore is not comparable in value with that from the Munglinup Deposits, although it yields a product quite suitable for many industrial requirements.

Mineral Composition of the Ore.

A representative sample of this ore was examined by the Mineral Section Government Chemical Laboratory, Perth, who reported that minerals other than graphite consisted mainly of quartz and oligoclase felspar, with some limonite and clay (probably illite) and a little kaolin. No carbonite minerals were detected.

Remarks.

At the time of writing (September, 1944) no work was being done on these deposits, and only a small amount of development had been carried out since they were inspected by the writer in December, 1943.

REPORT ON THE MUNGLINUP GRAPHITE DEPOSITS.

P.A. 802H, Munglinup River, Eucla Division, Western Australia.

Approx. Lat. 33°-40′ S.

Approx. Long. 120°-51′ E.

by

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

Introduction.

This report is supplementary to that appearing in the Annual Report of the Geological Survey for 1943, and contains information not available at the time of compiling that report.

It deals with the quantities and qualities of the various grades of graphite extractable by the methods described in "Investigation No. 266, Kalgoorlie Metallurgical Laboratory, 1944," reproduced hereunder.

Despite the excellent quality of the graphite obtainable, both Flake and "Amorphous," and the very promising nature of the deposit from both a geological and mining aspect, the deposits are as yet (September, 1944), undeveloped, due largely, the writer understands, to lack of a suitable market.

Sampling.

The material used in Investigation No. 266 was collected as follows:—

Sample No. 1—from No. 1 or Stewart's Shaft.

Approximately 1 cwt. of ore was broken from a channel cut in the shaft wall extending from the top of the seam at 3 feet vertical depth below ground level, over a width of 9 feet of ore body to the base of the seam, representing a true width of 7 feet of ore. This sample was further broken and quartered down to 56 lbs.

Sample No. 2—from No. 2 Shaft or Halbert's "South Shaft."

About 150 lbs. of ore was taken from a layer of ore previously covered over in the shaft dump, which is believed to have come from the continuation of the graphitic band exposed and sampled near the surface in Stewart's Shaft (Sample No. 1). Sample No. 2, therefore, is from an approximate vertical depth of 50 feet, and some 80 feet down the direction of dip from No. 1 Sample. It represents an approximate true width of 12 feet of ore.

This sample was further broken and quartered down to 65 lbs.

Sample No. 3a—from No. 3 Shaft or Halbert's "Middle Shaft."

Approximately 1 cwt. of ore was broken from a channel cut in the shaft wall extending from the top of the seam, commencing at a vertical depth of 10 feet below ground level over a width of 14 feet 6 inches of ore body to the base of the seam, representing a true width of 10 feet of ore.

This sample was further broken and quartered down to 52 lbs.

Sample No. 3b—from No. 3 Shaft or Halbert's "Middle Shaft."

Approximately 1 cwt. of ore was broken from a channel cut in the shaft wall extending from the top of the seam (separated from the base of the upper seam by 2 feet of yellow decomposed biotite gneiss containing some flakes of graphite) commencing at a vertical depth of 27 feet below ground level over a width of 12 feet of ore body to the base of the seam, representing a true width of 10 feet of ore.

A flattening of the dip or lensing of the ore body is noticeable here.

This sample was further broken and quartered down to 50 lbs.

Sample No. 3c—from No. 3 Shaft or Halbert's "Middle Shaft."

About 40 pounds of ore was broken from a channel cut in the shaft wall extending from the top of the seam (separated from the base of the middle seam (No. 3b) by 7 feet of yellow decomposed biotite gneiss) commencing at a vertical depth of 45 feet below ground level over a width of 4 feet 6 inches of ore body to the bottom of the shaft which was still in ore.

This sample was further broken and quartered down to 10 lbs.

Composite Sample.—A sample composed of equal parts by weight of samples 1, 2, 3a and 3b was made up in the Kalgoorlie Metallurgical Laboratory and treated as outlined in Series No. 4, Table No. 5, below.

Attention is drawn to the fact that a small amount of dilution of samples Nos. 1, 2, 3a and 3b unavoidably occurred during the collecton of the samples. Otherwise the material treated in the tests can be regarded as truly representative of the ore-bodies at the sample points.

Mineral Composition of the Ore.

Representative material from the samples tested in the Kalgoorlie Metallurgical Laboratory was examined by the Mineral Section, Government Chemical Laboratory, Perth, with results as set out below. All of the ore sampled was of a soft nature, the workings being still in the oxidised zone at 50 feet vertical depth.

Sample No. 1.—The minerals associated with the graphite in this sample are clay (probably allophane) quartz, and oligoclase felspar. Lesser amounts of magnetite, hornblende and magnesite, and traces of a colourless amphibolite, garnet, biotite, geothite, muscovite, rutile and staurolite are present.

Sample No. 2.—The minerals, other than graphite present consist mainly of quartz and oligoclase, with some magnesite, hornblende, rutile and biotite.

Sample No. 3a.—The principal mineral present with the graphite is calcite; some quartz and oligoclase present.

Sample No. 3b.—The associated minerals consist mainly of quartz and oligoclase with some clay (probably allophane) and a little magnesite.

Sample No. 3c.—The associated minerals are quartz and oligoclase. No carbonate minerals were detected.

MUNGLINUP RIVER GRAPHITE SAMPLES FROM P.A. 802H.

Locality and Sample Number (*See* Plan).	Head Value of Sample Carbon content as % by weight of Sample.	True Width of Seam.	Extractable Graphite, using method described in Investigation No. 266, Kalgoorlie Metallurgical Laboratory, 1944.			
			Flake (+ 80 mesh I.M.M.)		Amorphous (— 80 mesh I.M.M.)	
			Quantity (as % by weight of Sample).	Quality (as % of Carbon in the Graphite).	Quantity (as % by weight of Sample).	Quality (as % of Carbon in the Graphite).
		ft. ins.				
Munglinup River P.A. 802H—						
No. 1 from No. 1 shaft or Stewart's Shaft	27·1	7 0	5·0 to 5·5	99·0 to 99·7	17 to 21·85	95·1 to 80·0
No. 2, from No. 2 shaft or Halbert's "South Shaft" ...	15·25	12 0	4·7	96·9	9·4	82·0
No. 3A, from No. 3 shaft or Halbert's "Middle Shaft" ...	17·7	10 0	2·8	94·8	22·0	58·2
No. 3B, from No. 3 shaft or Halbert's "Middle Shaft" ...	23·1	10 0	4·6	96·8	21·5	84·4
No. 3C, from No. 3 shaft or Halbert's "Middle Shaft" ...	16·0	4 6 (Base not exposed)	3·0	96·0	12·6	88·1
Composite Sample, composed of equal proportions of Samples 1, 2, 3A, and 3B	22·2	...	4·2	99·4	14·4	96·0

Graphite is present in these samples in the flake form, but as remarked by the investigators who conducted the metallurgical tests, and also noticeable in the hand specimens of the ore, there is certainly a tendency to "chunkiness" in the form of some of the graphite in Sample No. 1.

Summary of Metallurgical Tests.

On page 69 in tabular form is a summary of the principal "Quantity" and "Quality" results of the metallurgical tests carried out by the Kalgoorlie Metallurgical Laboratory on samples of Munglinup ore.

The writer would here like to express his appreciation of the work done by the investigators in this research, and to share with them the satisfaction that the results obtained indicate that both this work in the Laboratory and the writer's field investigations have been done on deposits which show as the result of our combined effort, that they are of considerable economic importance.

The full report on the metallurgical tests carried out on Munglinup and Donnelly River graphite samples is included as Appendix No. 1 to this report.

Ore Reserves.

The writer indicated in the 1943 Annual Report of the Geological Survey that approximately 27,000 tons of graphite ore could be obtained from an inclined depth of 100 feet down the dip from seams already sufficiently exposed to warrant a provisional estimate being made, not taking into account the continuation of the ore-bodies to the north-east and south-west beyond the present limits of exploration.

No additional development work has been done on the deposits since this estimate was made, and as a result of the metallurgical tests recently carried out on the ore, it is now possible to arrive at some figures indicating the potential value of the deposits.

In this connection, the results of the tests on the composite sample (Series No. 4, Table No. 5 below) are particularly useful, as this material would closely represent the "run of mine" ore if the ore-body were being vigorously developed.

The use of Munglinup water—from the undeveloped springs ¼ mile west of the deposits—in the metallurgical tests, showed that it can therefore be seen that there are no obstacles, other than those of an economic nature, in the way of successful treatment of the ore at the site of the deposits, providing the springs prove to have a good capacity on testing.

The graphite content of the composite sample may be taken as some indication of the quality of the 27,000 tons estimated to be present within the limits defined above. Using these figures we obtain the following result:—

Total graphite content:—
Head value of ore 22.2% by weight—graphite.
Quantity of ore—27,000 long tons.
Quantity of graphite in ore—5,944 long tons.

Portion recoverable as Flake (+ 80 mesh I.M.M.).
4.2% of the ore
= 1,134 long tons.
Carbon content—99.4%.

Portion recoverable as "Amorphous" (— 80 mesh I.M.M.).
= 14.4% of the ore
= 3,888 long tons.
Carbon content = 96.0%.

It will thus be seen that a comparatively simple metallurgical process is capable of freeing a relatively high proportion of the graphite content of the ore as both Flake and "Amorphous" graphite of high carbon content, suitable for the most exacting requirements for which these types of material are required in industry.

The tests show also, that a higher proportion of the graphite content of the ore but of lower carbon content can be obtained if required, when the purposes for which the material is required, does not demand the maximum possible carbon content.

APPENDIX I.

KALGOORLIE METALLURGICAL LABORATORY, SCHOOL OF MINES.
Kalgoorlie, September 5, 1944.

Investigation No. 266.

REPORT ON INVESTIGATION CONDUCTED FOR THE GEOLOGICAL SURVEY DEPARTMENT ON MUNGLINUP AND DONNELLY RIVER GRAPHITE ORES.

Following the work carried out on samples of Munglinup ore, which had been forwarded to the Kalgoorlie Metallurgical Laboratory by Mr. E. A. Banfield, the results of which appeared in the Report on Investigation No. 254, the following advice was received from the Government Geologist that in consequence of a discussion between Mr. Banfield and Mr. H. A. Ellis, Senior Geologist, some confusion existed about the numbers and location of the samples submitted for the investigation as reported in the Investigation No. 254. Consequently it was desired that the investigational work be discontinued on the original samples received at the Laboratory and Mr. Banfield was desirous that samples taken by Mr. Ellis should be taken as the standard ones.

Included in the samples received from the Geological Survey Department was one taken from a deposit at the Donnelly River, this deposit being situated 15 miles west of Manjimup. The W.A. Minerals Development Ltd. of Pastoral House, St. George's Terrace, Perth, were said to be the holders of the lease on which this deposit occurs.

Shipment.

Five bags of samples were forwarded from the Geological Survey Department and were marked as shown.

Bag No. 1.—Munglinup River No. 1.
Bag No. 2.—Munglinup River No. 2.
Bag No. 3.—Munglinup River No. 3a.
Bag No. 4.—Two samples, Munglinup River 3b; Munglinup River 3c.
Note.—3c was in a sample bag.
Bag No. 5.—Donnelly River No. 1.

Sample Plan.

A sample plan of the Munglinup River Deposit was also received, from which the following information has been obtained:—

Sample No. 1.—From No. 1 or Stewart's Shaft which cut through graphitic schist of true width 7 ft., the sample being taken from the side walls of the shaft over a depth of 9 ft.

Sample No. 2.—Taken from the surface near Halbert's South Shaft, the shaft being inaccessible on 8/12/43. (This is the continuation of the seam sampled in No. 1 shaft.)

The above two shafts have been put down in a graphitic schist zone which outcrops at a width of 110 ft. and has a true width of 65 ft.

Samples Nos. 3a, 3b, 3c.

These three samples were taken from Halbert's Middle shaft, this shaft being approximately 400 ft. northerly from the Stewart's and Halbert's South shafts.

Sample 3a was taken over a width of 14ft. 6in.
3b was taken over a width of 12ft. 0in.
3c was taken over a width of 4ft. 6in.

at the bottom of the shaft which was still in the graphitic schist.

The outcropping graphitic schist zone at the Halbert's Middle Shaft was 300 ft. in width and the true width was estimated to be 210 ft.

The Donnelly River sample was taken from a graphitic seam 5 ft. thick.

Requirements.

The nature of the work required was:—

(a) Determination in each sample of the relative quantities, sizes, and qualities of the graphite obtainable from the ore by the processes used in the previous treatment scheme. (Vide Investigation No. 254).
(b) A bulk test of samples 1, 2, 3a, and 3b using Munglinup water.
(c) A brief description of the treatment process used in the above tests.

Note:

In this report all calculations are based on the ton of 2,000 lb.

All flotation reagent consumptions are calculated as lb. per ton of original ore.

No responsibility is taken for the results shown in this report except insofar as they apply to the samples of ore supplied for the test work.

Kalgoorlie tap water was used in all of the preliminary tests conducted, since only a small quantity of Munglinup water was made available for the bulk tests on samples 1, 2, 3a and 3b.

The bulk tests were to be made on samples containing equal proportions of the samples 1, 2, 3a and 3b.

A general description of "Flake Graphite" and "Amorphous Graphite" was given in the report of Investigation No. 254.

The results obtained in the treatment of these samples have been grouped in the following manner: No. 1 and No. 2 samples have been treated individually since they represent two different locations. Nos. 3a, 3b, and 3c have been grouped because these samples were obtained from the same shaft, although in the laboratory investigation each sample was treated separately.

Series 1.

Tests on No. 1 Sample—(Stewart's Shaft.)

The No. 1 Sample when received weighed 56 lb. and was crushed through the jaw crusher to ¾ inch. The sample was then stage crushed through the rolls to pass the ⅛ inch mesh screen.

A small portion of this sample was ground with pestle and mortar and on examination on the super-panner, was found to contain no sulphide minerals.

The gangue materials appeared to be magnesite, felspar, some quartz, and small amounts of muscovite mica.

Preliminary Tests.

The work conducted in the previous investigation *vide* Investigation No. 254 whereby the necessary technique was developed for this type of graphitic ore was helpful for the preliminary work, since the following conditions had been determined:—

(a) the desired grinding or attrition required to liberate the graphite flake from the gangue material, without undue overgrinding of the flake to a pulverulent product.

(b) the best method by which an optimum recovery of the flake graphite product (+80 mesh and 90 per cent. carbon) could be obtained, as well as the recovery of a product of a high carbon content which would be suitable for the dry cell or battery manufacturing industry.

(c) the best reagents or combination of reagents for the flotation of the graphite so as to obtain an optimum recovery of the desired products.

In the selection of suitable flotation reagents for the flotation of graphite to the above standards, it has been recognised that the reagents recommended must be procurable under the present war time conditions.

(a) *Grinding.*

Subsequent to the exerience gained with the first series of graphite samples it was decided to carry out the grinding programme in the following manner:—

The material was crushed to ¾ inch through the jaw crusher, followed by stage grinding through the rolls to pass the ⅛ inch mesh screen.

The material subsequent to being reduced to ⅛ inch mesh was then ground in Abbe Pebble Mills for 15 minutes, at a pulp ratio of 40 per cent. solids and a 11½ lb. pebble load, and at a mill speed of 58 r.p.m.

Sizing Analysis.

A sizing analysis was made of a composite sample containing equal proportions of each of No. 1, No. 2, No. 3a, No. 3b and No. 3c samples, subsequent to grinding under the above conditions.

The sizing analysis was as follows.—

I.M.M. Screen.	Aperture Inches.	Per Cent.
Plus 80	1/160	15·6
Minus 80	....	84·4

The plus 80 mesh I.M.M. screen product appeared to be mostly graphite with a larger amount of flake graphite predominating. This product was not assayed for carbon content, and gangue inclusions were observed.

(b) Although a large amount of experience had been gained with the first series of samples, it was found that the No. 1 Sample of ore taken from the No. 1 or Stewart's shaft gave a great amount of trouble in the initial flotation treatment.

The flow-sheet selected for the investigation was similar to that developed and recommended in the previous investigation and a copy is appended to this report. The following tabulation shows the results obtained with each of the samples, when the laboratory testing was applied parallel with the provisional flow-sheet.

TABLE No. 1.

Graphite Samples.	Assay Value Carbon.
	%
Sample No. 1 (Stewart's Shaft)—	
Flake (+ 80 mesh I.M.M.):	
Test No. 1	99·0
Test No. 2	99·0
Test No. 3	99·7
Third Cleaner Concentrate (— 80 mesh I.M.M.):	
Test No. 1	80·0
Test No. 2	88·4
Test No. 3	95·1
Sample No. 2 (Halbert's South Shaft)—	
Flake (+ 80 mesh I.M.M.) Test No. 1	96·9
Third Cleaner Concentrate (— 80 mesh I.M.M.) Test No. 1	82·0
Sample No. 3a (Halbert's Middle Shaft)—	
Flake (+ 80 mesh I.M.M.) Test No. 1	94·8
Third Cleaner Concentrate (— 80 mesh I.M.M.) Test No. 1	58·2
Sample No. 3b (Halbert's Middle Shaft)—	
Flake (+ 80 mesh I.M.M.) Test No. 1	96·8
Third Cleaner Concentrate (— 80 mesh I.M.M.) Test No. 1	84·4
Sample No. 3c (Halbert's Middle Shaft)—	
Flake (+ 80 mesh I.M.M.) Test No. 1	96·0
Third Cleaner Concentrate (— 80 mesh I.M.M.) Test No. 1	88·1
Composite Samples (No. 1, No. 2, No. 3a, No. 3b)—	
Flake (+ 80 mesh I.M.M.)	99·4
Third Cleaner Concentrate (— 80 mesh I.M.M.)	96·0
Donnelly River—	
Flake (+ 80 mesh I.M.M.) Test No. 5	*Nil*
Third Cleaner Concentrate (— 80 mesh I.M.M.)	89·3

(c) The reason for the difficult flotation of the graphite in the No. 1 Sample of this series has not been determined, but it is suggested that the failure of this sample to respond to the established flotation conditions was due to some particular physical feature of the crystalline structure of the carbon in the graphite such as chunkiness instead of the usual flake formation rather than to an association with some other mineral which prevented the flotation of the graphite.

Subsequent to overcoming this difficulty, the flotation products from the No. 1 Sample were comparable in carbon content with the graphite recovered from the remaining samples.

Without recording in detail all of the preliminary test work carried out on the No. 1 Sample some reference is desirable to the reagents used with which no results were obtained.

No less than twelve series of tests were carried out, using the following flotation reagents and combinations of reagents:—

(a) Denver Equipment Frother No. 52, in small quantities.

(b) Denver Equipment Frother No. 52 and cresylic acid.

(c) Denver Equipment Frother No. 52, cresylic acid and kerosene.

(d) Amyl Xanthate, cresylic acid, and Denver Equipment Frother No. 52, with the pH controlled from 9.0 to 5.0 by using sulphuric acid.

(e) Grinding the ore with Amyl Xanthate followed by flotation with Denver Equipment Frother No. 52.

(f) Kerosene and pine oil.

(g) Eucalyptus "Burnside D," and Denver Equipment Frother No. 60.

(h) Denver Equipment Frother No. 60 in large amounts.

(i) Denver Equipment Frother No. 52 in large amounts.

(j) Eucalyptus "Burnside D" in large amounts.

(k) Mixtures of Denver Equipment Frother No. 60 and Eucalyptus "Burnside D" used in large amounts.

(l) Mixtures of Denver Equipment Frother No. 52 and Eucalyptus "Burnside D" used in large amounts.

Note.—Denver Equipment Frother No. 52 will subsequently be referred to as "D.E.F.52."

As a result of the preliminary testing, using the above reagents and combination of reagents, it was eventually established that for the successful flotation of the graphite contained in the No. 1 Sample, it was necessary to use large amounts of the reagents as shown by items (j), (k), (l) in the above series. Furthermore it was found that, provided sufficient reagents were used, good results were obtained when either D.E.F.52 or Denver Equipment Frother No. 60 or Eucalyptus "Burnside D" were used, either separately or in combination.

Subsequent to the preliminary testing, as outlined above, whereby the use of the correct type of flotation reagents was determined, tests were carried out to completion, to recover the several graphite products.

The results of three of these tests are tabulated for comparison.

Note.—The rougher flotation for Test No. 1 was carried out in the Denver Sub "A" 2,000 gram machine and all subsequent cleaning flotation was carried out in the Fagergren machine. Tests No. 2 and No. 3 were carried out in the Fagergren machine.

TABLE NO. 2.

Remarks.	No. 1 Test.	No. 2 Test.	No. 3 Test.
Grinding—			
Sample—grams	2,000	1,000	1,000
Size to Pebble Mill	Minus ⅛ in. Screen	Minus ⅛ in. Screen	Minus ⅛ in. Screen
Pulp Ratio for Grinding	40 per cent. solids in each test	40 per cent. solids in each test	40 per cent. solids in each test
Time of Grinding—minutes	15	15	15
Pebble load in lb. per 1,000 grams	11·5	11·5	11·5
Speed of Pebble Mill—R.P.M.	58	58	58
Kalgoorlie Tap Water used in all tests :			
p.H. of Tap Water	9·5	9·5	9·5
p.H. at completion of grinding	8·0	8·0	8·0
Flotation—			
Rougher Concentrate :			
p.H. of Pulp	8·8	8·5	8·5
Pulp Ratio for Flotation	1 part solid to 3½ parts water	1 part solid to 3½ parts water	1 part solid to 3½ parts water
Reagents added at Start	Eucalyptus "Burnside D"	Eucalyptus "Burnside D"	D.E.F. 52
	1·0 lbs. per ton	1·6 lbs. per ton	1·4 lbs. per ton
After 10 minutes added	...	0·2 lbs. per ton	...
After 20 minutes added	0·25 lbs. per ton	...	...
After 38 minutes added	0·25 lbs. per ton	...	...
Total Reagents used—			
Eucalyptus "Burnside D"	1·5 lbs. per ton	1·8 lbs. per ton	...
D.E.F. 52	...	...	1·4 lbs. per ton
Flotation completed after—minutes	48	12	8
Rougher Concentrate :			
Per cent. weight of Total Sample	45·75	48·2	47·5
Assay Value—Per cent. carbon	56·9	56·2	51·8
Rougher Tailing :			
Per cent. weight of Total Sample	54·25	51·8	52·5
Assay Value—Per cent. carbon	2·4	2·7	2·6
Grinding of Rougher Concentrate in the Rod Mill—			
Pulp Ratio for Grinding	1 part of solid to 3 parts water	1 part of solid to 3 parts water	1 part of solid to 3 parts water
Time of Grinding—minutes	5	5	5
Rod load lb.—½ in. rods	22·5	22·5	22·5
Speed of Rod Mill—R.P.M.	52	52	52
Flotation (after Rod Mill Grinding)—			
Pulp Ratio for Flotation	1 part of solid to 3 parts water	1 part of solid to 3 parts water	1 part of solid to 3 parts water
Reagents added at Start	Eucalyptus "Burnside D"	Eucalyptus "Burnside D"	D.E.F. 52
	0·21 lbs. per ton	...	...
After 5 minutes added	0·1 lbs. per ton	...	0·04 lbs. per ton
After 9 minutes added	0·1 lbs. per ton	...	...
After 10 minutes added	...	0·1 lbs. per ton	...
Total Reagents used—			
Eucalyptus "Burnside D"	0·41 lbs. per ton	0·1 lbs. per ton	...
D.E.F. 52	...	...	0·04 lbs. per ton
Flotation completed after—minutes	11	12	12

TABLE No. 2—*continued.*

Remarks.	No. 1 Test.	No. 2 Test.	No. 3 Test.
First Cleaner Concentrate :			
Per cent. weight of Total Sample	34·85	32·0	32·6
Assay Value—Per cent. oarbon	70·7	76·9	71·6
First Cleaner Tailing :			
Per cent. weight of Total Sample	10·9	16·2	14.9
Assay Value—Per cent. carbon	12·8	15·2	8.7
Flake Graphite from First Cleaner Concentrate :			
Per cent. weight of Total Sample	5·0	5·5	5·5
Assay Value—Per cent. carbon	99·0	99·0	99·7
Grinding of Minus 80 *mesh First Cleaner Concentrate in Rod Mill :*			
Time of Grinding—minutes	...	...	15
Conditions as with earlier Grinding.			
Flotation of Minus 80 *mesh First Cleaner Concentrate* (Test Nos. 1 and 2 without Grinding, Test No. 3 after Grinding)—	Eucalyptus " Burnside D "	Eucalyptus " Burnside D "	D.E.F. 52
Reagents added at Start	...	...	0·08 lbs. per ton
After 3 minutes added	0·08 lbs. per ton	...	...
After 5 minutes added	0·05 lbs. per ton	...	...
After 6 minutes added	...	0·08 lbs. per ton	...
After 7 minutes added	0·1 lbs. per ton	...	...
Total Reagents used :			
Eucalyptus " Burnside D "	0·23 lbs. per ton	0·08 lbs. per ton	...
D.E.F. 52	...	...	0·08 lbs. per ton
Flotation completed after—minutes	12	10	5
Second Cleaner Concentrate :			
Per cent. weight of Total Sample	25·85	19·5	18·6
Assay Value—Per cent. carbon	72·4	85·2	88·6
Second Cleaner Tailing :			
Per cent. weight of Total Sample	4·0	7·0	8·5
Assay Value—Per cent. carbon	24·4	36·6	16·3
	Eucalyptus " Burnside D "		D.E.F. 52
Flotation of Second Cleaner Concentrate :			
Reagents added at Start	...	...	0·04 lbs. per ton
After 7 minutes	0·08 lbs. per ton	...	...
Total Reagent used—			
Eucalyptus " Burnside D "	0·08 lbs. per ton	...	...
D.E.F. 52	...	...	0·04 lbs. per ton
Flotation completed after—minutes	15	5	3
Third Cleaner Concentrate :			
Per cent. weight of Total Sample	21·85	18·3	17·0
Assay Value—Per cent. carbon	80·0	88·4	95·1
Third Cleaner Tailing :			
Per cent. weight of Total Sample	4·0	1·2	1·6
Assay Value—Per cent. carbon	31·1	36·6	19·5
Head Assay Value of Sample	27·1	27·1	27·1
Calculated Assay Value from above products	27·4	28·5	26·0
Total Reagent Consumption for Complete Test—			
Eucalyptus " Burnside D "	2·22 lbs. per ton	1·98 lbs. per ton	...
D.E.F. 52	...	...	1·56 lbs. per ton

Summary.—The results shown in Table No. 2 indicate that a satisfactory extraction of graphite can be obtained by flotation treatment, only as a result of using a large amount of flotation reagent.

Earlier experiences with graphitic ore from this region indicated that during the flotation treatment good results could be obtained when using approximately 0·4 lb. of the D.E.F. 52 per ton of ore, whereas the sample of ore taken from the Stewart's Shaft required 1·56 lbs. per ton of ore of the Frother No. 52 reagent, as indicated in Test 3 in the above table.

It is interesting to note that the quantity of " Flake " graphite extracted amounted to from 5·0 to 5·5 per cent. of the total weight of sample, and the assay value, per cent. carbon, varied from 99·0 to 99·7. The extraction of " amorphous " graphite amounted to from 17·0 to 21·85 per cent. of the whole sample and the assay value varied from 95·1 to 80·0 per cent. carbon.

The results obtained in Test No. 3 (*Vide* Table No. 2) indicate that a better grade of " amorphous " graphite is obtained as a result of grinding the minus 80 portion of the First Cleaner Concentrate, that is, subsequent to removing the " Flake " graphite portion by screening. As a result of this step in the process 17·0 per cent. of the whole sample was recovered as " amorphous " graphite which assayed 95·1 per cent. carbon. The small difference in the calculated head values for the three tests is probably due to the unequal distribution of large flakes of graphite in the minus $\frac{1}{8}$ in. mesh screen product taken for each of the tests.

The over-all extraction of graphite is indicated, by these tests, to be from 5·0 to 5·5 per cent. of the whole sample as " Flake " graphite and from 17·0 to 21·85 per cent. of the whole sample as " amorphous " graphite.

Actually, the Rougher Tailing, which represents from 51·8 to 54·25 per cent. of the whole sample containing from 2·4 to 2·7 per cent. carbon, is discarded direct, whilst in practice the first, second, and third cleaner tailings would be in closed-circuit during plant operations so that better extraction of graphite than the above figures indicate could be anticipated.

The flotation reagent consumption in all probability would be lower in plant practice because of the accumulation of reagents circulating in mill solutions.

MUNGLINUP RIVER GRAPHITE DEPOSITS

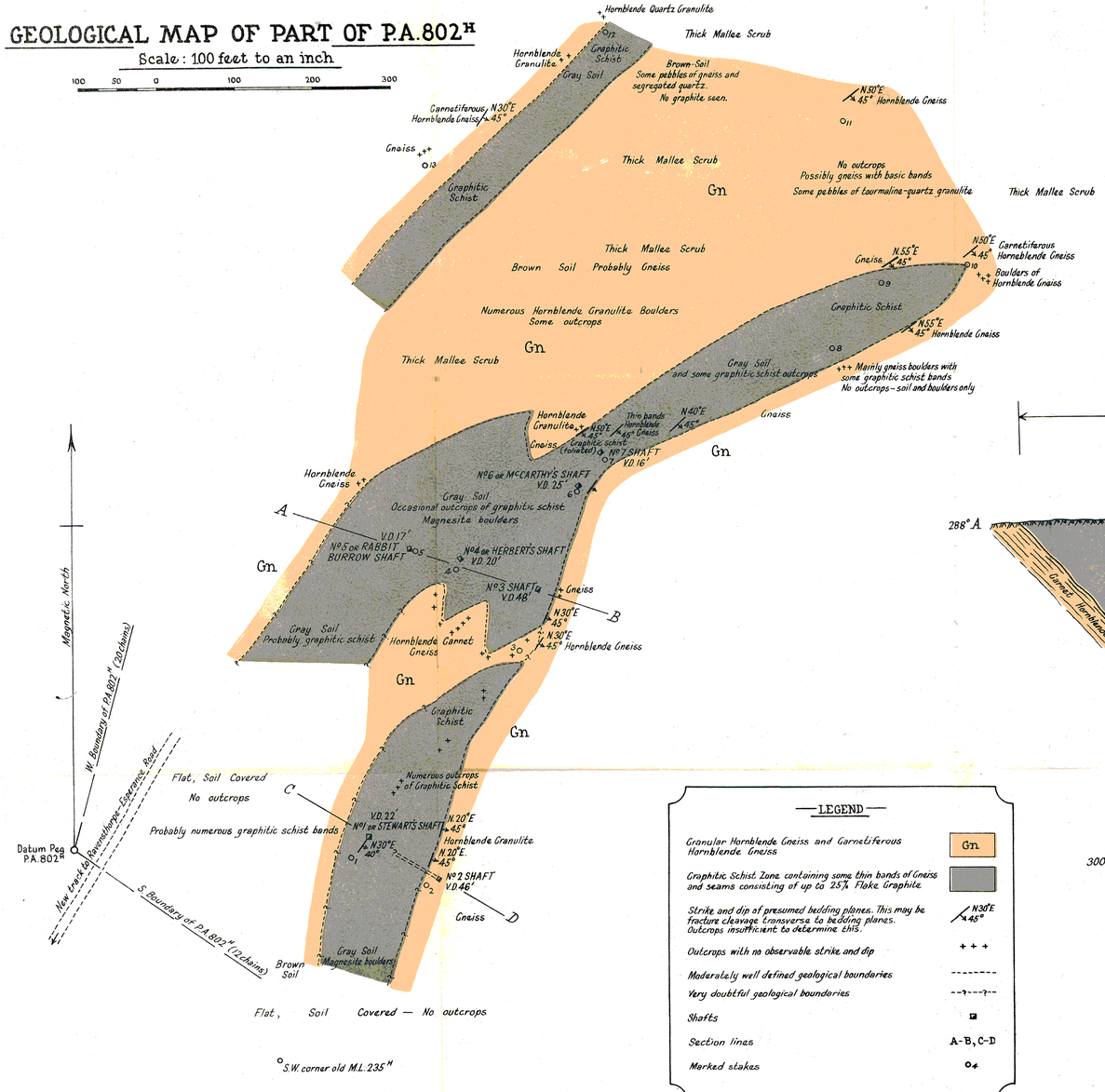
WESTERN AUSTRALIA

Lat. 33° 40'S } Approx
Long. 120° 51'E }

GEOLOGICAL MAP OF PART OF P.A.802H

Scale: 100 feet to an inch

100 50 0 100 200 300



LEGEND

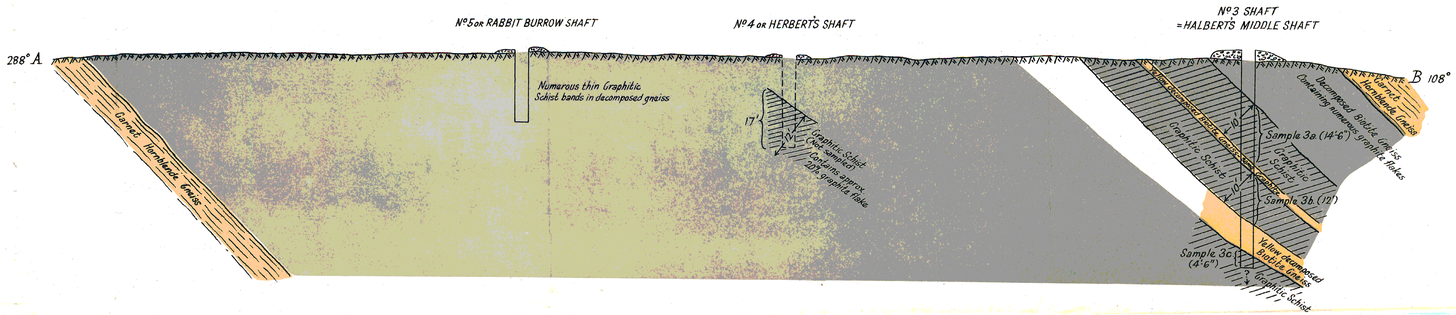
Granular Hornblende Gneiss and Garnetiferous Hornblende Gneiss	Gn
Graphitic Schist Zone containing some thin bands of Gneiss and seams consisting of up to 25% Flake Graphite	
Strike and dip of presumed bedding planes. This may be fracture cleavage transverse to bedding planes. Outcrops insufficient to determine this.	N30°E 45°
Outcrops with no observable strike and dip	+ + +
Moderately well defined geological boundaries	--------
Very doubtful geological boundaries	--?---?--
Shafts	◘
Section lines	A-B, C-D
Marked stakes	O4

CROSS SECTIONS SHOWING THICKNESS OF SEAMS AND SAMPLE LOCALITIES

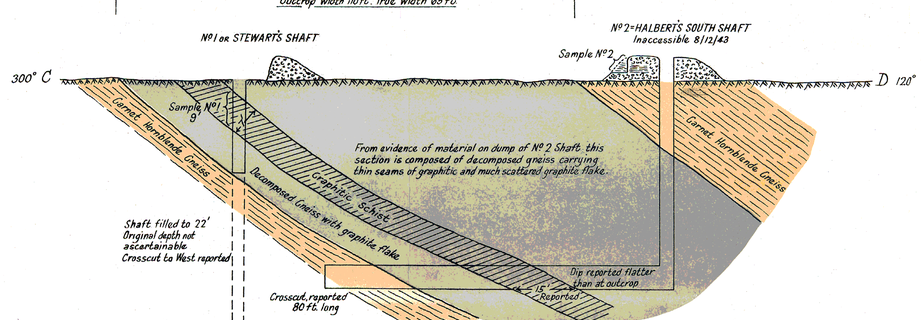
Natural Scale: 20 feet to an inch

20 10 0 20 40 60

GRAPHITIC SCHIST ZONE
Characterised by gray soil, occasional outcrops of graphitic schist, small magnesite boulders, some thin bands of Hornblende gneiss, floaters of graphitic schist and segregated quartz pebbles.
Outcrop width 300ft. True width 210ft.



GRAPHITIC SCHIST ZONE
Outcrop width 110ft. True width 65ft.



Geology, Compass and Chain Traverse by H.A. Ellis, G.S.W.A. Dec. 8th 1943

Series No. 2.

Tests on No. 2 Sample—(Halbert's South Shaft).

The No. 2 Sample weighed 65 lb. when received and was crushed through the dry crushing unit to minus ⅛ inch screen product before reducing to working samples.

Preliminary flotation tests indicated that this sample was similar to the first series of samples (Report No. 254) and that it presented no difficulty in the treatment process.

The tests on this sample were carried out on similar lines to those on the No. 1 Sample, the mode of treatment being identical to that shown in Test No. 3 on Sample No. 1 in Table No. 2.

The outstanding difference between the results obtained with the treatment of the No. 2 Sample and the No. 1 Sample was the difference in consumption of the flotation reagent, Denver Equipment Frother No. 52, the amount required being very much less in the treatment of the No. 2 Sample.

The results obtained during a test on the No. 2 Sample are shown in Table No. 3.

The treatment conditions throughout the test, regarding grinding, flotation, recovery of flake graphite, etc., were identical with the conditions shown in Table No. 2, Test No. 3 and therefore the tabulation of these conditions has not been repeated in Table No. 3.

TABLE No. 3.

Remarks.	Test No. 1.
Grinding—	
Sample—grams	1,500
Size to Pebble Mill	Minus ¼ in. Screen
Flotation—	
Rougher Concentrate :	
p.H. of Pulp	8·5
Pulp Ratio for Flotation	1 part solid to 3½ parts water
Reagents added at Start	D.E.F. 52 0·2 lbs. per ton
Total Reagent used—	
D.E.F. 52	0·2 lbs. per ton
Flotation completed after—minutes	3
Rougher Concentrate—	
Per cent. weight of Total Sample	42·0
Assay Value—Per cent. carbon	38·8
Rougher Tailing—	
Per cent. weight of Total Sample	58·0
Assay Value—Per cent. carbon	0·84
Grinding of Rougher Concentrate in the Rod Mill—	
Time of Grinding—minutes	5
Flotation after Rod Mill Grinding—	
Pulp Ratio for Flotation	1 part solid to 3 parts water
Reagent added at Start	D.E.F. 52 0·035 lbs. per ton
Total Reagent used :	
D.E.F. 52	0·035 lbs. per ton
Flotation completed after—minutes	4
First Cleaner Concentrate—	
Per cent. weight of Total Sample	31·0
Assay Value—Per cent. carbon	51·9
First Cleaner Tailing—	
Per cent. weight of Total Sample	11·0
Assay Value—Per cent. carbon	2·0
Flake Graphite from First Cleaner Concentrate—	
Per cent. weight of Total Sample	4·7
Assay Value—Per cent. carbon	96·9
Grinding of Minus 80 mesh First Cleaner Concentrate in Rod Mill—	
Time of Grinding—minutes	15
Flotation of Minus 80 mesh First Cleaner Concentrate—	
Reagents added at Start	D.E.F. 52 0·035 lbs. per ton
Total Reagent used—	
D.E.F. 52	0·035 lbs. per ton
Flotation completed after—minutes	10
Second Cleaner Concentrate—	
Per cent. weight of Total Sample	15·8
Assay Value—Per cent. carbon	60·0
Second Cleaner Tailing—	
Per cent. weight of Total Sample	10·5
Assay Value—Per cent. carbon	19·5

TABLE No. 3—*continued.*

Remarks.	Test No. 1.
Flotation of Second Cleaner Concentrate—	
Reagents added at Start	...
Flotation completed after—minutes	3
Third Cleaner Concentrate—	
Per cent. weight of Total Sample	9·4
Assay Value—Per cent. carbon	82·0
Third Cleaner Tailing—	
Per cent. weight of Total Sample	6·4
Assay Value—Per cent. carbon	28·3
Head Assay Value of Sample	15·25
Calculated Assay Value from above products	16·8
Total Reagent Consumption for Complete Test	D.E.F. 52 0·27 lbs. per ton

The test work carried out on the No. 2 Sample indicated that no abnormal conditions prevailed during the treatment. The amount of flotation reagent required for the recovery of the flake and amorphous graphites compared favourably with the amounts used during the previous investigations, that is 0·27 lb. per ton.

No difficulty was experienced with the flotation of the flake graphite and the rougher tailing at 0·84 per cent. carbon indicates a recovery of 97·1 per cent. of the graphite in the rougher flotation treatment.

Series No. 3.

Tests on Samples Nos. 3a, 3b, 3c.

These three samples were taken from Halbert's Middle Shaft, consequently the results of a typical test on each of these three samples have been grouped for the tabulation shown below.

The weights of these three samples were:—

No. 3a .. .. 52 lb.
No. 3b .. .. 50 lb.
No. 3c .. .. 10 lb.

Each sample was crushed through the dry crushing unit to a minus ⅛ inch screen product, before reducing through the Jones Riffle to a working sample.

The preliminary flotation tests on each sample indicated that no difficulties should be experienced with the treatment process.

The tests on these samples were carried out similarly to those on the No. 2 Sample, the mode of treatment being similar to the treatment indicated in Table No. 3.

The treatment conditions throughout the tests regarding grinding, flotation, recovery of flake graphite, etc., were identical with the conditions as shown in Table No. 2, Test No. 3 and therefore the tabulation of these conditions has not been repeated in Table No. 4.

The results obtained during a complete test on each one of the above samples Nos. 3a, 3b, 3c, are shown in Table No. 4.

TABLE No. 4.

Remarks.	Sample No. 3a.	Sample No. 3b.	Sample No. 3c.
Grinding—			
Sample—grams	2,000	1,000	1,000
Size to Pebble Mill	Minus	⅛ inch	screen
Flotation—			
Rougher Concentrate :			
p.H. of Pulp	8·5	8·5	8·5
Pulp ratio for flotation	1 part of Solids to 3½ parts water D.E.F. 52	1 part of Solids to 3½ parts water D.E.F. 52	1 part of Solids to 3½ parts water D.E.F. 52
Reagents added at Start	0·2 lbs. per ton	0·2 lbs. per ton	0·24 lbs. per ton
After 6 minutes	0·1 lbs. per ton	...	...
Total Reagent used—			
D.E.F. 52	0·3 lbs. per ton	0·2 lbs. per ton	0·24 lbs. per ton
Flotation completed after—minutes	10	3	4
Rougher Concentrate—			
Per cent. weight of Total Sample	59·75	54·5	44·1
Assay value—Per cent. carbon	29·2	43·3	35·2
Rougher Tailing—			
Per cent. weight of Total Sample	40·25	45·5	55·9
Assay Value—Per cent. carbon	1·4	0·7	0·6

TABLE No. 4—*continued.*

Remarks.	Sample No. 3a.	Sample No. 3b.	Sample No. 3c.
Grinding of Rougher Concentrate in the Rod Mill—			
Time of Grinding—minutes	5	5	5
Flotation after Rod Mill Grinding Pulp Ratio for Flotation—			
Pulp Ratio for Flotation	1 part Solid to 3 parts water	1 part Solid to 3 parts water	1 part Solid to 3 parts water
	D.E.F. 52	...	D.E.F. 52
Reagent added at Start	0·1 lbs. per ton	...	...
After 3 minutes	...	...	0·04 lbs. per ton
Total Reagent used—			
D.E.F. 52	0·1 lbs. per ton	...	0·04 lbs. per ton
Flotation completed after—minutes	10	3	5
First Cleaner Concentrate—			
Per cent. weight of Total Sample	41	40	24·4
Assay Value—Per cent. carbon	40·4	58·4	61·3
First Cleaner Tailing—			
Per cent. weight of Total Sample	18·75	14·5	19·7
Assay Value—Per cent. carbon	4·9	1·45	3·0
Flake Graphite from First Cleaner Concentrate—			
Per cent. weight of Total Sample	2·8	4·6	3·0
Assay Value—Per cent. carbon	94·8	96·8	96·0
Grinding of Minus 80 mesh First Cleaner Concentrate in Rod Mill—			
Time of Grinding—minutes	15	15	15
Flotation of Minus 80 mesh First Cleaner Concentrate—			
	D.E.F. 52	D.E.F. 52	D.E.F 52
Reagents added at Start	0·04 lbs. per ton	0·035 lbs. per ton	0·08 lbs. per ton
After 3 minutes	0·04 lbs. per ton	...	...
Total Reagent used—			
D.E.F. 52	0·08 lbs. per ton	0·035 lbs. per ton	0·08 lbs. per ton
Flotation completed after—minutes	5	5	4
Second Cleaner Concentrate—			
Per cent. weight of Total Sample	25·7	25·0	15·0
Assay Value—Per cent. carbon	51·2	74·2	79·5
Second Cleaner Tailing—			
Per cent. weight of Total Sample	12·5	10·4	6·14
Assay Value—Per cent. carbon	5·9	3·5	2·3
Flotation of Second Cleaner Concentrate—			
		D.E.F. 52	
Reagents added at Start	...	0·035 lbs. per ton	...
Flotation completed after—minutes	5	5	3
Third Cleaner Concentrate—			
Per cent. weight of Total Sample	22	21·5	12·6
Assay Value—Per cent. carbon	58·2	84·4	88·1
Third Cleaner Tailing—			
Per cent. weight of Total Sample	3·7	3·5	2·4
Assay Value—Per cent. carbon	9·7	11·6	34·4
Head Assay Value of Sample—Per cent. carbon ...	17·7	23·1	16·0
Calculated Assay Value from above products—Per cent. carbon	18·0	23·9	15·9
Total Reagent Consumption for Complete Test—			
D.E.F. 52	0·48 lbs. per ton	0·27 lbs. per ton	0·36 lbs. per ton

The tests carried out on the three samples taken from Halbert's Middle Shaft show that fairly satisfactory results can be obtained when the samples are similarly treated, although the head value of each sample varied in carbon content. The amount of flake graphite varied from 2·8 per cent. to 4·6 per cent. in the samples, although the grade held at approximately 96·0 per cent. throughout.

It is interesting to note that although No. 3b sample contained the greatest quantity of "flake graphite," that is, 4·6 per cent., the least amount of flotation reagent was required for the recovery of both the "flake" and amorphous types of graphite from this sample. It will be noted that the grade of the graphite products from the No. 3a sample is lower in carbon content than those from samples Nos. 3b and 3c. The No. 3a sample was much more refractory and for this reason should, if treated alone, be given a longer period of grinding to liberate the associated gangue material.

Further to the above investigation it was requested that tests be carried out on a composite sample selected from the samples forwarded, the flotation tests being made when using Munglinup water.

Series No. 4.

Tests on Composite Sample of Nos. 1, 2, 3a *and* 3b.

As requested, the composite sample was made up of equal portions of No. 1, No. 2, No. 3a and No. 3b samples, the portions being well mixed subsequent to stage grinding through 1/8th inch mess screen.

Approximately two gallons of Munglinup River water were received in bottles, the contents of which, prior to being used, were well mixed in an enamel bucket. When emptying the water from the bottles a very strong smell of sulphuretted hydrogen was given off from the water. The water contained an appreciable amount of organic matter in suspension. The pH value was 8.

Tests were carried out almost in parallel to the previous work, the mode of treatment being similar to the treatment as indicated in Table No. 3. The main exceptions with these tests, compared with the previous work, were that Munglinup water was used for flotation and slightly increased grinding time in the rod mill was allowed during the grinding of the rougher concentrate.

The treatment conditions throughout the tests regarding initial grinding, flotation, recovery of flake graphite, etc., were identical with the conditions as shown in Table No. 2, Test No. 3, and therefore the tabulation of these conditions has not been repeated in Table No. 5.

The results obtained during a complete test on a composite sample containing 25 per cent. by weight of each of the samples Nos. 1, 2, 3a and 3b are shown in Table No. 5.

Summary.

The extraction of ''flake'' graphite from the composite sample amounted to 4.2 per cent. by weight of the original sample, the assay value of this product being 99.4 per cent. carbon. The extraction of ''Amorphous'' graphite amounted to 14.4 per cent. of the weight of the composite sample and the assay value of this product was 96.0 per cent. carbon.

The graphite recovery as indicated in the rougher flotation treatment amounted to 91.8 per cent. of the total carbon content; an examination of the tailing product revealed several ''chunks'' rather than ''flakes'' of graphite. The presence of these chunky pieces of graphite may be accounted for by the presence of the 25 per cent. portion of the No. 1 Sample which gave so much trouble in the early stages of the investigation (*vide* Series 1, Sample No. 1).

The test work on No. 1 Sample showed that satisfactory results could be obtained when using large amounts of flotation reagent, e.g., 1.56 lb/ton of D.E.F.52.

In the above test the total consumption of Frother No. 52 amounted to 0.56 lb/ton, so that an increase in the consumption of the reagent may possibly have improved the recovery.

The grades of the products are very satisfactory and it is evident that the Munglinup water can be credited with the improvement in flotation. During the test work, the Munglinup water was used throughout the processes and the pH value at 8.0 remained unchanged.

A slight alteration was made with the rod mill grinding time, it being increased from 5 minutes to 6 minutes, that is, 20 per cent. increase. The reason for increasing the grinding of the rougher concentrate was to improve the grade of the ''flake'' graphite product, a 99.4 per cent. carbon product being obtained. The tests on the individual samples No. 1, No. 2, No. 3a and No. 3b gave variable assay values for the ''flake'' graphite product varying from 94.8 to 99.7 per cent. carbon (vide Table No. 1).

It will be noted that the calculated head value from the assay values of the products shown in Table No. 5, is 21.7 per cent. carbon, whilst the head value calculated from the values of the portions taken to make up the composite sample, is 21.2 per cent. carbon. The actual assay value of the composite sample was found to be 22.2 per cent. carbon, this variation of carbon content in the composite sample may be due to the segregation of portion of the chunky graphite associated with the No. 1 sample.

A sizing analysis of the rougher flotation tailing showed that 86 per cent. of the product would pass through the 200 mesh I.M.M. screen.

Series 5.

Tests on Donnelly River Graphite Sample.

The Donnelly River sample weighed 20 lb. when received, and was said to have been taken from a seam five feet thick.

In appearance this graphitic ore was very different from the samples of the Munglinup ore which were received at the same time. The Donnelly River sample was very close grained, and no flake graphite could be distinguished with the hand lens; the graphite appeared to be bonded by an argillaceous matrix. When agitated in water the sample disintegrated rapidly to a slime.

The sample was crushed through the dry crushing unit to minus ⅛ inch screen, prior to reducing through the Jones Riffle to a working sample.

Preliminary flotation tests indicated that the graphite in this sample responded readily to the Denver Equipment Frother No. 52 flotation reagent; consequently this reagent was used in all of the tests. Furthermore, the preliminary tests indicated the total absence of the ''flake'' variety of graphite, as a result of which the value of this graphitic ore cannot be compared with that from the Munglinup deposit.

Subsequent to the preliminary testing whereby the use of a suitable flotation reagent was established, several tests were carried out to completion, to obtain correct conditions for the treatment of this ore.

The results of five of these tests are tabulated for comparison in Table No. 6.

TABLE 5.

Remarks.	Sample.
Grinding—	
Sample—grams	1,000
Size to Pebble Mill	Minus $\frac{1}{8}$ inch Screen
Flotation—	
Rougher Concentrate :	
p.H. of Pulp	8·0
Pulp ratio for Flotation	1 part solid to 3 parts water
	D.E.F. 52
Reagents added at Start	0·4 lbs. per ton
Total Reagent used—	
D.E.F. 52	0·4 lbs. per ton
Flotation completed after—minutes	8
Rougher Concentrate—	
Per cent. weight of Total Sample	41·1
Assay Value—Per cent. carbon	48·6
Rougher Tailing—	
Per cent. weight of Total Sample	58·9
Assay Value—Per cent. carbon	3·0
Grinding of Rougher Concentrate in the Rod Mill—	
Time of Grinding—minutes	6 (an increase of one minute compared with previous test.)
Flotation after Rod Mill Grinding—	
Pulp ratio for flotation	1 part solid to 3 parts water
	D.E.F. 52
Reagent added at Start	...
After 6 minutes	0·08 lbs. per ton
Total Reagent used—	
D.E.F. 52	0·08 lbs. per ton
Flotation completed after—minutes	12
First Cleaner Concentrate—	
Per cent. weight of Total Sample	27·1
Assay Value—Per cent. carbon	71·3
First Cleaner Tailing—	
Per cent. weight of Total Sample	14·0
Assay Value—Per cent. carbon	4·6
Flake Graphite from First Cleaner Concentrate—	
Per cent. weight of Total Sample	4·2
Assay Value—Per cent. carbon	99·4
Grinding of Minus 80 *mesh First Cleaner Concentrate in Rod Mill—*	
Time of Grinding—minutes	15
Flotation of Minus 80 *mesh First Cleaner Concentrate—*	D.E.F. 52
Reagents added at Start	0·08 lbs. per ton
Total Reagent used—	
D.E.F. 52	0·08 lbs. per ton
Flotation completed after—minutes	5
Second Cleaner Concentrate—	
Per cent. weight of Total Sample	16·4
Assay Value—Per cent. carbon	88·0
Second Cleaner Tailing—	
Per cent. weight of Total Sample	6·5
Assay Value—Per cent. carbon	11·3
Flotation of Second Cleaner Concentrate—	
Reagents added at Start	...
Flotation completed after—minutes	4
Third Cleaner Concentrate—	
Per cent. weight of Total Sample	14·4
Assay Value—Per cent. carbon	96·0
Third Cleaner Tailing—	
Per cent. weight of Total Sample	2·0
Assay Value—Per cent. carbon	29·9
Calculated Head Value from the Assay Values of the above products	21·7
Calculated Assay Value obtained from the proportion of Samples taken for the composite sample	21·2
Total Reagent consumption for complete Test—	
D.E.F. 52	0·56 lbs. per ton

TABLE NO. 6.

Remarks.	Test No. 1.	Test No. 2.	Test No. 3.	Test No. 4.	Test No. 5.
Grinding—					
Sample—grams	500	1,000	800	500	500
Size to Pebble Mill	Minus ½ in. Screen	Minus ¼ in. Screen	Minus ½ in. Screen	Minus ½ in. Screen	Minus ½ in. Screen
Pulp Ratio for Grinding	In this test the sample was not ground, but agitated in the Fagargren Machine for 2 minutes prior to flotation	40 per cent Sclids	40 per cent Solids	In this test the minus ½ in. mesh was not ground, but agitated in the Fagergren Machine for 10 minutes prior to flotation	The initial benefication was carried out as in Test No. 4
Time of Grinding—minutes		45	60		
Pebble load in lb. per 1,000 gram		11·5	11·5		
Speed of Pebble Mill—R.P.M.		58	58		
Kalgoorlie Tap Water used in all Tests		....	....		
p.H. of Tap Water		9·5	9·5		
p.H. at completion of Grinding		8·0 to 8·5	8·0 to 8·5		
Flotation—					
Rougher Concentrate :					
p.H. of Pulp	8·0	8·0	8·0	8·0	8·0
Pulp Ratio for Flotation	1 part solids to 3½ parts of water	1 part solids to 3½ parts water	1 part solids to 3½ parts water	1 part solids to 3½ parts water	1 part solids to 3½ parts water
	D.E.F. 52	D.E.F. 52	D.E.F. 52	D.E.F. 52	D.E.F. 52
Reagents added at Start	0·16 lbs. per ton	0·24 lbs. per ton	0·2 lbs. per ton	0·16 lbs. per ton	0·16 lbs. per ton
Total Reagents used—					
D.E.F. 52	0·16 lbs. per ton	0·24 lbs. per ton	0·2 lbs. per ton	0·16 lbs. per ton	0·16 lbs. per ton
Flotation completed after—minutes	6	6	8	5	5
Rougher Concentrate :					
Per cent. weight of Total Sample	49·4	51·5	66·2	50·8	51·2
Assay Value—Per cent. carbon	50·3	49·4	39·9	48·0	51·1
Rougher Tailing—					
Per cent. weight of Total Sample	50·6	48·5	33·8	49·2	48·8
Assay Value—Per cent. carbon	7·3	6·4	5·2	5·2	4·6
Grinding of Rougher Concentrate in the Rod Mill—					
Pulp Ratio for Grinding	....	....	1 part solid to 3 parts water	....	1 part solid to 3 parts water
Time of Grinding—minutes	....	....	30	....	30
Rod load lb.—½ in. rods	....	....	22·5	....	22·5
Speed of Rod Mill—R.P.M.	....	....	52	....	52
Flotation—After Rod Mill Grinding—					
Pulp Ratio for Flotation	1 part solid to 3 parts water	1 part solid to 3 parts water	1 part solid to 3 parts water	1 part solid to 3 parts water	1 part solid to 3 parts water
	D.E.F. 52		D.E.F. 52	D.E.F. 52	D.E.F. 52
Reagents added at Start	....	....	....	....	0·08 lbs. per ton
After 3 minutes added	0·08 lbs. per ton	....	....	....	....
After 5 minutes added	....	....	....	0·08 lbs. per ton	0·08 lbs. per ton
After 7 minutes added	....	....	0·05 lbs. per ton	....	....
Total Reagent used—					
D.E.F. 52	0·08 lbs. per ton	....	0·05 lbs. per ton	0·08 lbs. per ton	0·16 lbs. per ton
Flotation completed after—minutes	5	6	10	8	8
First Cleaner Concentrate—					
Per cent. weight of Total Sample	36·4	34·5	42·5	34·6	30·2
Assay Value—Per cent. carbon	57·1	63·2	57·9	62·7	69·6
First Cleaner Tailing—					
Per cent. weight of Total Sample	13·0	17·0	23·7	16·2	21·0
Assay Value—Per cent. carbon	31·3	21·35	7·6	16·8	24·4
Flake Graphite from First Cleaner Concentrate	*Nil*	*Nil*	*Nil*	*Nil*	*Nil*
Grinding of Minus 80 mesh First Cleaner Concentrate in Rod Mill—					
Time of Grinding—minutes	5	....	....	30	15
Conditions as with earlier Grinding.					
Flotation of Minus 80 mesh First Cleaner Concentrate (Nos. 1, 4, and 5 after grinding, Nos. 2 and 3 without grinding)—					
Reagents added at Start	D.E.F. 52	D.E.F. 52	D.E.F. 52	D.E.F. 52	D.E.F. 52
After 5 minutes added	0·08 lbs. per ton	....	....	0·08 lbs. per ton	0·08 lbs. per ton
Total Reagent used—	....	0·08 lbs. per ton	0·1 lbs. per ton	....	....
D.E.F. 52	0·08 lbs. per ton	0·08 lbs. per ton	0·1 lbs. per ton	0·08 lbs. per ton	0·08 lbs. per ton
Flotation completed after—minutes	7	7	7	7	7
Second Cleaner Concentrate—					
Per cent. weight of Total Sample	27	28	31·2	21	21·8
Assay Value—Per cent. carbon	71·7	72·7	73·1	79·1	84·1
Second Cleaner Tailing—					
Per cent. weight of Total Sample	9·4	6·5	11·3	13·6	8·4
Assay Value—Per cent. carbon	15·2	22·0	15·5	29·9	32·1
Flotation of Second Cleaner Concentrate—					Second Cleaner Concentrate ground in Rod Mill for 15 minutes prior to flotation.
Reagents added at Start	....	....	....	D.E.F. 52	D.E.F. 52
After 5 minutes added	....	....	....	....	0·08 lbs. per ton
Flotation completed after—minutes	....	6	5	0·08 lbs. per ton	....
				8	7
Third Cleaner Concentrate—					
Per cent. weight of Total Sample	....	22·5	25·0	19·0	18·0
Assay Value—Per cent. carbon	....	77·8	80·0	87·5	89·3
Third Cleaner Tailing—					
Per cent. weight of Total Sample	....	5·5	6·2	2·1	3·8
Assay Value—Per cent. carbon	....	52·1	45·7	50·0	59·5
Head Assay Value of Sample	28·0	28·0	28·0	28·0	28·0
Calculated Assay Value from above products	28·0	28·5	28·1	26·8	28·4
Total Reagent Consumption for Complete Test—					
D.E.F. 52	0·32 lbs. per ton	0·32 lbs. per ton	0·35 lbs. per ton	0·40 lbs. per ton	0·48 lbs per ton

Sizing Analysis.—Sizing analyses were made on the products from three of the above tests, the results of which are shown in Table No. 7.

TABLE NO. 7.

Test No.	Product.	I.M.M. Screen.	Aperture Inches.	Per Cent.
3	Rougher Tailing	Minus 200	...	97·0
	Third Cleaner Concentrate	Minus 200	...	97·0
4	Rougher Tailing	Minus 200	...	76·0
	Third Cleaner Concentrate	Minus 200	...	91·2
5	Rougher Tailing	Minus 200	...	76·0
	Third Cleaner Concentrate	Minus 200	...	92·0

Summary.

The results of the tests carried out on the Donnelly River sample show that no "flake" graphite can be recovered from this ore.

The optimum carbon content of the "amorphous" graphite recovered during Test No. 5 was 89·3 per cent. carbon, the amount recovered being 18·0 per cent. by weight of the original sample.

The tests show that the final grade of graphite recoverable is not entirely dependent upon the feature of grinding, so much as on the application of the process of grinding, this phenomenon being clearly demonstrated by a comparison of the two tests, Nos. 3 and 5.

After initial grinding of the ore prior to flotation, final concentrate has a low carbon content, and is not a marketable product, whereas disintegration of the ore by agitation with water, prior to the primary flotation and subsequent grinding between the flotation treatments produces a higher carbon content product.

It is suggested that the initial grinding treatment of the ore may cause an adherence of the fine particles of graphite to particles of gangue slime causing it to float with the graphite. The preliminary agitation treatment on the minus ⅛ inch rolls product produces sufficient disintegration of the ore without the sliming effect of the fine graphite particles on to the gangue. Subsequent to the agitation treatment, the rougher concentrates show a better graphite recovery than when produced subsequent to grinding. The grinding of the rougher concentrate (*vide* Test No. 5) releases further amounts of gangue material associated with the graphite, this gangue material not being "activated" as with the ore during the initial grinding process.

The flotation reagent consumption was approximately the same at 0·32 lb. per ton of ore treated, for the first three tests; with increased grinding and handling during the test work the consumption of reagents shows an increase (*vide* Tests No. 4 and No. 5). In actual plant practice where mill solutions are in closed circuit the consumption of reagent should not be higher than the amounts shown for the first three tests.

Table No. 7 shows the sizing analyses of the final flotation concentrate recovered from tests Nos. 3, 4 and 5. Although the samples were submitted to different grinding processes, the quantities of minus 200 mesh materials are approximately the same, but the carbon content varies considerably.

The assay value of the head sample was 28·0 per cent. carbon. The calculated assay value resulting from the tests is approximately the same, with the exception of the result shown by Test No. 4, in which the difference between the two values amounts to 1·2 per cent. carbon. As shown in the report on the Munglinup ore, this difference may be due to segregation of graphite, when obtaining the sample of ⅛ inch mesh product for the test.

The investigation on the Donnelly River sample of ore, was carried out using Kalgoorlie tap water the pH of which is usually 9·5. Further tests should be carried out using the available local water, if the working of this ore body is contemplated. Tests were carried out using an acid circuit, pH5 to 6, the results obtained being unsatisfactory when using the Denver Equipment Frother No. 52 with the acid circuit.

R. W. WILSON,
Assistant Research Metallurgist.

A. S. McDONALD,
Senior Research Metallurgist.

B. H. MOORE,
Officer in Charge.

REPORT ON THE YOUNG RIVER VERMICULITE DEPOSITS.

Young River, Eucla Division, W.A.

Approx. Lat. 33°-32′ S.
Approx. Long. 121°-00′ E.

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

It is now possible to supply information concerning the quality of the vermiculite obtainable from these deposits, additional to that contained in the report contributed by the writer to the Annual Report of the Geological Survey for 1943.

The investigations reported below were carried out by the Mineral Section, Government Chem. Lab., Perth, on material collected by the writer in June of 1940. Production on a scale sufficient to meet the current small demand has continued since the deposits were last seen by the writer (December, 1943).

It may be here pointed out that the material on which these tests were carried out came from various deposits at depths varying from 2 feet below the surface to 18 feet.

The exfoliation tests show that it is possible to obtain material of varying screen sizes which in general exhibit a strong tendency to weigh less in pounds per cubic foot as the screen size increases.

Report on the Analysis of, and of Commercial Tests on Vermiculite from Young River.

(By J. N. A. Grace, A.W.A.S.M., A.A.C.I.)

Two samples were selected for chemical analysis, one from 1 foot below water level and the other from 5 feet below the surface, in the shaft of Halbert's Main Lode. The analytical results obtained were as follows:—

Lab. No. 5150:

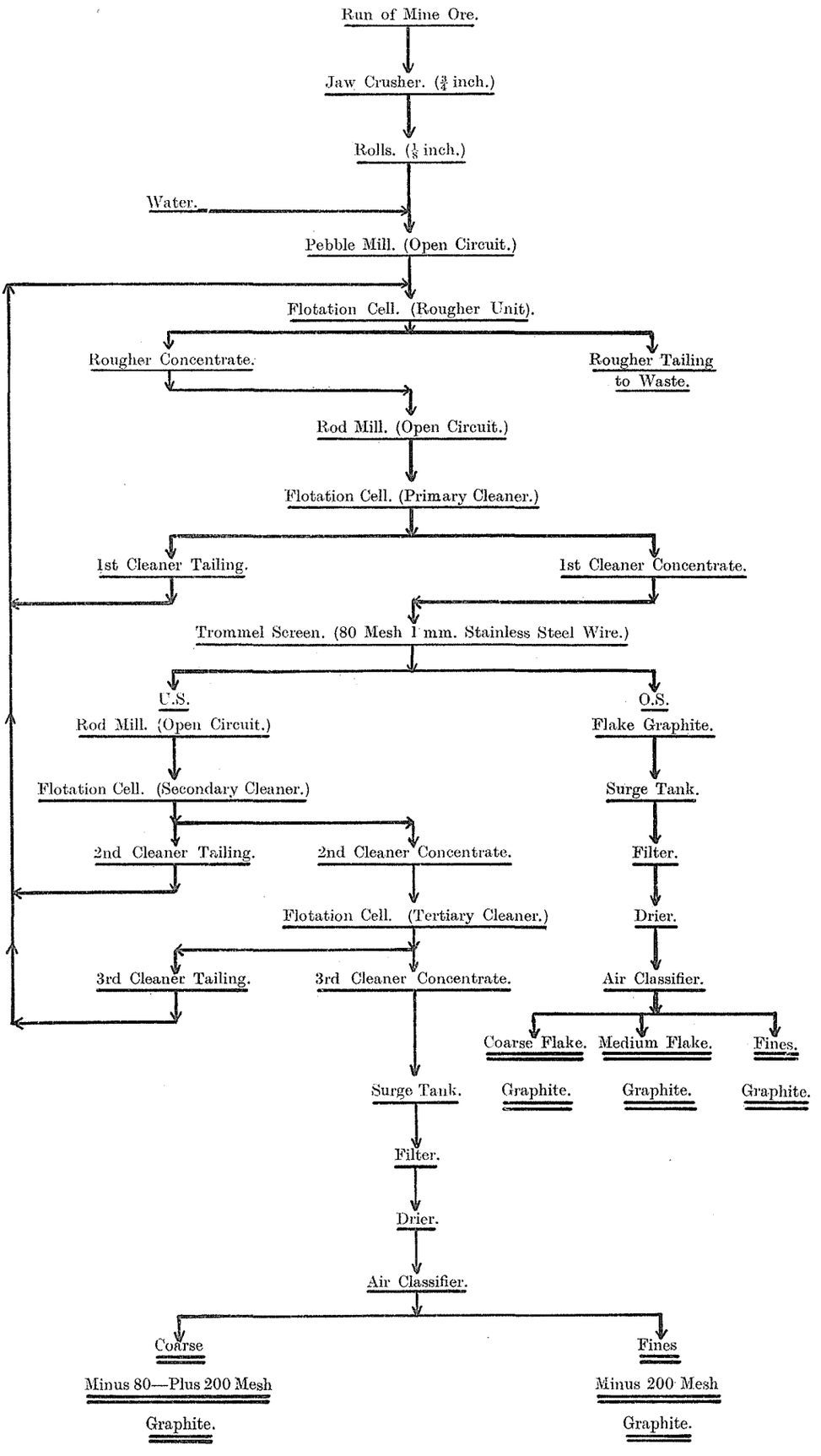
Vermiculite No. 1.—From 1ft. under water in shaft. Halbert's main vermiculite lode, Young River. Vertical Depth 18 feet.

Analysis:

	Per cent.
SiO	33.92
Al_2O_3	13.63
Fe_2O_3	8.71
FeO	2.44
MnO	1.13
MgO	17.03
CaO	Nil
K_2O	.30

PROVISIONAL FLOW-SHEET.

MUNGLINUP GRAPHITE.



Analysis—*continued.*

	Per cent.
Na_2O	2.92
H_2O+	6.30
$H_2O—$	12.85
CO_2	Nil
P_2O_5	.01
TiO_2	.74
SO_3	Nil
Cl	.30
F	.06
Ba	Nil
	100.34
$O = Cl_2$	.07
$O = F_2$	.03
	100.24
Sp. Gr.	2.37
R.I. Nm	1.553

(Nm = Ng or very nearly.)

Lab. No. 6341:

Vermiculite G.S/V. 43.—Five feet from surface, Halbert's main vermiculite lode, Young River.

Partial Analysis.

	Per cent.
K_2O	.30
Na_2O	1.54
FeO	2.07
H_2O+	8.00
$H_2O—$	9.73
Cl	.07

These results suggest that alteration of the original mineral to vermiculite may gradually decrease with depth.

No details of laboratory tests could be found in the scientific journals available. A pilot plant operating at Tanganyika, South Africa, was described in the J. Cm. Met. & Min. Soc., Dec. 1939. The vermiculite is crushed in a special type of hammer mill, and then graded. Winnowing is used to remove gangue. The screen sizes used for grading were given, and these with additional small sizes, were adopted.

Commercial Tests.

Each sample of natural vermiculite was similarly treated as follows:—

(i) 100 grams were crushed and screened into the following grades:—

Grade.	*Screen Sizes.*
A	—$\frac{1}{2}$ inch + $\frac{1}{4}$ inch
B	—$\frac{1}{4}$ inch + $\frac{1}{8}$ inch
C	—$\frac{1}{8}$ inch + $\frac{1}{16}$ inch
D	—$\frac{1}{10}$ inch + 30 mesh
E	—30 mesh + 60 mesh
F	—60 mesh + 90 mesh
G	—90 mesh

(ii) Each grade was weighed, and the per cent. of the total sample calculated.

(iii) The weight of 1 cubic inch of each grade was determined, from which the gross weight per cubic foot was calculated.

(iv) The cubic inch of each grade was exfoliated by heating until expansion ceased. The furnace was brought to 1100°C. before putting in the vermiculite. The time of heating required was only a few seconds, after which it was withdrawn and rapidly cooled.

(v) The volume of the expanded material was measured in cubic inches.

(vi) The expanded material was weighed.

From (v), (vi) the weight per cubic foot of exfoliated material was calculated.

(vii) The true specific gravity, 2.37, of the natural vermiculite was determined. Using this figure, the free air space in each grade was calculated.

(viii) The true specific gravity, 2.88, of the expanded material was determined. Using this figure, the free air space in the expanded material was calculated.

(ix) The exfoliated grades were examined for fines and dust.

(x) Colour and other qualities of the expanded material, such as softness, were noted.

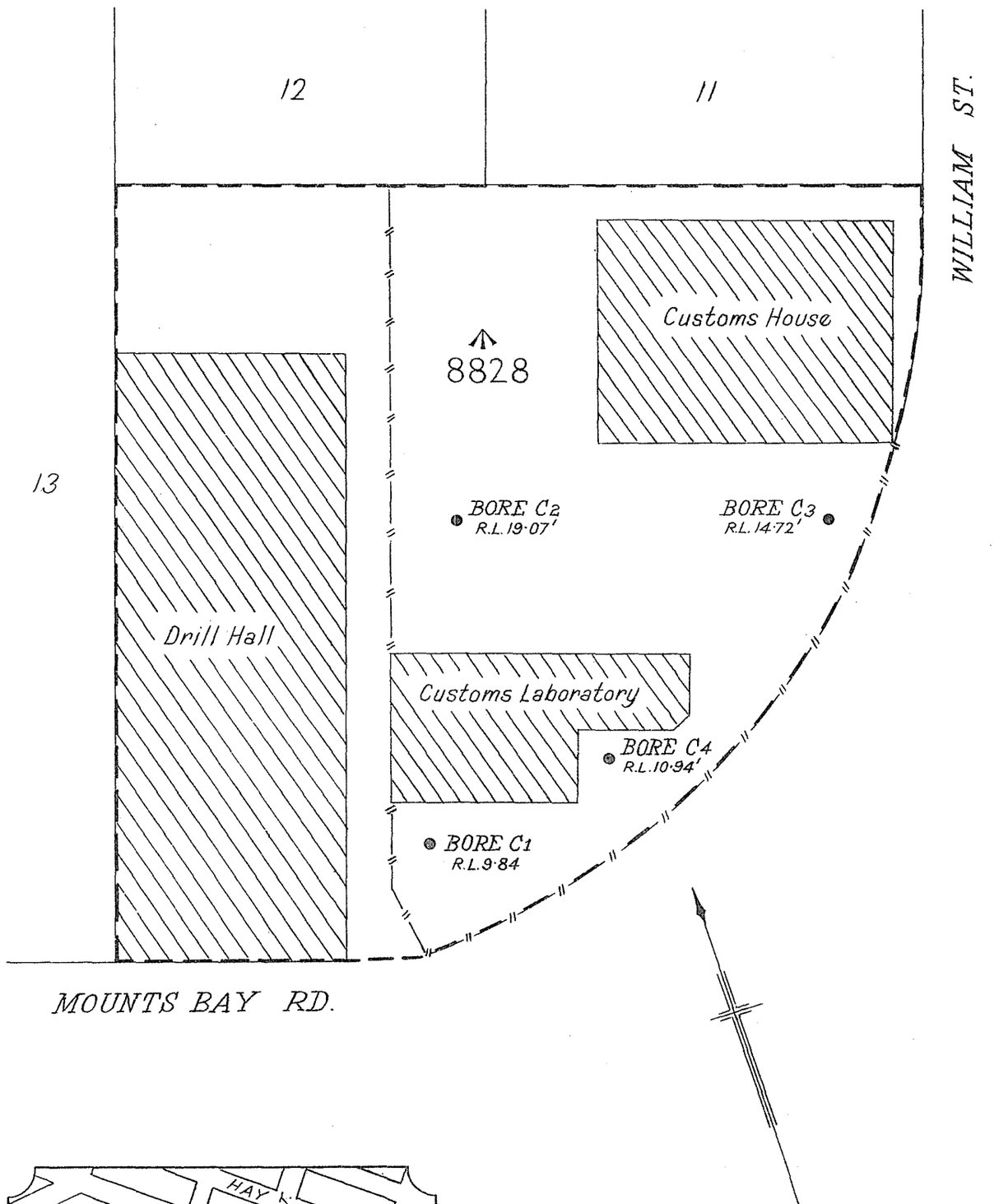
Ten samples were examined. The results obtained are given below:—

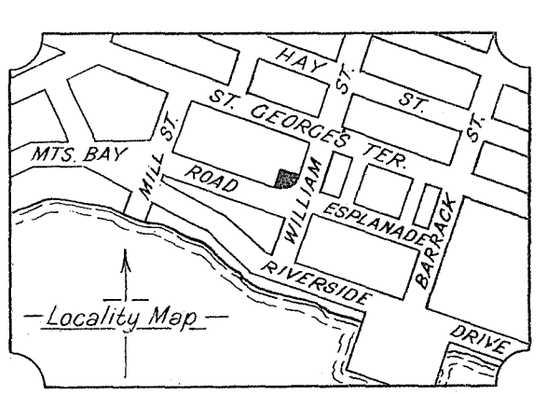
Grade.	Per Cent.	Mineral before Exfoliation.		Exfoliated Mineral.			Remarks.
		Weight (lbs. per cub. foot gross).	Total Air Space (%).	Weight (lbs. per cub. foot gross).	Volume Increase (gross).	Total Air Space (%).	
Lab. No. 6520. *G.S./V.* 48.							
A	9·7	57·9	61·0	8·0	6	96	Grades B and C show about 25% curved exfoliation. Colour silver to golden brown on face, brown on edges. Strong.
B	32·0	56·8	61·6	8·1	6	96	
C	32·8	57·2	61·4	8·1	6	96	
D	15·3	54·5	63·3	10·2	$4\frac{1}{2}$	94	
E	6·0	48·8	67·0	12·1	$3\frac{1}{2}$	93	
F	2·0	48·8	67·0	16·6	$2\frac{1}{2}$	91	
G	2·2	...	...	impure	...	...	
Lab. No. 6521. *G.S./V.* 49.							
A	11·6	58·7	60·4	8·1	6	96	Mostly straight exfoliation. Colour silver to golden brown on face, brown on edges. Strong. Long pieces break to short ones very easily.
B	22·5	57·9	61·0	9·8	5	95	
C	39·2	59·4	60·0	8·7	$5\frac{3}{4}$	95	
D	17·8	53·3	64·0	10·6	$4\frac{1}{4}$	94	
E	6·0	48·8	67·0	11·4	$3\frac{3}{4}$	94	
F	·9	...	...	impure	...	...	
G	2·0	...	...	impure	...	...	
Lab. No. 6522. *G.S./V.* 50.							
A	*nil*	...	...	...	...	...	Mostly straight exfoliation. Colour silver to golden brown on face, brown on edges. Friable. Weak.
B	7·9	56·4	61·9	9·4	5	95	
C	24·1	56·8	61·6	9·1	$5\frac{1}{4}$	95	
D	26·9	57·5	61·2	12·3	4	93	
E	17·8	62·9	57·9	19·3	3	85	
F	9·2	67·1	54·7	32·0	2	82	
G	14·1	...	...	impure	...	...	

Grade.	Per Cent.	Mineral before Exfoliation.		Exfoliated Mineral.			Remarks.
		Weight (lbs. per cub. foot gross).	Total Air Space (%).	Weight (lbs. per cub. foot gross).	Volume Increase (gross).	Total Air Space (%).	
Lab. No. 6523. *G.S./V.* 51.							
A	8·7	57·2	61·4	4·3	12	98	Grades C and D better than A and B. A and B straight exfoliation, open leaves; C and D more curved. Colour silver to golden brown on face, brown on edge. A and B poor.
B	16·5	50·4	66·0	4·5	10½	98	
C	30·8	54·9	62·9	4·9	10	97	
D	24·2	53·0	64·2	6·9	7	96	
E	11·8	48·8	67·0	9·4	4½	95	
F	2·4	54·9	62·9	17·8	2¾	90	
G	5·6	...	...	impure	...	...	
Lab. No. 6524. *G.S./V.* 52.							
A	*nil*	...	...	...	...	...	Grade C poor. Grades D and E good. Mostly straight exfoliation and even. Colour silver to golden on face, brown on edge.
B	*nil*	...	...	...	...	...	
C	2·8	45·7	69·2	4·3	9	98	
D	48·0	60·2	59·4	9·4	6	95	
E	28·4	62·9	57·9	14·7	4	92	
F	9·5	64·8	56·1	20·1	3	85	
G	11·3	...	...	impure	...	...	
Lab. No. 6525. *G.S./V.* 53.							
A	24·4	45·3	69·4	2·5	15½	99	Mostly curved exfoliation. Light coloured silver white on face, light brown on edge, Very springy when compressed on face. A and B grades tend to crumble on edges. In general, the best sample.
B	34·7	49·3	66·7	3·8	10½	98	
C	20·1	48·8	67·0	4·6	9	98	
D	13·5	50·0	66·2	5·7	7½	97	
E	4·3	51·8	60·8	6·1	7	96	
F	1·4	46·4	68·6	10·4	3½	94	
G	1·6	...	...	impure	...	...	
Lab. No. 6526. *G.S./V.* 54.							
A	5·7	59·4	60·0	9·8	5	95	Mostly straight exfoliation. Colour dark silver to golden brown on face, brown on edge. Compact and strong.
B	26·7	56·4	61·9	9·2	5	95	
C	41·2	60·2	59·2	9·1	5½	95	
D	19·3	59·4	60·0	9·5	5¼	95	
E	4·2	54·9	62·9	10·2	4½	94	
F	1·1	...	...	impure	...	...	
G	1·8	...	...	impure	...	...	
Lab. No. 6527. *G.S./V.* 55.							
A	15·1	53·7	63·7	11·1	4	94	Straight exfoliation. A and B grades strong and compact. Colour dark silver to golden brown on face, brown on edge.
B	38·2	55·2	62·7	12·9	3½	93	
C	30·1	56·0	62·2	11·9	4	93	
D	11·7	54·9	62·9	11·4	4	94	
E	2·1	48·8	67·0	14·2	3	92	
F	·6	...	...	impure	...	...	
G	2·2	...	...	impure			
Lab. No. 6528. *G.S./V.* 56.							
A	*nil*	...	...	...	...	...	D grade strong. B and C poor and friable. Colour dark silver to golden brown on face, brown on edge. B and C grades exfoliation open and uneven.
B	1·9	48·8	67·0	7·1	6	96	
C	34·0	54·5	63·3	6·7	7	96	
D	41·9	52·2	64·8	7·2	6¼	96	
E	11·7	51·8	65·0	9·3	5	95	
F	4·4	48·8	67·0	14·2	3	92	
G	6·1	...	...	impure	...	...	
Lab. No. 6529. *G.S./V.* 57.							
A	*nil*	...	...	...	...	...	All grades only of fair strength. D and E are best. Colour dark silver to golden brown on face, dark brown on edge.
B	7·7	49·5	66·6	7·2	6	96	
C	39·2	44·8	69·7	7·2	5½	96	
D	33·2	46·4	68·7	8·7	4¾	95	
E	9·2	48·8	67·0	10·2	4½	94	
F	4·0	54·9	62·9	24·4	2	86	
G	8·7	...	...	impure	...	...	

Grades below 30-mesh all contain gangue and would require winnowing. The 90-mesh material was mostly gangue and would be discarded.

PLATE II





GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

PROPOSED REPATRIATION BUILDING

RESERVE 8828

LOCATION OF BORES C1, C2, C3 & C4

Scale 40 ft to an inch

Information from Dept of Interior, Works and Services Branch, Perth; drawing WA/S 1322 A, dated 16·12·44

BORING AT SITE OF PROPOSED REPATRIATION BUILDING.

(RESERVE 8828.)

By R. A. Hobson, B.Sc. (Hons.).

Introduction:

Between 6th and 22nd of December 231 feet 6 inches of boring was done on Reserve 8828, situated at the intersection of William street and Mount's Bay road, by Davis, Hankinson and Co. under contract to the Department of the Interior, Works and Services Branch, Perth. The object of this work was to ascertain the nature of the underlying rocks and to obtain suitable samples of all clays for subsequent engineering tests. The geology and sampling were done by the writer. The sites were selected and located by the Works and Services Branch. It was desired to drill the first hole to about 80 feet and three others to depths of from 40-50 feet, provided correlation between the various holes could be established at those depths. A grant of £200 was available for the job.

Drilling was done with a light portable percussion plant. The diameter of the holes drilled was 6 inches, except in C1, below 62 feet 6 inches, when the diameter had to be reduced to 5 inches as no more 6 inch casing was available. Standard drilling procedure was adopted, but special care was taken to see that the water was sealed off before drilling into the clay beds. Cores of these were obtained by attaching a piece of 5 inch casing to the drilling tools and driving this by means of the jar bars. After being driven 6 inches or a foot, depending upon the nature of the clay, the tools were withdrawn, the piece of casing unscrewed, and the core removed by means of a jack. Details of procedure for individual bores are given in the descriptive logs.

The localities of the four holes drilled are shown on the accompanying plan.

Geology.

The nature of the various beds and the correlation between bores are fully dealt with in the accompanying bore logs and sections to which reference should be made. It is proposed here only to draw attention to a few points not fully dealt with there.

The rocks intersected in the bores consist for the most part of a conformable series of shales, clays, silts, sands and pebble beds, generally lenticular, and having a dip broadly parallel to the surface of the ground. The clays are generally moist, but never wet. Their moisture content appears to vary. Sometimes they can be moulded with some difficulty with the fingers while at other times they are crumbly. Complete information will be obtained from the samples collected. The sands and pebble beds all contain water—usually sub-artesian. In bore C1, however, the water flowed over the top of the casing and continued to flow after the casing was pulled until the hole was filled in. Full details regarding the various waters encountered in the holes have been noted in bore logs.

The surface material at all bores included some filling, and the boundary between this surface material and the underlying beds was always indefinite. In bore C1 from 5 to 7 feet there was a medium grained cream coloured sand, with well rounded grains, which was not found in any of the other bores. Inspection of an old contour plan of Perth, dated 1897, shows that at that time the river extended to what is now Mount's Bay road. It seems probable therefore that the sand noted in bore C1 at 5 to 7 feet is a beach sand and is, therefore, considerably younger than the underlying beds.

The clays contain a number of yellow to brown ferruginous patches and streaks. These are merely portions of the clay, which have been stained by iron solutions. They are always less plastic than the unstained clay and usually quite crumbly. They appear to be due to the inclusion of ferruginous material with the clay during deposition. Their distribution is quite irregular.

Samples and Specimens.

Samples of the clay for subsequent testing were collected at intervals of approximately 2 feet, except from the deeper beds, where less frequent samples were taken. It has already been explained how cores were obtained from the clay beds. The outsides of the cores were cut away and the sample taken from the inside and immediately put into a suitable bottle and sealed. In all 33 samples were taken—10 from bore C1, 9 from bore C2, 10 from bore C3, and 4 from bore C4—and handed to the Works and Services Branch for subsequent testing. These samples were numbered from 1 to 33.

Specimens of all sands and pebble beds intersected were collected. One set has been handed to the Works and Services Branch and another retained at the Geological Survey. Type pieces of all clay beds have been placed in the Geological Survey collection.

Plans, Sections and Bore Logs.

This report is accompanied by the following:

(1) Plan giving localities of bores C1, C2, C3 and C4. Scale 40 feet to an inch.

(2) Descriptive logs of all bores, with details regarding samples, and notes on general procedure.

(3) Graphic logs of all bores.

(4) Three sections—(i) through bores C1 and C2; (ii) through bores C2 and C3; (iii) through bores C1, C4 and C3.

PROPOSED REPATRIATION BUILDING—RESERVE 8828.

Log of Bore C1.

Location of bore ... South-west corner of reserve.
Reduced level ... 9·84 feet.
Commenced ... ... 6th December, 1944.
Completed ... ... 12th December, 1944.
Total Depth ... ... 77 feet 6 inches.

Bore Depth.	Strata.	Test Samples.		Notes.
		Number.	Depth.	
ft. in. ft. in. 0 0— 5 0	Surface sand, with small clay nodules and surface rubbish.	...	ft. in. ft. in. ...	
5 0— 7 0	Medium grained cream coloured sand. Well rounded grains. Slightly clayey at 6 feet. Becoming finer grained and more clayey at 7 feet.	...	...	
7 0—10 6	Fine grained clayey sand, with some small black grains (ilmenite ?)	...	...	Moist at 7 feet, *water* at 8 ft. 6 in. and sand lost from shell bit at 9 ft. Run in 10 ft. 3 in. of 6 in. *casing* and drive to 9 ft. 6 in. Continue drilling with shell bit.
10 6—18 0	Medium to coarse grained yellow clayey sand. More clayey at 14 ft. to 16 ft. 6 in. than above and below. Angular quartz grains	...	...	Below 10 ft. 6 in. drill with sand pump, lowering casing at same time. Add 6 ft. 3 in. of 6 in. *casing* and drive to 15 ft. *Water* partially shut off. Continue drilling with shell bit. At 16 ft. 6 in. *water* back into hole again. Continue with sand pump to 18 ft. At 18 ft. 6 in. *casing* removed from hole and approx. 18 ft. of 8 in. *casing* run in and driven.
18 0—20 0	Coarse grained sand and pebble bed, with pebbles up to 1 in. diameter. Usual size of pebbles is ¼ in. to ⅜ in.	...	...	Run in 26 ft. 8 in. of 6 in. *casing* and drive to 21 ft. 1 in. *Water* shut off. Hole pumped dry.
20 0—21 6	Grey sandy clay. At 21 ft. 6 in. hard ferruginous layer ½ in. to 1 in. thick. Moist, but no free water	1	20 0—20 6	*Sample* probably contaminated with ground water from above. Hole not quite dry. NOT a good sample.
21 6—29 6	Blue-grey clay with some yellow, brown and red streaks and patches. Some harder yellow ferruginous nodules	2 3 4 5	21 6—22 0 23 6—24 0 25 6—26 0 27 6—28 0	 Note some harder yellow nodules. Some water in bore, but sample not affected.
29 6—46 6	Fine to medium grained sand. Somewhat clayey to 30 ft. 6 in. Water sand. Sand readily flows into hole	 6	 29 6—30 0	At 30 ft. *water* rose in hole to within 8 ft. of surface. Additional 6 in. *casing* added and driven to 26 ft. 6 in. After bailing *water* rose to within 2 ft. of surface. Add additional *casing* and continue drilling. Drive *casing* to 50 ft. Clayey sand.
46 6—54 6	Brown clay-silt, with blue patches. Small flakes of mica. Somewhat sandy to 48 ft. 6 in. and from 54 ft. to 54 ft. 6 in.	7 8	50 6—51 0 52 6—53 0	Some water in hole. Hole dry. Clay appears moister than 50 ft. 6 in. to 51 ft.
54 6—62 0	Fine to medium grained sand ...	...	...	At 55 ft. struck water, which rose to within 12 ft. of surface. *Water* commenced to flow over top of 8 in. casing, *i.e.*, is coming up between the 6 in. and 8 in. casing probably mainly from 29 ft. 6 in. to 46 ft. 6 in. sand. *Water* from this sand previously rose to within 2 ft. of surface. *Water* sample A taken from *water* flowing over 8 in. casing. *Water* sample B from water inside 6 in. casing after bailing. Add more 6 in. *casing* and drive to 56 ft. 6 in. Use sand pump. Drive *casing* to 62 ft. 6 in.
62 0—64 0	Coarse sand and pebble bed. Quartz, granite and ironstone pebbles up to 2 in. diameter. Larger pebbles not abundant. Usual size is up to ⅜ in.	...	...	After standing overnight *water* rose to within 6 in. of surface. Bore cleaned out and pumped. *Water* rose rapidly to within 6 in. of surface. Good supply of *water* from 62 ft. to 64 ft. *Water* sample C taken from inside top of 6 in. casing. 67 ft. 2 in. of 5 in. casing run into hole and driven to 65 ft. Pump hole, *water* shut off.

PROPOSED REPATRIATION BUILDING—RESERVE 8828—*continued.*

LOG OF BORE C1—*continued.*

Bore Depth.	Strata.	Test Samples.		Notes.
		Number.	Depth.	
ft. in. ft. in.			ft. in. ft. in.	
64 0—77 6	Grey calcareous shale, with small fragments of shells. Partly cemented. Very difficult to remove plug from socket			*Water* has not risen in hole after standing overnight. Pump hole and drive 5 in. *casing* to 67 ft.
		9	67 0—67 6	Hole not quite dry. Sample under 5–6 tons pressure when removing from socket.
		10	77 0—77 6	Sample could not be removed whole from socket. Broken out in pieces.

Bottom of hole at 77 ft. 6 in.

PROPOSED REPATRIATION BUILDING—RESERVE 8828.

LOG OF BORE C2.

Location of bore ... North-west corner of reserve.
Reduced level ... 19·07 feet.
Commenced ... ... 14th December, 1944.
Completed ... ... 18th December, 1944.
Total Depth ... 65 feet.

Bore Depth.	Strata.	Test Samples.		Notes.
		Number.	Depth.	
ft. in. ft. in.			ft. in. ft. in.	
0 0— 0 6	Surface soil, with some laterite filling.	...	...	
0 6— 1 0	Fine grained sand.			
1 0—10 3	Grey clay, with yellow ferruginous patches. Sandy streaks 1 ft. to 4 ft. A sandy clay below 9 ft. 6 in. Note that the ferruginous patches are more crumbly than the other portion of the clay	...	...	Below 3 ft. 6 in. drill with socket.
		11	3 6— 4 0	Grey clay, with some yellow ferruginous patches and some sandy streaks.
		12	5 6— 6 0	As for 3 ft. 6 in. to 4 ft., but no sandy streaks.
		13	7 3— 7 9	
		14	9 8—10 1	Grey sandy clay.
10 3—14 0	A fine grained clayey sand, with fine grained sand band at about 11 ft. to 12 ft.	15	12 3—12 9	A fine grained clayey sand.
14 0—15 3	A fine grained white sand, clayey below 15 ft.	...	...	*Water* in bore at 14 ft. Rose to 13 ft. from surface.
15 3—16 9	Blue clay, similar to clay at 1 ft. to 10 ft. 3 in.	16	15 6—16 0	
16 9—25 6	Medium to coarse grained yellow sand. A thin clay band (½ in.) at 18 ft. Below 22 ft. 8 in. a number of hard ferruginous bands, each about 1 in. thick	...	...	At 18 ft. both sand and *water* flowing into hole. Water rose to 11 ft. 6 in. of surface. Run in 19 ft. 6 in. of 6 in. *casing* and drive. Add more *casing*. drive and clean out casing. Use sand pump.
25 6—28 2	Coarse grained clayey sand ...	...	...	Drive *casing* to 27 ft. and clean out hole to 25 ft. 6 in. Fit socket and drill. Drive *casing* to 28 ft. 6 in.
28 2—32 1	Blue clay, with yellow ferruginous patches	17	29 3—29 6	
		18	31 3—31 9	
32 1—46 6	Fine to medium grained white sand	...	...	At 33 ft. *water* in hole. Rose to 17 ft. from surface. Add more *casing*, drive and use sand pump. Drive *casing* to 46 ft. 8 in.
46 6—63 0	Brown to blue clay-silt with small flakes of mica. Sandy bands containing water at 50 ft. 9 in. to 51 ft. 3 in., 53 ft. 9 in. to 54 ft. 3 in., 62 ft. 6 in. to 62 ft. 9 in.			Drill with socket to 51 ft. 9 in. *Water* in hole at 50 ft. 9 in. to 51 ft. 9 in. Rose to within 21 ft. of surface. On standing overnight rose to within 9 ft. of surface. Drive *casing* to 52 ft. 6 in.
		19	53 3—53 9	Not a representative sample of 46 ft. 6 in. to 63 ft. Sample moister than material above.
63 0—64 0	Medium to coarse grained sand.			
64 0—64 3	Blue clay.			
64 3—65 0	Very coarse sand, with some pebbles about ⅜ in to ½ in.	...	...	*Water* rose in hole to 10 ft. from surface. After standing about 4 hours water was 9 ft. from surface.

Bottom of hole at 65 ft.

PROPOSED REPATRIATION BUILDING—RESERVE 8828.

Log of Bore C3.

Location of bore ... North-east corner of reserve.
Reduced level ... 14·72 feet.
Commenced ... ... 18th December, 1944.
Completed ... ... 20th December, 1944.
Total Depth ... 55 feet.

Bore Depth.	Strata.	Test Samples.		Notes.
		Number.	Depth.	
ft. in. ft. in. 0 0— 2 0	Surface sand.		ft. in. ft. in.	
2 0—12 3	Grey clay, with yellow-brown ferruginous patches. Sandy streaks to 5 ft. 6 in. Note.—Ferruginous portions crumbly and also moister than remaining portions of clay	20 21 22 23	4 10— 5 4 6 9— 7 3 8 9— 9 3 10 9—11 3	
12 3—19 6	A fine grained clayey sand. Very clayey at 16 ft.	 24	 15 6—16 0	First *water* in hole, when socket at 15 ft. to 16 ft. 8 in. Clay above was moist, but no free water. A sandy clay.
19 0—27 0	A medium-coarse grained white sand, carrying a lot of water. Thin (6 in.) coarse sand and pebble band at 27 ft.	...	...	At 20 ft. *water* in hole. Rose to 6 ft. 6 in. from surface. Run in some 6 in. *casing* and pump. Drive *casing* to 27 ft. 6 in. and pump hole dry. Fit socket.
27 0—27 3	Coarse grained clayey sand.			
27 3—34 3	Grey clay, with a number of light brown ferruginous patches and streaks	25 26 27 28	28 6—29 0 29 3—29 9 32 3—32 9 33 3—33 9	Note thin band (½ in.) of sand in this sample. Grey crumbly clay. Sample very crumbly and contains a big proportion of brown ferruginous material. Note: During above sampling casing was driven to 28 ft.
34 3—51 6	A fine grained white sand, very even grained. Flows readily into hole. A few thin clay bands, probably about 1 in. in thickness	...	...	At 34 ft. to 35 ft. no recovery by socket. *Water* in hole. Rose to 4 ft. 10 in. of surface. Add more casing, drive and use sand pump. Drive casing to 52 ft. 3 in. and pump hole dry.
51 6—55 0	Blue clay-silt, with brown streaks. Small flakes of mica. Sandy below 54 ft. 6in.	29	52 6—53 0	*Water* in hole at 54 ft. 6 in. to 55 ft.

Bottom of hole at 55 feet. *Note.*—Casing pulled and hole allowed to stand overnight. Water was 4 ft. 6 in. from surface in morning.

PROPOSED REPATRIATION BUILDING—RESERVE 8828.

Log of Bore C4.

Location of bore ... Between C1 and C3.
Reduced level ... 10·94 feet.
Commenced ... ... 21st December, 1944.
Completed ... ... 22nd December, 1944.
Total Depth ... 34 feet.

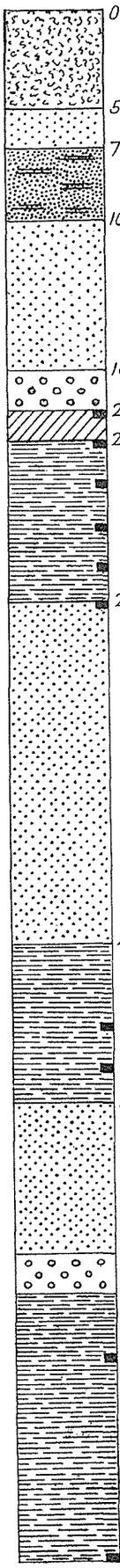
Bore Depth.	Strata.	Test Samples.		Notes.
		Number.	Depth.	
ft. in. ft. in. 0 0— 4 0	Surface filling, with pieces of old brick.		ft. in. ft. in.	
4 0— 5 0	Brown clayey sand.			
5 0— 8 0	Varying from a fine grained clayey sand to sandy clay. More clayey below 7 ft. 6 in.	...	...	Use shell auger to 8 ft.
8 0— 8 8	Grey blue clay.			
8 8—20 0	Medium grained yellow sand, with some thin (1 in.) clay bands. Thin coarse sand band at 16 ft. 3 in.	...	...	*Water* in hole at 8 ft. 8 in. Rose to 6 ft. 5 in. of surface. Run in 6 in. *casing* and drive.

PLATE III

PROPOSED REPATRIATION BUILDING – RESERVE 8828

BORE C1 – GRAPHIC LOG.

Reduced Level – 9·84 feet
Commenced – 6·12·44
Completed – 12·12·44
Total depth – 77 feet 6 in.



0′ *Surface sand*

5′ *Medium grained, cream coloured sand.*
7′ *Well rounded grains.*

Fine grained clayey sand. Moist at 7′, water 8′6″

10′6″ *Medium to coarse grained yellow clayey sand. Water*

18′ *Coarse grained sand and pebble bed. Water*
20′ *Grey sandy clay. Hole pumped dry with casing at 21′1″*
21′6″

Blue-grey clay with some yellow, brown and red streaks and patches. Dry hole.

29′6″

Fine to medium grained white sand. Water rose to within two feet of surface.

46′6″

Brown clay-silt, with blue patches. Small flakes of mica. Hole pumped dry with casing at 50′

54′6″

Fine to medium grained sand. Water rose within 12′ of surface.

62′ *Coarse sand and pebble bed. Water rose within 6″*
64′ *of surface. Hole pumped dry with casing at 67′*

Grey calcareous shale. Dry hole

77′6″

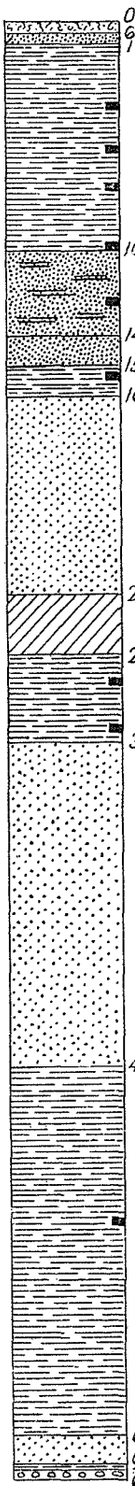
Note:–
Samples indicated thus ■

PLATE IV

PROPOSED REPATRIATION BUILDING — RESERVE 8823

BORE C2 — GRAPHIC LOG.

Reduced Level — 19·07 feet
Commenced — 14·12·44
Completed — 18·12·44
Total depth — 65 feet



0"
6" Surface soil, with some laterite filling
1' ← Fine grained sand

Grey clay, with yellow ferruginous patches

10'3"

Fine grained clayey sand

14' Fine grained white sand. Water in bore at 14'
15'3" Rose to 13' from surface.

16'9" Blue clay

Medium to coarse grained yellow sand.

25'6"

Coarse grained clayey sand

28'2"

Blue clay, with yellow ferruginous patches. Hole pumped dry with casing at 28'6"

32'1"

Fine to medium grained white sand. Water rose to 17' from surface.

46'6"

Brown to blue clay silt, with small flakes of mica. Hole pumped dry with casing at 46'8" and later at 52'6"

63'
64 64'3" Blue clay
65' Very coarse sand and some pebbles. Water rose to within 9' of surface.

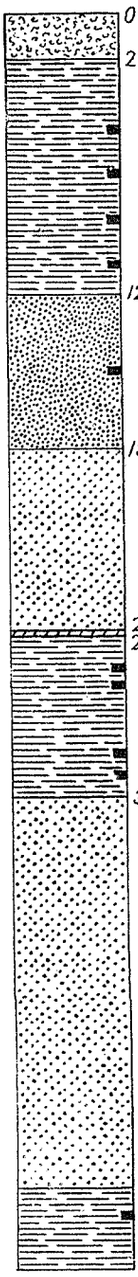
Note :—
Samples indicated thus ⊠

PLATE V

PROPOSED REPATRIATION BUILDING — RESERVE 8828

BORE C3 — GRAPHIC LOG

Reduced Level — 14·72 feet
Commenced — 18·12·44
Completed — 20·12·44
Total depth — 55 feet



0′ *Surface sand*

2′ *Grey clay, with some yellow-brown ferruginous patches*

12′3″ *Fine grained clayey sand. Water at 15½-16′8″*

19′ *Medium-coarse grained white sand. Water rose in hole to 6′6″ from surface.*

27′ 27′3″ *Coarse grained clayey sand.*

Grey clay, with a number of light brown ferruginous patches. Hole pumped dry with casing at 28′

34′3″ *Fine grained white sand. A few clay bands about 1″ in thickness. Water rose in hole to 4′10″ from surface*

51′6″ *Blue clay silt. Small flakes of mica. Hole pumped dry with casing at 52′3″.*

55′

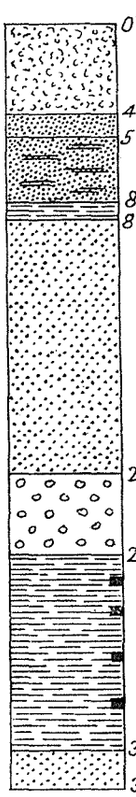
Note:—
Samples indicated thus ■

PLATE VI

PROPOSED REPATRIATION BUILDING — RESERVE 8828

BORE C4 — GRAPHIC LOG

Reduced Level	10·94 feet
Commenced	21·12·44
Completed	20·12·44
Total depth	34 feet



0′ Surface sand and filling

4′ Brown clayey sand

5′ Varying from a fine grained clayey sand to a sandy clay.

8′ 8′8″ Grey blue clay

Medium grained yellow sand, with some thin (1″) clay bands. Water in hole at 8′8″. Rose to 6′5″ from surface.

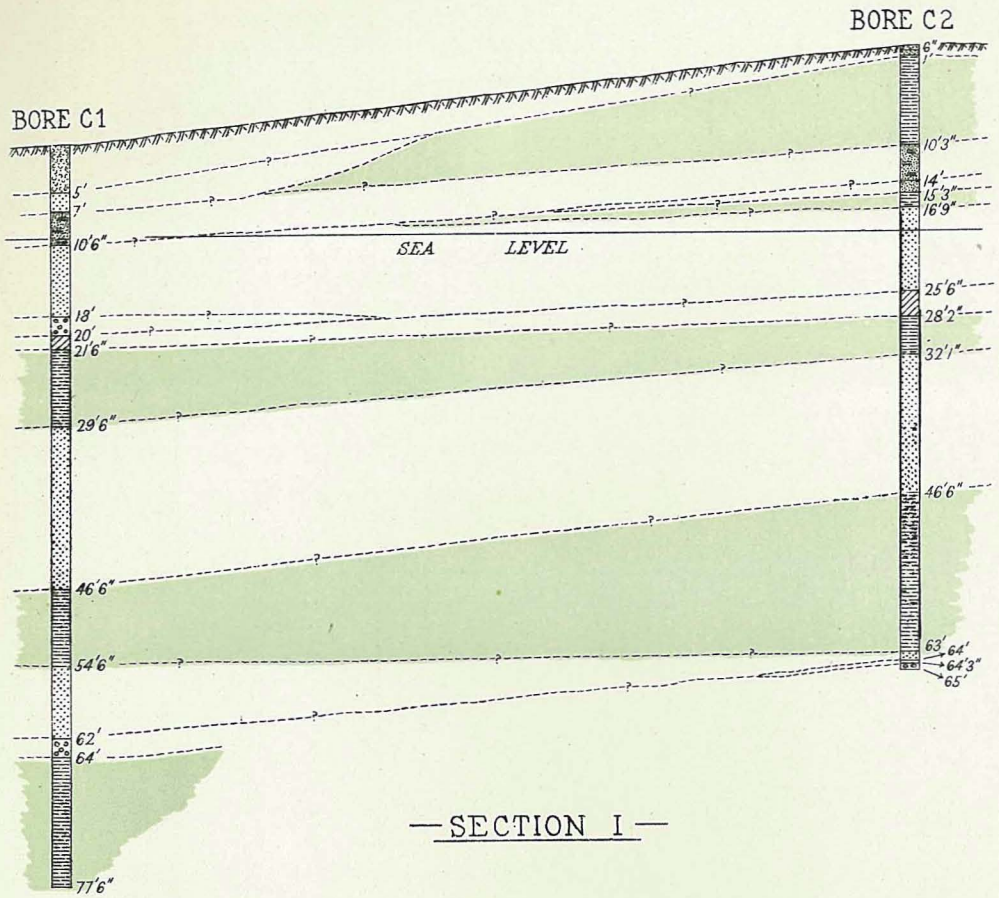
20′ Coarse sand and pebble bed

23′8″ Grey clay, with brown and yellow ferruginous patches. Hole pumped dry with casing at 24′6″

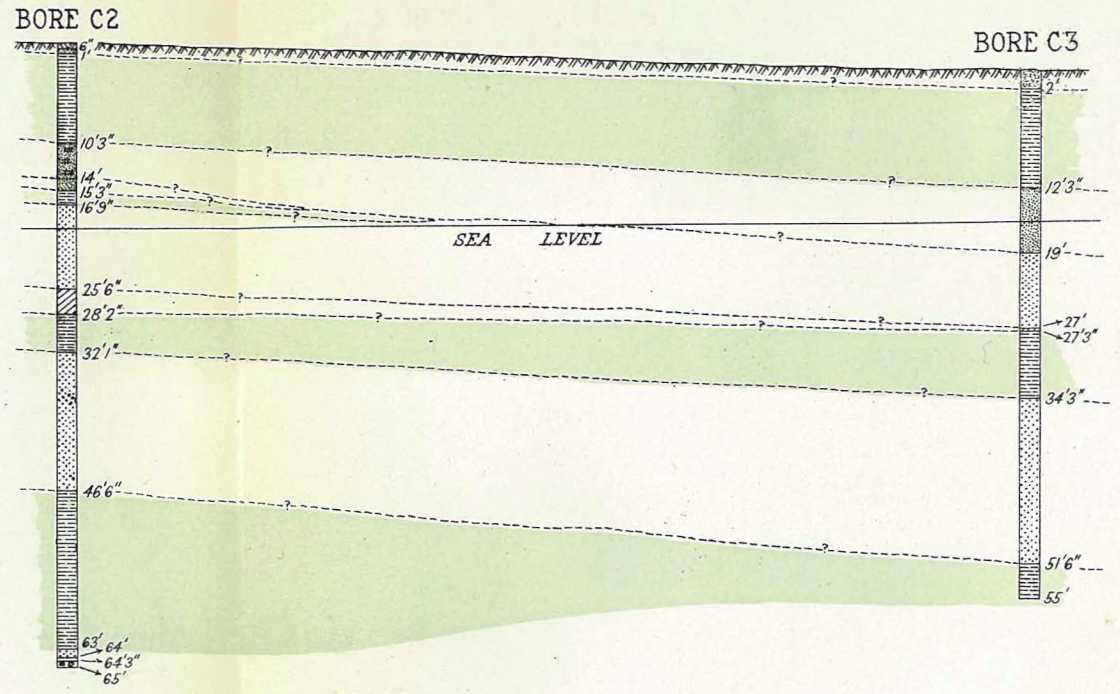
32′3″ Fine-medium grained white sand. Water rose to

34′ 6′ from surface.

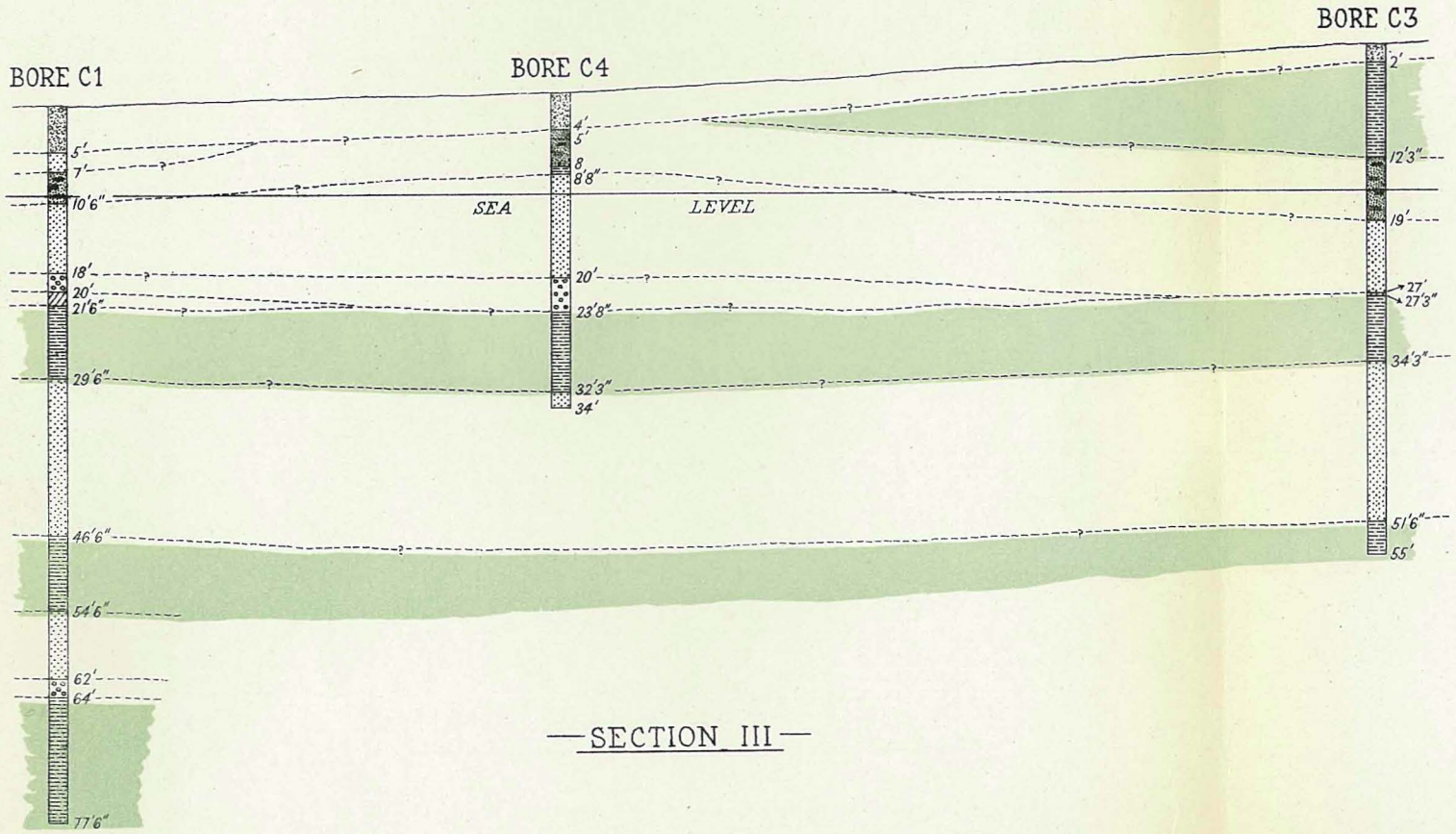
Note:—
Samples indicated thus ■



—SECTION I—



—SECTION II—



—SECTION III—

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

PROPOSED REPATRIATION BUILDING
RESERVE 8828

—SECTIONS I, II & III—

Scale 20ft. to an inch

20 15 10 5 0 20 40

Note:- The same symbols are used as in the graphic logs
Argillaceous beds are tinted grey.

PROPOSED REPATRIATION BUILDING—RESERVE 8828—*continued.*

LOG OF BORE C4—*continued.*

Bore Depth.	Strata.	Test Samples.		Notes.
		Number.	Depth.	
ft. in. ft. in. 20 0—23 8	Very coarse sand band, with pebbles up to ½ in. diameter. Hard band (1 in. thick) of cemented sand at 23 ft. 8 in. (ferruginous cement)	...	ft. in ft. in. ...	Drive *casing* to 24 ft. 6 in.
23 8—32 3	Grey clay with brown and yellow ferruginous patches	30 31 32 33	24 9—25 3 26 0—26 6 28 0—28 5 30 0—30 5	
32 3—34 0	Fine-medium grained white sand ...	...	...	*Water* in hole below 32 ft. 6 in. Rose to 6 ft. 5 in. of surface. After standing for 1 hour *water* rose to within 6 ft. of surface. Pump to 34 ft.

Bottom of hole at 34 feet.

REPORT ON YELLOWDINE GOLD MINE, MT. PALMER, YILGARN GOLDFIELD.

By R. S. Matheson, B.Sc.

CONTENTS.

PLANS.

Plate VIII.—Reconstructed Outcrop Plan of Lodes.

Plate IX.—Transverse Section at 170ft. South, showing Main Lode, East Lode and West Lode, and Transverse Section at 450ft. south of New Lode.

Plate X.—Longitudinal Section, illustrating pitch of synclinal trough on Main Lode and East Lode.

GENERAL INFORMATION.

During the period 23rd March to 1st April, 1944, a brief geological examination was made of the workings of the Yellowdine Gold Mine. This mining property is situated on the western shore of a salt lake approximately 8¾ miles south-southwest of Yellowdine Siding, and about ¾ mile south-east of Mt. Palmer townsite, and was previously examined by the writer in 1936*. The present report should be treated as supplementary to the earlier report.

The mine has been an important gold producer, and from the commencement of mining operations in 1935 to 31st December, 1943, produced 153,377.88 fine ozs. of gold from 300,478.50 long tons of ore. Alluvial, dollied and specimen gold amounting to 1,661.67 fine ozs. is also recorded from the area to the end of 1943.

GEOLOGY.

The mine is situated in an area of metamorphosed, inter-bedded, basic lavas, undifferentiated schistose greenstones and jaspilites, which strike between N. 50° E. and N. 20° W., dip steeply in varying directions, and are intersected by flatly dipping joints. The series is intruded by quartz reefs, and also by garnetiferous, pegmatite dykes younger in age than the auriferous quartz. It grades westwards into acid gneiss, considered to be of replacement origin.

* Matheson, R. S., G.S.W.A. Bull. 98, pp. 120-136.

Previous mapping* has shown that this greenstone belt is the eastern limb of a large, south-easterly pitching, anticline, folded on a northwest-southeast axis. Local folding (or drag-folding) of the greenstones has also occurred, and, as will be seen later in this report, has had an important influence on ore deposition. There are two axes of local folding, namely, an approximate north-south axis, and on an approximate east-west axis. The latter can be conveniently referred to as cross-folding.

ORE BODIES.

Four separate ore bodies consisting of white translucent, quartz reefs, which are known as the Main Lode (or Whinfield's Reef), the East Lode, the West Lode and the New Lode, have been mined on this property. Egan's Lode constitutes a fifth ore body, but it has been previously described. The Main Lode and East Lode have been the principal ore bodies.

The quartz is granular and occasionally laminated parallel with the schistosity of the adjacent country, and the presence of these structures together with the fact that large isolated "horses" of country are met with in the reefs, suggest that they have been formed by metasomatic replacement.

Below ground water level, which is reported to have been 80 to 90 feet from the surface, the ore bodies are mineralised with sulphides, chiefly pyrite and arsenopyrite, but small amounts of chalcopyrite and pyrrhotite have been recorded in some of the bores. Calcite veinlets also occur in the deeper workings, and were noted by the writer in the main east crosscut at the No. 5 level.

As a high gold recovery is obtained by direct cyanidation, the sulphide minerals are apparently not intimately associated with the gold.

A general description of the lodes is given hereunder, and their structure and relative positions are shown on the accompanying plan and sections (Plates VIII, IX and X). For more detailed information reference should be made to the mine plans and sections, copies of which are stored at the Geological Survey Office.

Main Lode.

The Main Lode is exposed in the workings between the surface and the No. 5 Level (400 feet V.D.), and has been stoped almost continuously to the No. 4 Level (300 feet V.D.), over an average length of about 350 feet. The best values and maximum development of quartz occurred in this ore body in the section above the No. 3 Level (200 feet V.D.), where it occupied a large dragfold. The folded character of the reef is well illustrated on the accompanying plan and sections, and it will be noted that besides being folded on a north-south axis, the reef is syn-

* Ellis, H. A., G.S.W.A. Bull. 97, pp. 118-121.

clinally folded on an east-west axis. The latter folding (or cross-folding) has caused a reversal in pitch of the synclinal portion of the reef (see Plate X).

Between the Nos. 2 and 3 levels, and north of co-ordinate line 200 feet south, the Main Lode is intersected by a tongue of pegmatite, which strikes and pitches out of the reef channel farther south where the stoping is continuous between the two levels.

Another tongue of pegmatite, with a similar attitude intersects the Main Lode between the Nos. 4 and 5 levels.

Low values averaging less than 1 dwt. gold per ton occur in the Main Lode at the No. 5 level, but driving has so far only been carried out over a length of 120 feet. At the south end of the drive a narrow pegmatite dyke occurs in the reef channel.

On the transverse section (Plate XXIV, Bulletin 98) prepared by the writer after his inspection of the mine in 1936, a probable fault is shown intersecting the Main Lode between the Nos. 2 and 3 levels. Later development work proved that no fault occurred here.

East Lode.

The East Lode was discovered by surface bore No. 15, which intersected the auriferous quartz between reduced levels 994 feet and 966 feet, at a point bearing 143 degrees and about 440 feet distance from the main shaft. Development of this ore body commenced at the No. 3 level, and it was subsequently mined to about 40 feet below the No. 6 level, and upwards in places to the surface.

From the accompanying plan and sections, it will be seen that quartz was deposited in the trough and eastern limb of a northerly pitching syncline. The angle of pitch of the trough flattens with depth, changing from 60 degrees between the surface and the No. 5 level, to 20 degrees between the No. 5 and No. 6 level, where it becomes almost horizontal. This variation is apparently due to the influence of the same synclinal crossfold, which caused the reversal in pitch of the main lode.

The best values and maximum development of quartz occurred in the synclinal trough, and along the eastern limb of the fold, for an average length of about 150 feet, and this section of the lode has been almost entirely stoped out between the surface and the No. 6 level. The manager's estimate of the quantity of unbroken ore remaining in this section is 12,000 tons.

The eastern limb of the fold has been driven on for lengths of about 400 feet at the Nos. 3, 4 and 5 levels, but, beyond 150 feet from the trough, values have been consistently unpayable, with the exception of a dragfolded portion of the limb situated on the crossfold axis between the Nos. 4 and 5 levels (see Plate IX). This ore body appears to be the northerly continuation on the pitch, of a fold with low values occurring in the reef at the No. 4 level between co-ordinate lines 200 feet south and 300 feet south. A pegmatite dyke occurs on the hanging wall of this ore body, and also intersects it underfoot, forming a fairly impervious barrier which could assist the process of secondary enrichment. As the ore body contains sulphides and is over 200 feet below original ground water level, it is more likely however that the structural position rather than secondary enrichment has influenced the gold content of the quartz. Some of the pegmatite in contact with the reef contains payable values due to assimilation of auriferous quartz.

This pegmatite dyke intersects the East Lode at varying places throughout the workings, and has caused difficulties in mining and prospecting, as well as mechanically replacing a large section of the reef.

West Lode.

The West Lode consists of a quartz reef which strikes northeasterly and dips 60° S.E., and it has been driven on for a length of about 140 feet at the No. 2 level. The lode has been stoped underfoot from the level over a length of 60 feet to a depth of 40 feet where the reef is intersected by pegmatite. The overhand stoping has been carried out over a length of 100 feet to 15 feet from the surface where the reef is said to have disappeared. It was impossible to ascertain the behaviour of the quartz at the roof of the stope, but the fact that it does not outcrop, is, under local conditions, strongly suggestive of it being a folded reef, or the limb of a folded reef. Judging from its direction of dip and width, the reef is most likely the southeastern limb of an anticlinally folded reef, but for this to be true, the quartz should turn sharply into the north-western wall near the roof of the stope.

New Lode.

The New Lode outcrops as an elliptical mass of quartz containing two centrally situated "horses" of country rock. The reef has been opened up to a depth of 90 feet from the surface, and from an examination of the workings it was seen that the quartz is in the form of an isoclinal anticline, which is overturned to the southeast. The quartz pitches 40 to 50 degrees northeasterly at the northeast end, and appears to have a southwest pitch at the southwest end. This reversal in pitch suggests that reef is anticlinally crossfolded.

Unpayable values were apparently met with below 90 feet on the eastern limb of the lode, and below 44 feet on the western limb. Driving has been done on the eastern and western limbs at the 80 ft. and 44 ft. levels respectively, for distances of about 180 feet from the northeast nose of the fold. The New Lode is connected with the No. 2 level from the main worings, at the 80 ft. level, and, at this level, is mineralised in places with sulphides and intersected by two narrow pegmatite dykes.

DIAMOND DRILLING.

During the course of mining operations 36 surface bores and 152 underground bores were drilled, most of which were for prospecting purposes, but a few were drilled with the prime object of intersecting water-bearing fissures, which were afterwards sealed off by grouting.

Information obtained from these bores has been used in the preparation of the accompanying plan and sections, and has also been borne in mind when making the prospecting recommendations.

Viewing the drilling programme broadly it appears that the best advantage has not been made of the knowledge obtained in the early stages of development of the property, that auriferous quartz deposition was closely associated with the folding of the country rocks. Drilling has been carried out by the scheme usually adopted when prospecting for steeply dipping unfolded ore bodies, and, while being useful to some extent in determining the limits of known folded ore bodies, is not the best scheme for locating new ore bodies of the type occurring in this mine. Mining operations have shown that the best values and maximum development of quartz occur at the noses and troughs of the folded reefs, and, to locate new ore bodies of this type, prospecting could, as a general practice, best be done by vertical bores, or by bores parallel with the dip on the stratigraphical hanging wall of the reefs. Bores parallel with the dip would locate any further folds on the downward continuations of the reefs, while vertical bores would have the extra advantage of prospecting for parallel ore bodies. Drilling should be confined to east-west strips of country with widths corresponding to the limits of known crossfolds, in particular synclinal crossfolds.

It will be seen from the accompanying plates that a vertical bore, or a bore parallel with the dip, drilled from any one of innumerable positions on the eastern side of the Main Lode, between co-ordinate lines 150ft. S. and 600ft. S., would have located the East Lode.

CONCLUSIONS.

1. Ore deposition has been controlled by the folding in a belt of schistose greenstones, which acted as an incompetent zone during regional folding. The incompetent zone, and consequently the country potentially favourable for ore deposition, may possibly be confined between the two jaspilite horizons shown on the 5 chain to 1 inch geological map of the area (see Plate XIX, Bulletin 98).

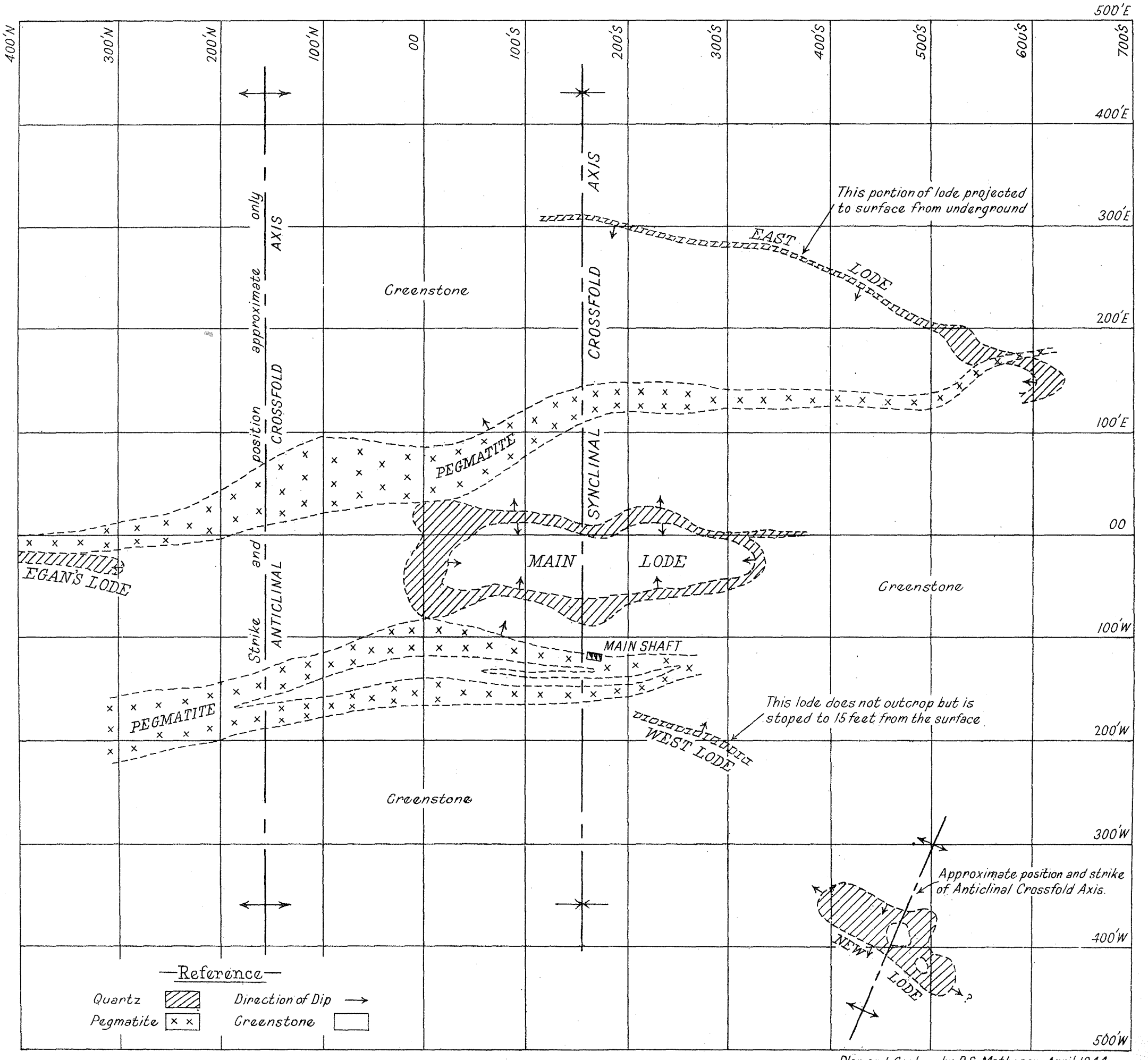
PLATE VIII

YELLOWDINE GOLD MINE

RECONSTRUCTED OUTCROP PLAN OF LODES

YILGARN GOLDFIELD

Scale: 100 feet to an inch



Plan and Geology by R.S. Matheson, April 1944

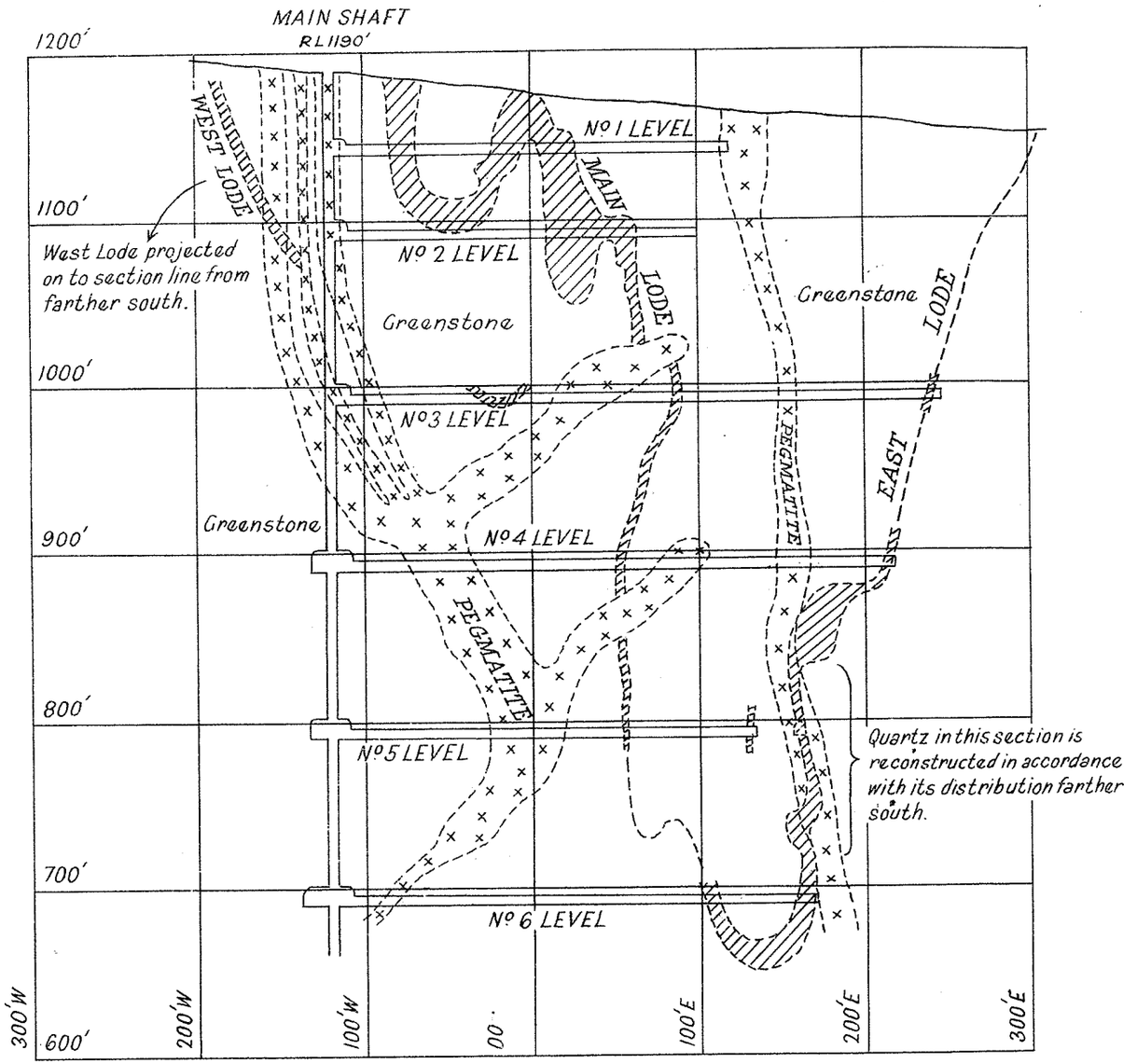
YELLOWDINE GOLD MINE

PLATE IX

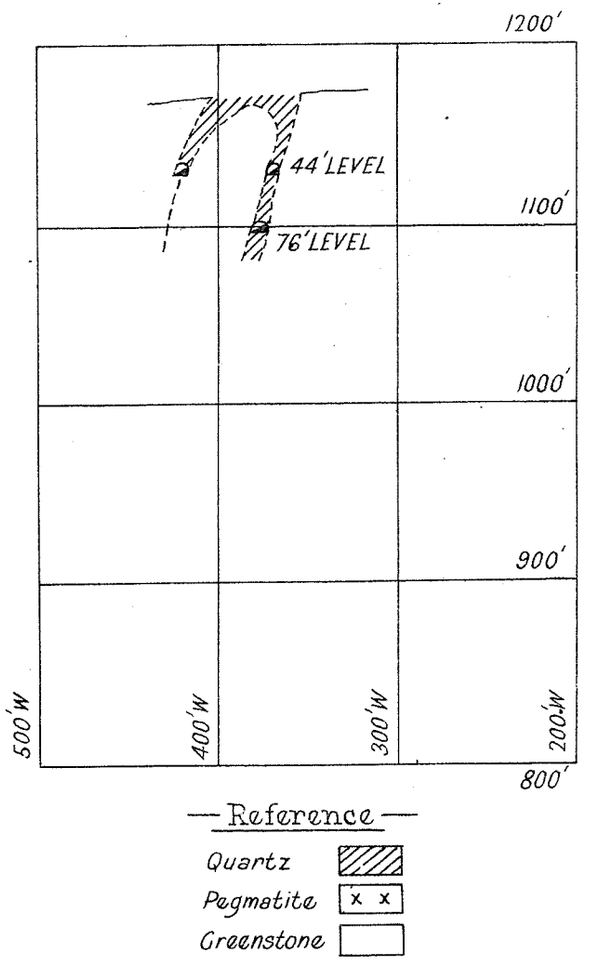
YILGARN GOLDFIELD

Scale 100 feet to an inch

TRANSVERSE SECTION AT 170 FT. SOUTH
SHOWING MAIN, EAST AND WEST LODES



TRANSVERSE SECTION AT 450 FT SOUTH
SHOWING NEW LODE



Reference

- Quartz
- Pegmatite
- Greenstone

Section and Geology by R.S. Matheson, April 1944

YELLOWDINE GOLD MINE

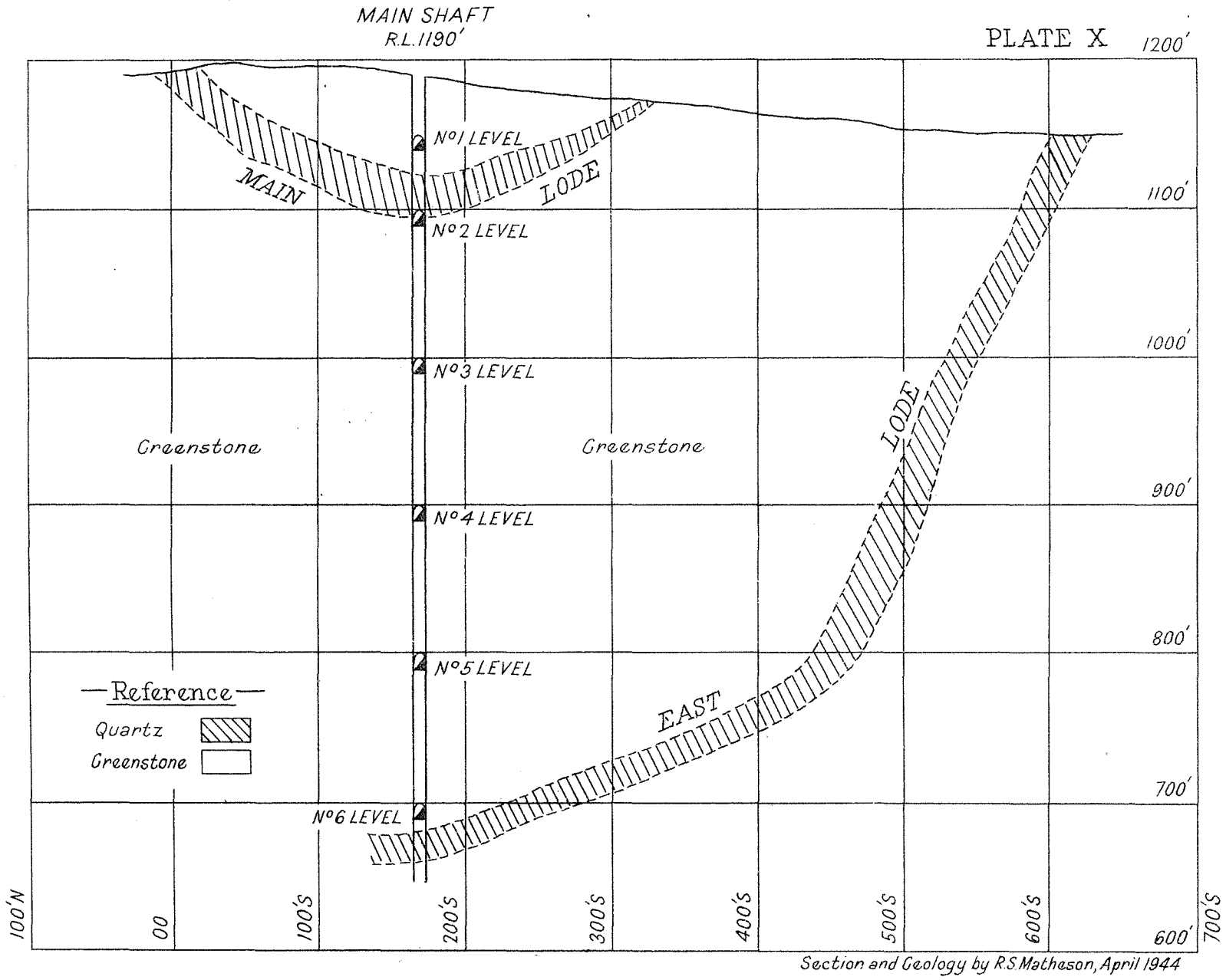
N-S LONGITUDINAL SECTION

ILLUSTRATING PITCH OF SYNCLINAL TROUGHS ON MAIN AND EAST LODES

YILGARN GOLDFIELD

Scale: 100 feet to an inch

PLATE X



Section and Geology by R.S. Matheson, April 1944

2. Folding has occurred on two intersecting axes, namely, on an approximate north-south axis and on an approximate east-west axis. The latter folding (or crossfolding) has caused reversals in pitch of the folds of the other system, and also appears to have localised ore deposition in the favourable host rocks. Most of the ore bodies so far located occur in synclinal cross-folds.

3. The reefs have probably been formed by metasomatic replacement, and the maximum development of quartz and also the best values occur around the crests and troughs of the replaced folds. On the limbs the quartz is generally narrow and low grade, but shows an improvement in width and values where dragfolds are replaced.

4. Although the Main Lode and East Lode have not been connected in the workings, by reference to Plate IX, it can be seen that there is every reason to believe that they do connect at the No. 6 level east of the main shaft, and to all intents and purposes the East Lode can be regarded as a continuation of the Main Lode occurring in the synclinal fold immediately to the east. As this syncline is intersected by a synclinal cross-fold, it is expected to be a closed fold, similar to the synclinal portion of the Main Lode, but of greater dimensions. For this reason it is thought that a southerly pitching ore body, somewhat similar to the northerly pitching ore body, which occurred at the south end of the fold and was mined to the No. 6 level, may occur at the north end of the fold.

5. As the West Lode does not outcrop, it may possibly be the limb of a folded reef. Reference to Plate II shows that there may be some connection between the West Lode and the synclinal mass of quartz exposed in the main east crosscut at the No. 3 level.

6. The New Lode occurs on the crest of an anticlinal fold, with a northeast-southwest axis which has been anticlinally crossfolded. Its situation suggests that it may represent auriferous quartz deposition in an horizon other than that containing the Main and East Lodes. Although the New Lode has not been very productive, higher grade quartz may have been deposited in the adjacent synclines, and they should be prospected.

The New Lode itself should also be prospected due west of the mainshaft where, if it persists on the pitch, it should intersect the synclinal cross-fold axis somewhere between 250 and 300 feet from the surface.

There may possibly be some connection by folding between the New Lode and the West Lode.

7. Previous regional mapping has shown that the greenstone belt is the eastern limb of a large anticline, and the shape of the Main lode is in agreement with this interpretation. The folds in the horizon containing the Main and East Lodes may therefore be expected to progress upwards towards the west, and downwards towards the east. It is reasonable to assume that the auriferous horizon has been anticlinally folded at least once more between the limb of the East Lode and the eastern jaspilite band. Prospecting for this possible line of reef should be undertaken on the synclinal cross-fold axis, and if located then further prospecting should be carried out down its eastern side parallel to the dip.

8. Where the jaspilite is intersected by the synclinal crossfold it may have been suitably fractured and folded to allow the entry and deposition of auriferous quartz, and consequently this section of it should be prospected to see if an ore body exists.

9. The large irregular quartz reef, occurring along the top of the ridge on the western side of the Main Lode, is considered to be of the same age as the auriferous quartz and to have a folded structure. Judging from the prospecting that has already been done a few erratic values were located near the northern end of the reef. A small quantity of ore has also been mined from a branch of the reef known as Egan's Lode, which has the form of a tightly folded northerly pitching, syncline. Although the outcrop of the reef is, generally speaking, non-auriferous, it is thought some further prospecting is warranted, as payable values may occur near the base of synclinally folded portions of the reef, in particular, where they occur in synclinal crossfolds.

PROSPECTING RECOMMENDATIONS.

The following prospecting, which is based on the above conclusions, is recommended, and it should be realised that the drilling programme is solely for locating ore bodies not for determining their extent. Further prospecting recommendations could be made, if the drilling proves successful.

1. To prospect for the possible ore body at the northern end of the syncline containing the East Lode, the following three bores are recommended.

From a site, co-ordinates 00′ and 150′ E, two bores, one bearing northeast and the other due north, should be drilled with depressions of 45 degrees for lengths of 350 feet.

From a site, co-ordinates 50′ N. and 150′ E., a vertical bore should be drilled to a depth of 550 feet, or alternatively a bore bearing 310 degrees and depressed 60 degrees, should be drilled for a length of 150 feet, from a site with approximate co-ordinates 5′ S and. 205′ E. at the No. 5 level. It may be argued that underground bore No. 147 has already prospected this section, but the writer is of the opinion that due to its steep depression this bore would pass under the synclinal trough of the supposed ore body.

2. To prospect for the possible reef between the East Lode and the jaspilite, and to prospect the jaspilite also, the following two surface bores are recommended.

One bore, depressed 45 degrees, should be drilled due east for a length 450 feet, from a site, with co-ordinates 150′S and 250′ E.

The other bore should be drilled with the same bearing and depression, from a site with co-ordinates 150′S and 550′E, until the jaspilite is intersected, which should be between 450 to 500 feet in the bore.

If a single, easterly dipping, auriferous quartz reef or vein is located by the drilling, then a third bore parallel with its dip should be drilled from a point a short distance (say 50 feet) east of its projected outcrop.

If more than one auriferous quartz vein is encountered vertical drilling, from sites, the positions of which are dependent on the results obtained, may prove more advantageous.

3. To prospect the synclines adjacent to the New Lode, and to prospect the New Lode itself on the synclinal crossfold axis, three vertical bores are recommended. The bores should be drilled for 350 to 400 feet from the surface from the following sites: 460′ S, 320′ W; 400′ S, 470′ W and 150′ S, 220′ W.

4. Vertical drilling is the best method of prospecting the large quartz reef occurring along the top of the ridge west of the Main Lode, and the most favourable sites are in the centre of reef, due west of the main shaft, due west to Egan's Lode, and about 300 feet north of Egan's Lode. If the reef is folded, as is thought to be the case, the bores should pass into country rocks at fairly shallow depths. The intervening sections of this reef are not without possibilities however.

5. Vertical drilling should be carried out, immediately below the anticlinal nose in the Main Lode and the synclinal trough in the East Lode, to a few hundred feet below the No. 6 level, to prospect for possible parallel ore bodies. This could best be done by underground boring from the No. 6 level, and the sites should be located as near as possible to the synclinal crossfold axis.

REPORT ON RED OCHRE DEPOSITS, M.L. 370H, OPHTHALMIA RANGE.

Windell District, North-West Division.

By R. S. Matheson, B.Sc.

CONTENTS.

PLAN.

Geological Plan Vicinity Red Ochre Workings, M.L. 370H, Ophthalmia Range, Scale 100 feet to 1 inch.

GENERAL INFORMATION.

The examination of M.L. 370H was made during the period 14th to 17th June, 1944, in the company of Mr. H. B. Owen of the Mineral Resources Survey. There was unfortunately insufficient time available to visit other ochre deposits in the area, namely, Howard's Show and Nelly's Show, but samples reported to be representative of the ochre at these deposits were obtained.

Mineral Lease 370H, the principal producer in the Hamersley-Ophthalmia Plateau, corresponds with late Mineral Lease 49L, and is situated about 12 miles south of Poonda Homestead, in latitude 23° 3′, and on bearing 19° 25′ from Mt. Newman. It can be reached by tracks which branch off the main Meekatharra-Marble Bar road near both Roy Hill and Ethel Creek Homesteads. Roy Hill is the chief centre for stores and communications, however, and it is about 40 miles by road north-east of M.L. 370H. The track from Roy Hill is rough, particularly the last few miles where it leaves the plain country of the Fortescue Basin and follows up a gorge into the Hamersley-Ophthalmia Plateau.

PRODUCTION.

The production of red ochre from the ground now held as by M.L. 370H, reported to the Mines Department to 31st May, 1944, is shown in the following table.

Lease Number.	Period.	Quantity.	Estimated Value.*
		long tons.	£A.
49L	1938–1941	667·40	6,652
370H	1941–1943	515·00	9,150
370H	1943–1944	443·00†	4,430
Total Production	to May, 1944	1,625·40	16,232

* This includes 188 tons ochre produced 1943, but not reported until 1944.

† Judging from information supplied by Prices Branch, Perth, given in a latter section of the report, the value of consignments since 1st April, 1943 has been under estimated.

The only other production from the district is from Howard's Show, P.A. 825H, from which eight tons were mined and forwarded to Melbourne as a trial parcel.

GEOLOGY.

By reference to the accompanying geological plan it will be seen that the ochre deposits occur in metamorphosed sediments consisting of interbedded quartzites, cherts, slates and schistose greenstones (probably metamorphosed pyroclastic rocks), which are considered to be of Nullagine age. In places the metasediments contain seams of specular and/or earthy hematite, and they have been intruded by quartz veins and by a thick sill-like body of quartz-dolerite. The strike of the meta-sediments varies from west to north-west, and the dip from flat to moderate in a southerly direction. Outcrops are good except in the valley between the northern and southern workings where the quartz dolerite is highly decomposed and partly covered by a limonitic capping.

THE WORKINGS.

The ochre has been mined from two different sets of workings which can be conveniently referred to as the Northern Workings and Southern Workings.

In the northern workings, where mining was in progress at the time of inspection, a seam of ochre with an average width of 6 feet has been mined in open cuts, over a length of about 200 feet, to a maximum depth of 15 feet from the surface. The ochre seam is laminated and interbedded with the enclosing sediments, and is distributed parallel, and in proximity to, the intrusive quartz-dolerite contact.

The ochre consists chiefly of ochreous hematite, with small variable quantities of specular hematite, limonite, kaolin and quartz. Analyses and pigment tests on two samples of ochre from these workings are given in a later section of this report. The ochre seam is not uniform in quality throughout the workings and at times hand picking or selective mining is necessary to keep the quality of the ochre up to market requirements. Variations in quality are due chiefly to the occurrence of thin clayey or gritty seams in the ochre, but also to variations in specular hematite and limonite content.

Three seams of ochre of similar composition, and occurring under similar circumstances, appear to have been mined in the southern workings. Mining has been carried out by open cutting to depths varying from 7 to 31 feet from the surface. The two northern seams could not be examined underfoot as the floor of the open cut is covered by mullock, but the fact that mining has been discontinued suggests that the seams narrowed or became poorer in quality. The southern seam can still be partly seen in the floor of a short drive, where it is 2 feet wide and appears to be of good quality.

FORMATION OF DEPOSITS.

As the commercial ochre deposits, and also all the ochreous slates, quartzites and cherts, are in proximity to the intrusive contact there is little doubt that the intrusion of quartz-dolerite has played an important role in the formation of the deposits. Farther from the intrusive contact the sediments are still hematite-bearing, but the hematite occurs mainly as the specular, not the earthy (or ochreous), variety. Magnetite appears to be absent from the meta-sediments.

It appears, therefore, that contact metamorphism associated with the quartz-dolerite intrusion, has been responsible for the alteration of the specular hematite in the sediments near the contact, to the earthy (or ochreous) variety. The high quality seams of ochre are believed to have been formed from argillaceous sediments which were very rich in specular hematite. Argillaceous sediments containing smaller amounts of specular hematite have formed ochre of inferior quality, while the specular hematite-bearing arenaceous sediments have altered to vermilion quartzites and jaspers. The specular hematite itself was probably formed by metamorphic processes prior to the quartz-dolerite intrusion, from iron minerals, possibly iron carbonate and iron oxides, which were included in the sediments during their deposition.

Weathering processes rather than assisting in the formation of the ochre deposits appear to have had the opposite effect, and in places have caused the hematite to weather to limonite. The presence of much limonite in the red ochre detracts from its quality, but fortunately the ochre seams at present being mined have only been weathered to shallow depths.

ECONOMIC CONSIDERATIONS.

The lessee of M.L. 370H is Mrs. C. Smith and the deposits are being mined on a contract basis by Messrs. J. Sheppard and P. Lacey, while the bagged ochre is

being carted to Meekatharra as back loading by Messrs. Smith and Dods. The buyers of the ochre are Minerals (Vic.) Pty. Ltd., Melbourne; S. N. Rodda and Company, Melbourne; and McLeod and Company, Sydney. It is reported that the red ochre is being used as a successful substitute for Spanish Red Oxide. A comparison of the price and costs set out below, clearly shows that the ochre could not be profitably marketed, if the lessee did not have an interest in the firm doing the carting.

Details of the price of red ochre as advised by the Prices Branch, Perth, on 10th July, 1944, are as follows:—

Price to 31st March, 1942—£10 10s. per long ton F.O.B. Fremantle.

Price since 31st March, 1942—£12 per long ton F.O.B. Fremantle.

Representations have recently been made to the local Prices Branch for an increase in price to £14 10s. per long ton F.O.B. Fremantle* and although they are favourable to the increase, confirmation has not yet been received from Canberra.

The costs for mining and marketing the red ochre are reported to be as follows:—

	£	s.	d.	
Remuneration to Contract Miners for bagged ochre at Mine Stack	2	10	0	per long ton
Cartage to Meekatharra (360 miles) as back loading, is equivalent to	6	10	0	per long ton
Cost of bags, string, tools, etc., supplied by lessee	1	0	0	per long ton approx.
Railway Freight, Meekatharra to Fremantle	1	8	0	per long ton†
Wharfage, Demurrage, etc. ...	0	7	6	per long ton
Agency Fees	0	6	0	per long ton
	£12	1	6	per long ton

ANALYSES AND PIGMENT TESTS.

The following results have been received for four samples of red ochre submitted to the Government Mineralogist and Analyst for analyses and pigment tests.

G.S.W.A. Registered No. 2/2882. *Lab. No.* 2803/44.

Description.—Best grade ochre from northern workings, M.L. 370H.

Composition.

Fe_2O_3 (ferric oxide) ..	90.16%
SiO_2 (silica) free	2.41%
SiO_2 (silica) combined ..	1.83%

Colour of Fine Ground Raw Pigment.

With light raw oil: Ridgeway's 5l, between Morocco Red and Claret Brown.
With water .. : Ridgeway's 3'm. Diamine Brown.

Colour of Fine Ground Roasted Pigment.

With light raw oil: Ridgeway's 5k, Morocco Red.
With water .. : Ridgeway's 3"m, Dark Indian Red.

Body and Covering Capacity.

The raw roasted pigments have a very dense body both in oil and water and spread well giving an opaque covering.

Conclusions.

This is a Red Oxide of excellent quality forming bright opaque paints when mixed with oil. It is improved by roasting in air, the pigment is redder, and gives a brighter and redder paint with oil. The distemper formed by grinding in water is considerably darker than oil colour and somewhat purplish. The purplish tinge is largely removed by roasting.

G.S.W.A. Registered No. 2/2883. *Lab. No.* 2804/44.

Description: Reported poorest grade ochre being marketed from northern workings, M.L. 370H.

Composition.

Fe_2O_3 (ferric oxide) ..	85.66%
SiO_2 (silica) free	5.44%
SiO_2 (silica) combined ..	1.55%

Colour of Fine Ground Raw Pigment.

With light raw oil: Ridgeway's 5'm, Hessian Brown.
With water .. : Ridgeway's 5"m, Haematite Red.

Colour of Fine Ground Roasted Pigment.

With light raw oil: Ridgeway's 5m. Claret Brown.
With water .. : Ridgeway's 3'm. Diamine Brown.

Conclusions.

This sample lacks the redness and brightness of the previous sample, and these properties are little improved by roasting in air. It forms opaque paints with oil, but of darker shade, and duller in lustre. The distemper formed by mixing with water is dense with rather dull; it is appreciably improved by roasting in air.

G.S.W.A. Registered No. 2/2884. *Lab. No.* 2805/44.

Description: Reported average grade ochre from Howard's Show, P.A. 825H, situated 26 miles south of Poonda Homestead.

Composition.

Fe_2O_3 (ferric oxide)	90.00%
SiO_2 (silica) free	2.30%
SiO_2 (silica) combined ..	0.88%

Colour of Fine Ground Raw Pigment.

With light raw oil: Ridgeway's 5k. Morocco Red.
With water .. : Ridgeway's 3'm. Dark Indian Red.

Colour of Fine Ground Roasted Pigment.

With light raw oil: Ridgeway's 5k. Morocco Red.
With water .. : Ridgeway's 3'm. Dark Indian Red.

Conclusions.

This is a Red Oxide of excellent quality forming bright opaque paints when mixed with oil. It is not improved by roasting in air. The distemper formed by grinding in water is much darker than the oil colour. The colour is not changed by roasting.

G.S.W.A. Registered No. 2/2885. *Lab. No.* 2806/44.

Description: Reported average grade ochre from Nelly's Show 3 to 4 miles N.N.W. of M.L. 370H.

Composition.

Fe_2O_3 (ferric oxide) ..	86.08%
SiO_2 (silica) free	1.63%
SiO_2 (silica) combined ..	1.57%

Colour of Fine Ground Roasted Pigment.

With light raw oil: Ridgeway's 5k. Morocco Red.
With water .. : Ridgeway's 5l, between Morocco Red and Claret Brown.

Colour of Fine Ground Roasted Pigment.

With light raw oil: Ridgeway's 5l, between Morocco Red and Claret Brown.
With water: Ridgeway's 5"l, between Haematite Red and Prussian Red.

Body and Covering Capacity.

The raw and roasted pigments have a very dense body both in oil and water, and spread well giving an opaque covering.

Conclusion.

This is a Red Oxide of excellent quality forming bright opaque paints when mixed with oil. The oil paint prepared from the roasted pigment is of darker colour. The distemper formed by grinding in water is very bright of good red colour and very dense. The distemper from the roasted pigment is much duller.

CONCLUSIONS AND RECOMMENDATIONS.

As the red ochre deposits have been formed by contact metamorphism, not by weathering processes, they should persist with depth, provided that their position with relation to the intrusive contact remains unchanged. Variations in quality of the ochre, necessitating selective mining and hand picking, are also likely to

*Confirmation of the increase in price was received from Canberra on 7th August, 1944.

†Usual freight rate is £1 17s. 6d. per long ton but the lower figure applies to parcels below a certain value.

persist with depth however, due to variations in the original specular hematite content of the seams and to variations in the amount of unaltered specular hematite. For this reason it is impossible to make any reliable estimate of the reserves, but taking into account the favourable prospects of persistence with depth, and also the favourable prospects of locating other deposits, it can reasonably be assumed that fairly large quantities of red ochre are yet to be mined from this lease. Other ochre deposits known to occur in the district may also come into production.

The present demand is solely for high quality red ochre, which can be used directly as a pigment without any treatment other than grinding. It is likely that much of the material at present being discarded could be used as lower quality red ochre or to obtain high quality ochre by roasting or by other means of beneficiation. The present buyers are unwilling to accept the lower quality material for Eastern States consumption, but it could possibly be used for local consumption, and the cost of beneficiation in Perth would probably be offset by the saving of shipping and handling charges to the Eastern States. The shipping charges between Fremantle and Melbourne plus the handling charges in Melbourne are reported to amount to £3 16s. per ton.

Reference to results of analyses and pigment tests shows that the main differences between the best and poorest grades of ochre being marketed from M.L. 370H are in the ferric iron content, the free silica content and the colour. From hand specimens there appears to be more specular hematite, and more limonite, in the poorest grade ochre than in the best grade ochre. The poorest grade ochre also shows little improvement in redness and brightness after roasting in air.

The other two samples of ochre are useful pigments, but whether or not they are acceptable to the present buyers is dependent on commercial tests. The ochre from Nelly's Show is of particular interest as it contains less ferric oxide and has a better colour in the raw state than the best grade of ochre from M.L. 370H. Instead of improving in colour after roasting, this ochre develops a brownish tinge.

The manner of formation of the ochre suggests that prospecting for new deposits could best be done, by first locating slate beds containing abundant specular hematite, and then traversing them along the strike to an intrusive dolerite contact. An alternative method of prospecting would be to traverse around contacts between intrusive dolerite and Nullagine sediments.

Two localities on M.L. 370H warrant prospecting, namely, on the slope of the hill about 85 yards east of the southern workings, and on the hill top about 300 yards east-southeast of the southern workings. At both these localities the ochre appears to be of high quality except for being slightly off colour due to the presence of limonite in quantities in excess of the usual amount. The limonite has probably resulted from the weathering of hematite, however, and it may disappear from the ochre at shallow depths.

With a view to increasing production and facilitating marketing it is recommended that efforts be made to obtain from the various buyers, the minimum specifications of their requirements with regard to both composition (mineral and chemical) and pigment tests, or alternatively samples of their standard lines for local determination of the specifications. If this information is obtained it will be of great value for the guidance of prospectors and of our own prospecting activities.

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ADDENDUM TO REPORT ON RED OCHRE DEPOSITS M.L. 370H, OPHTHALMIA RANGE, WINDELL DISTRICT, NORTH-WEST DIVISION.

By R. S. Matheson, B.Sc.

Since compiling the report on the Ophthalmia Range ochre deposits a few samples of red ochre, known to be of commercial grade, were obtained from Minerals (Vic.) Pty., Ltd., Melbourne, and from McLeod and Company, Sydney. Both companies kindly supplied samples said to be imported Spanish red oxide, and Minerals (Vic.) Pty., Ltd., also supplied a sample of their standard line ($\frac{O}{2DH}$) and a sample of the rejects from beneficiation of the Ophthalmia Range ochre. The samples were submitted to the Government Chemial Laboratory for analyses and pigment tests, and the results of this work are given below. As these samples were subjected to a similar grinding and treatment process as was adopted in the case of the samples from the Ophthalmia Range deposits the results are comparable.

Lab. No. 3318/44.

Description: Said to be imported Spanish red oxide, sample supplied by Minerals (Vic.) Pty., Ltd.

Mineral Determination.

Largely hematite with some quartz and clay matter and a little calcite and psilomelane (?). No garnet, or other mineral to account for the manganese which is acid soluble, oould be definitely recognised.

Composition.	%
SiO_2	23.71
Al_2O_3	7.51
Fe_2O_3 (total iron as) ..	55.18
MnO_2 (total manganese as) ..	3.82
MgO	present (small)
CaO	3.98
$H_2O\pm$	2.62
TiO_2	0.23
CO_2	2.62
P_2O_5	0.36
	100.03

Colour of Pigment as Received.

With light raw oil: Ridgeway's 5j, between Brazil Red and Morocco Red.

With water: Ridgeway's 5″j, between Ocher Red and Prussian Red.

The sample was not finely ground, and would be unsuitable for use as a pigment in this form. The prepared oil and water paints show segregation of lighter and redder material to the surface.

Colour of Fine Ground Raw Pigment.

With light raw oil: Ridgeway's 5k, Morocco Red.

With water: Ridgeway's 5″j, between Ocher Red and Prussian Red.

Portions of the fine ground pigments were roasted in air and then further ground in both oil and water.

Colour of Fine Ground Roasted Pigment.

With light raw oil: Ridgeway's 6k, between Morocco Red and Mahogany Red.

With water: Ridgeway's 5″j, between Ocher Red and Prussian Red.

Lab. No. 5013/44. *G.S.W.A. No.* 2/3004.

Description: Reported to be Spanish red oxide as received from overseas. Sample supplied by McLeod and Company, Sydney.

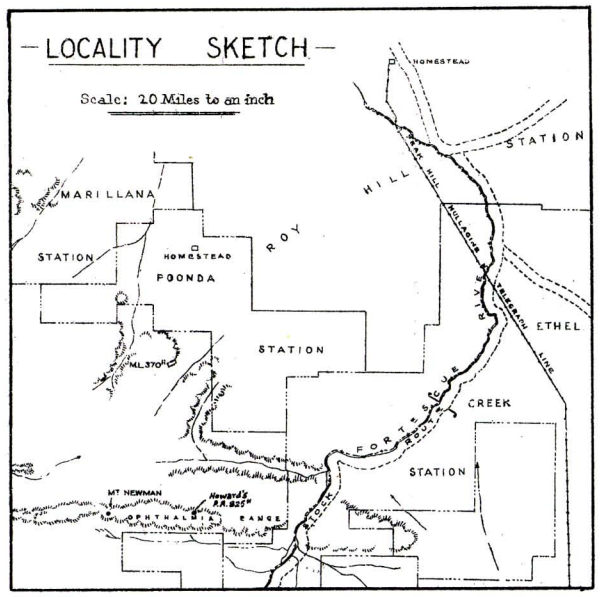
Mineral Determination.

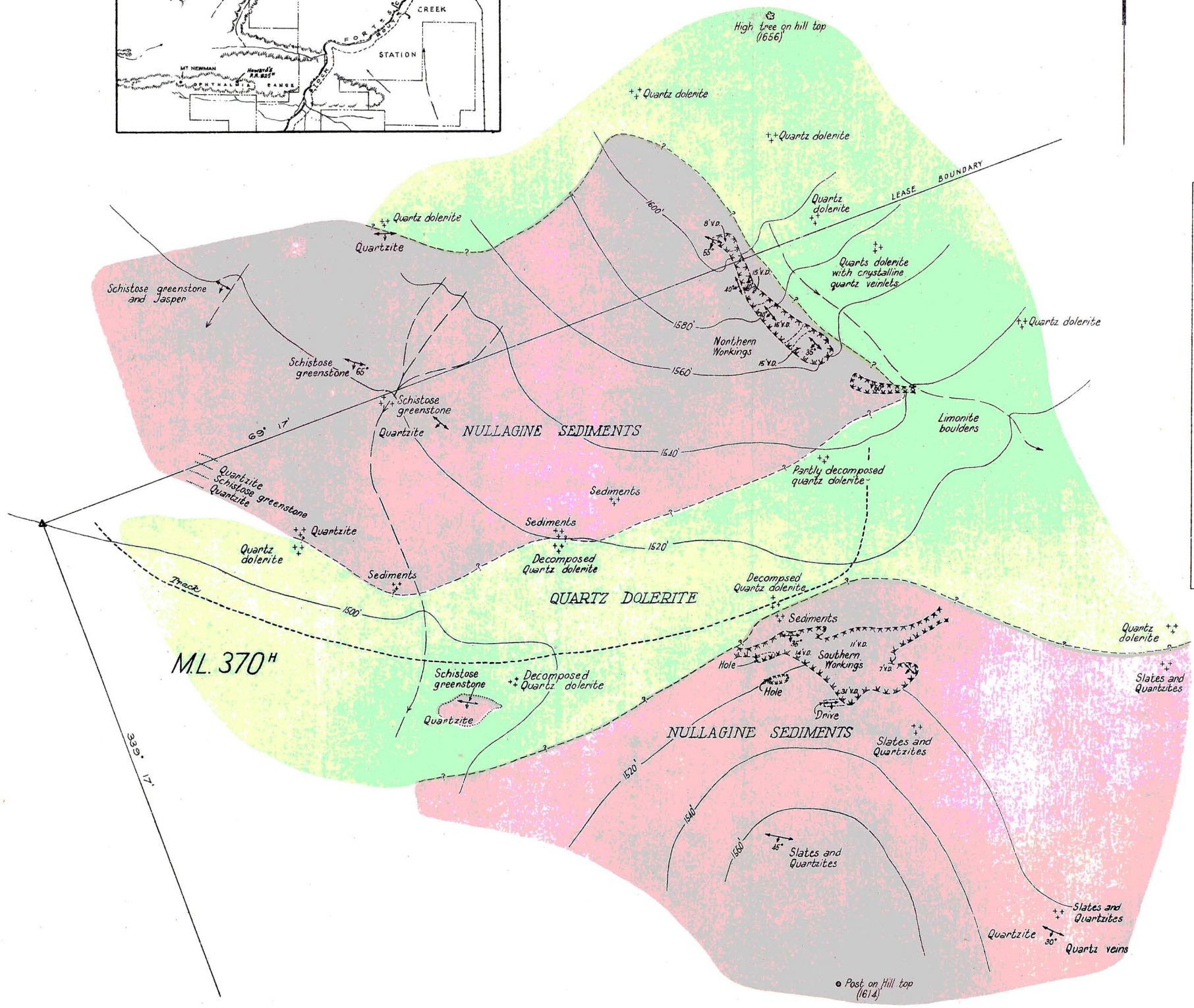
Mainly haematite with some clay matter, calcite and a little limonite and quartz.

Composition.	%
SiO_2	7.00
Al_2O_3	3.81
Fe_2O_3 (total iron as)	79.11
MnO	0.01
MgO	present (small)
CaO	4.86
$H_2O\pm$	1.55
TiO_2	0.05
CO_2	3.80
	100.19

LOCALITY SKETCH

Scale: 20 Miles to an inch





REFERENCE

NULLAGINE SEDIMENTS	Interbedded quartzites, cherts, slates and schistose greenstones (meta-tuffs) partly hematite-bearing and ochreous injected by quartz veins.
QUARTZ DOLERITE (Intrusive)	
Strike and dip of bedding	35°
Outcrops	
Drainage channels	
Track	
Open cuts	
Contours at 20ft intervals	1520'

Datum for contours is North West peg M.L. 370H which has an assumed level of 1500 feet.

GEOLOGICAL PLAN

VICINITY RED OCHRE WORKINGS M.L. 370H OPHTHALMIA R.A.

NORTH WEST DIVISION

Scale: 100 Feet to an inch

Compass, tape and Abney level Survey and geology, by R.S. Matheson & H.B. Owen June 1944.

The sample was dry ground and then further ground in both oil and water, smooth even brushing paints resulting.

Colour of Fine Ground Raw Pigment.

With light raw oil: Ridgeway's 7k. Mahogany Red.
With water .. : Ridgeway's 5"l between Prussian Red and Hæmatite Red.

Portion of the fine ground pigment was roasted in air and then further ground in both oil and water.

Colour of Fine Ground Roasted Pigment.

With light raw oil: Ridgeway's 6k. between Morocco Red and Mahogany Red.
With water .. : Ridgeway's 3"k. Indian Red.

Remarks.

This is a much denser red oxide than the sample of imported Spanish Red Oxide obtained from Minerals (Vic.) Pty., Ltd. (Lab. No. 3318/44). The colours in oil are similar, but the distemper is not such a bright red, being nearer the local, Minerals (Vic.) Standard O/2DH Spanish Red (Lab. No. 3319/44).

Lab. No. 3319/44.

Description: Sample of Minerals (Vic.) Pty. Ltd. Standard O/2DH, said to be sold as a substitute for previously imported Spanish red oxide.

Mineral Determination.

Mainly hematite with a little limonite and clay matter.

Composition.

	%
SiO_2	4.30
Al_2O_3	4.80
Fe_2O_3 (total iron as)	88.20
MnO_2 (total manganese as) ..	0.03
MgO	Nil
CaO	0.26
$H_2O\pm$	3.14
TiO_2	0.05
CO_2	N.D.
P_2O_5	N.D.
	100.78

Colour of Pigment as Received.

With light raw oil: Ridgeway's 5k. Morocco Red.
With water .. : Ridgeway's 5"k. Prussian Red.

The sample was not finely ground, and would be unsuitable for use as a pigment in this form. The prepared oil and water paints show segregation of lighter and redder material to the surface, although to a considerably lesser degree than with imported Spanish Red.

Both samples were dry ground and then further ground in both oil and water, smooth even brushing paints resulting.

Colour of Fine Ground Raw Pigment.

With light raw oil: Ridgeway's 5k. Morocco Red.
With water .. : Ridgeway's 5"m. Haematite Red.

Colour of Fine Ground Roasted Pigment.

With light raw oil: Ridgeway's 5k. Morocco Red.
With water .. : Ridgeway's 5"l, between Prussian Red and Haematite Red.

Lab. No. 3795/44.

Description: Sample of rejects from beneficiation of ochre from M.L. 370H, Ophthalmia Range. Sample supplied by Minerals (Vic.) Pty. Ltd.

Mineral Determination.

Haematite (oxide of iron) with some opal (hydrous silica and a little quartz.

Composition.

	%
Fe_2O_3 (ferric oxide)	93.14
Insoluble in acids	2.23

The material was finely ground, then further ground in both oil and water.

Colour of Fine Ground Raw Pigment.

With light raw oil: Ridgeway's 7k. Mahogany Red.
With water .. : Ridgeway's 1"'k. Dark Livid Brown.

Portion of the sample was roasted in air and further ground in both oil and water.

Colour of Fine Ground Roasted Pigment.

With light raw oil: Ridgeway's 71, between Mahogany Red and Bay.
With water .. : Ridgeway's 5"'k Dark Vinaceous Brown.

Body and Covering Capacity.

The body of the raw pigment in both oil and water is dense, but is impaired to some extent by roasting.

Conclusions.

The sample is composed mainly of hard hematite grains which require extremely fine grinding to produce an easily brushing paint, when finely ground in oil or water.

The oil paint is dense and bright, the colour being somewhat browner than Lab. No. 3319 (local substitute for Spanish Red). When ground in water, the water paint is a dark purplish-brown haematite colour, and it is unchanged by roasting in air. Continued grinding does slowly improve the colour.

CONCLUSIONS.

The two samples of imported Spanish red have a similar chemical composition and produce paints with colours of the same order, but they show wide differences in their ferric oxide content. The analysis of the sample from McLeod and Company (Lab. No. 5013/44) is more comparable with available published information concerning the composition of Spanish Red Oxide* than that from Minerals (Vic.) Pty. Ltd. If the wide differences in ferric oxide content as is indicated by these two samples do exist in imported Spanish Red Oxide however, then it is obvious that the physical properties (particularly the colour) of the ochre, not the chemical composition, is the main consideration with present buyers. It is thought however that with red ochres of suitable physical properties those with the higher ferric oxide content will produce better quality and more durable paints. If this can be proved there is some justification in recommending the use of Ophthalmia Range ochre in preference to Spanish Red oxide when conditions again return to normal, as the Ophthalmia Range ochre has a higher ferric oxide content and similar physical properties. In this regard the form in which the ferric oxide occurs is important, and from a visual examination there appears to be more specular hematite in the ochre from local deposits than in the imported Spanish Red oxide. Judging from the results obtained from the sample of reject from the beneficiation of Ophthalmia Range ochre, which consisted largely of specular hematite, specular hematite is an undesirable constituent in the local ochre when utilised directly for paint manufacture as is being done at the present time.

REPORT ON YINNIETHARRA MICA PROJECT LYONS DISTRICT, NORTH-WEST DIVISION.

By R. S. Matheson, B.Sc.

CONTENTS.

PLANS.

Geological Plan, Vicinity of Workings, Yinnietharra Mica Project. Scale: 100 feet to inch.

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*Wilson, H., Iron Oxide and Mineral Pigments of the United States, U.S. Bur. Mines, Bull. 370, p. 48.

GENERAL INFORMATION.

An examination of the Yinnietharra Mica Project was made during the period 21st to 26th June, 1944, in the company of Mr. H. B. Owen of the Mineral Resources Survey.

The workings are situated on a low rise approximately 1 mile, on a bearing of 285 degrees, from the Cairn on M.C. 173H, and the deposit being mined corresponds with deposit "D" referred to in a previous report* by the writer prepared in 1942.

The mining operations are being carried out by the Commonwealth Minerals Production Directorate with a view to obtaining supplies of clear mica, which is in demand for war purposes, but so far they have resulted in a considerable financial loss. As will be seen later in this report, this is believed to be mainly due to too severe grading and trimming in Melbourne on the consignments of trimmed mica from the mine, not to any shortage of commercial sheet mica in the deposit. The urgent demand for high quality mica, led to the adoption of mining and dressing practices, which would not be recommended under normal conditions, and this has no doubt also contributed to the economic failure of operations to date.

Water suitable for mining purposes occurs in the main shaft, and was encountered at a depth of 60 feet from the surface, but water for domestic purposes is being carted from a station well a few miles distant.

Access to the mine can be obtained, either by the Airlines (W.A.) Ltd., plane which passes through Yinnietharra on its weekly service between Perth and Port Hedland; by the mailman from Carnarvon who passes through Yinnietharra weekly; or by the cartage contractor who makes a trip to the mine fortnightly from Mullewa. Urgent communications are received and despatched from the mine by wireless while Yinnietharra Homestead is the telephonic communication with Carnarvon. A suite of specimens from the area (registered numbers 2/2899 to 2/2942) has been added to the Geological Survey collection.

* Matheson, R. S., Report on the Mica Deposits in the Yinnietharra, Ajana, Northampton and Mullalyup Districts. Unpublished.

PRODUCTION.

Table 1, which has been compiled from official records, shows the production from the Yinnietharra Mica Project from the commencement of production on 25th August, 1943, to 18th July, 1944. At the time of inspection results had only been received up to consignment No. 16 but those for consignments Nos. 17 to 19 inclusive, have since come to hand. The results for consignments Nos. 20 and 21 are still outstanding. The mica produced has been chiefly of commercial clear quality, but varying amounts of stained and spotted mica, details of which are shown in Table II, were included in some of the early consignments. The stained and spotted mica recorded did not come from the present workings, but was obtained from old workings; chiefly those of the old "Mica King" mine.

Further details concerning the quantities, and the proportions of the various sizes of sheet mica recovered, can be obtained by reference to Mines Department File 619/43.

The value of various consignments shown in Table I includes the value of the scrap, the price of which was 1½d. per lb.

High quality beryl also occurs in the pegmatite dyke being mined, but its scarcity can be judged from the fact that only one consignment weighing 1,169 lbs. and assaying 13·24 per cent. BeO, which was obtained from the mining of 10,250 tons of dyke rock, has so far been despatched from the mine.

GEOLOGY.

The area in which the workings of the Yinnietharra Mica Project are situated is composed of granulated quartz-muscovite-biotite schists and gneisses, which have been intruded by a large pegmatite dyke, and by numerous small quartz veins. Outside the area mapped bands of amphibolite schist (specimen 2/2914) are included in the country rocks. The complex is presumably of Pre-Cambrian age.

TABLE I.

PRODUCTION OF MICA FROM YINNIETHARRA MICA PROJECT TO 18TH JULY, 1944.

Consignment Nos.	Case Nos.	Nature of Mica Consigned.	Quantity† Consigned.	Quantity Sheet Recovered.	Scrap.	Total Value.	Recovery of Sheet.
			lb.	lb.	lb.	£ s. d.	%
Special	1	Specially Trimmed	15	15	...	4 18 0	...
1	2–6	Thumb Trimmed	361	139½	220	46 17 6	38·6
2	7–10	do. do.	374	47	324	27 18 10	12·6
3	11–16	do. do.	617½	94½	518	50 12 3	15·3
4	17–22	do. do.	628¼	92	530	43 9 1	14·6
5	23–34	do. do.	1,199	146½	1,044	67 13 0	12·2
6	35–45	do. do.	1,205½	159¾	1,040	67 16 0	13·2
7	46–49	do. do.	422	45½	378	19 11 1	10·8
8	50–64	do. do.	1,538	205½	1,325	70 0 9	13·3
9	65–84	do. do.	2,047¾	206½	1,835	78 8 11	10·1
9A	85	Specially Trimmed	90½	90½	...	60 6 0	...
10	86–135	Thumb Trimmed	5,224¼	266½	4,956	146 7 4	5·1
11	136–150	do. do.	1,564½	276	1,285	152 8 1	17·6
12	151–165	do. do.	1,627	289½	1,296	176 6 9	17·7
13	166–175	do. do.	1,054½	198½	855	111 6 8	18·7
14	176–185	do. do.	1,045	183¾	845	90 14 0	17·5
15	186–188	Sickle Trimmed	304	51	251	39 16 0	16·5
16	189–190	do. do.	232	46	185	22 9 8	20·0
17	191–193	do. do.	327	140¾	185	83 7 3	43·0
18	194–197	do. do.	424	159¼	264	81 3 9	37·5
19	198–199	do. do.	223	128¼	94	60 12 0	57·5
20	200–201	do. do.	209	}	Results not yet to hand.		
21	202–204	do. do.	302	}			
Totals to Consignment 19			20,523¾	2,981½	17,430	1,511 2 11	14·5

† Weights stated are those given by Melbourne Store, except for Consignments 20 and 21.

TABLE II.

STAINED AND SPOTTED MICA INCLUDED IN PREVIOUS TABLE BUT NOT OBTAINED FROM PRESENT WORKINGS.

Consignment Nos.	Quantity Consigned.	Sheet Recovered.	Value. £A.
	lbs.	lbs.	£ s. d.
Special	12	12	4 0 0
1	213½	99¼	33 19 2
8	582½	100	23 11 0
9	767	107¼	23 8 8
10	107	16½	3 3 8
Total ...	1,682	435	£88 2 6

The strike of the schists and gneisses varies from N. 35° W. to N. 50° W. and the dip from about 80° N.E. to 80° S.W. Lineations, which have a fairly constant pitch of 35° S.E., are showing on the schist and gneiss walls in several places in the workings. The country rocks are tourmalinised and garnetiferous in places, and this is particularly noticeable near the boundaries of the pegmatite. Albitisation and muscovitisation of the wall rocks (specimens 2/2917 and 2/2916) have also occurred. Magnetite is present in the country rocks in places, and a few crystals were picked up on the surface about 6 chains south of the main open cut.

The pegmatite dyke is irregular but has a general northeasterly strike and a fairly steep northwesterly dip. It is aparently a metamorphic pegmatite*, formed by progressive replacement of an original microcline pegmatite dyke. The dyke varies from coarsely granitic in texture to coarsely crystalline, and consists mainly of felspar (microcline and oligoclase), quartz and muscovite mica, but tourmaline garnet, beryl, and biotite also occur in the dyke as well as very small amounts of manganese oxides.

Microcline occurs as large crystals up to 4 feet 6 inches in length in the coarsely crystalline part of the dyke, and as small residuals in the granitic part. The microcline shows incipient replacement by oligoclase, both in mass, and in the form of irregular veinlets and stringers along its cleavage planes. Specimens (2/2899 to 2/2903 and 2/2924 to 2/2926) showing the different types of replacement have been added to the Geological Survey Collection. Quartz was also seen replacing large microcline crystals in places in the workings.

Oligoclase† is abundant in the dyke and occurs, as large masses where it has replaced large microcline crystals, and as small masses, intergrown with quartz and muscovite, in the granitic portion.

Large, irregular, lenticular masses of milky, translucent, partly banded quartz, occur in close association with the large masses of oligoclase and the large microcline crystals. The quartz has replaced microcline and probably oligoclase also, but the indications of the latter are not quite so definite. Small masses of quartz, which may or may be not, of the same age as the large masses of replacement quartz, occur in the granitic part of the dyke.

Muscovite occurs in the dyke as large books around the margins of the lenticular masses of replacement quartz, as small books in the granitic part, and as fine scaly veinlets of erratic occurrence. The manner of occurrence of the large muscovite books suggest that they are later in age than the large replacement quartz masses. The small book muscovite however may be at least in part an original constituent of the dyke, while the fine scaly muscovite may belong to a still later replacement phase.

Beryl has a sporadic distribution, but where found is in close association with the large muscovite books around the margins of the replacement quartz masses. It is yellow to yellowish-green in colour, and well formed crystals enclosed by mica books were seen in several places in the workings. The beryl is reported to have been most abundant on the hanging wall side of the dyke.

Well formed crystals of both tourmaline and garnet* are of widespread occurrence in the dyke, and intergrowths of each of these minerals with microcline, with oligoclase, with quartz, with book muscovite and with scaly muscovite were noted. In the western open cut a garnet vein (specimen 2/2919) can be seen intruding the granitic portion of the dyke. The wide mineral associations of the garnet and tourmaline suggest that they were formed at a late stage in the replacement of the dyke.

Biotite was seen scattered through a narrow granitic zone along the footwall of the dyke in the Western Open Cut, and its development instead of muscovite may be due to the assimilation of some of the wall rock.

The accessory mineral phase, during which minerals such as columbite, tantalite, tin, bismuth, etc., are deposited, is not represented in the dyke, and this may be due to the low accessory mineral content of the solutions, or to replacement being interrupted by early consolidation.

The coarsely crystalline portion of the dyke has a variable width, and, in general, is distributed somewhat discontinuously along, but not always in contact with, the walls. The granitic portion on the other hand occupies most of the central part of the dyke, but in the Main Open Cut a narrow coarsely crystalline zone extends from the footwall to the hanging wall.

A detailed study of the pegmatite will be necessary to determine the relationships and order of deposition of the various minerals, but from the evidence so far obtained it is highly probable that the order of deposition will be similar to that found by Anderson† in pegmatites in Idaho. These dykes which are believed to have originally consisted of graphic microcline granite, have been progressively replaced by albite, quartz, muscovite, tourmaline, beryl, garnet, and quartz with accessory minerals.

The quartz veins scattered through the country rocks are probably all of pegmatite origin, and two veins can actually be seen branching off the pegmatitic dyke near its south-western end. The tourmalinised and garnetiferous patches in the country rocks appear to be closely associated with these quartz veins.

THE WORKINGS.

The mica-bearing pegmatite has been mined in three places by means of open cuts, namely, the Main (or No. 1) Open Cut, the Western (or No. 2) Open Cut and the Eastern (or No. 3) Open Cut, but mining has been concentrated chiefly in the Main Open Cut. Due no doubt to the urgent need for mica, mining has been carried out over the full width of the dyke in both the Main and Western Open Cuts, and consequently the quantity of crude mica recovered per ton of dyke rock mined has been low (1.5%), and the cost of its recovery high. The proportion of crude mica recovered to dyke rock mined would have been greater, and the cost of its recovery probably less, had selective mining of the mica shoots been undertaken.

Main Open Cut.

The dyke has been mined in this open cut over a length of 200 feet, an average width of 20 feet, and to a depth of 45 feet, for about 130 feet of its length from the eastern face. There are two benches in the remaining 70 feet of the open cut, one 14 feet from the surface and the other 29 feet from the surface. The section of the dyke, which has been open cut to 45 feet, has a fairly constant steep dip, and is intersected by a crosscut at 84 feet from the surface. Mica shoots of variable width occurring on both the hanging wall and footwall have been mined, and the footwall shoot is well exposed along the

*Hess, F. L., Pegmatites, Econ. Geol., Vol. XXVIII, No. 5, Aug. 1933, pp. 447 to 462.

†Determined as Oligoclase $Ab_{82}An_{18}$ by Dr. K. R. Miles.

*Almandine variety Lab. No. 3223.

†Anderson, A. L., Genesis of the Mica Pegmatite Deposits of Latah County, Idaho., Econ. Geol., Vol. XXVIII, No. 1, Jan.-Feb., 1933, pp. 41-58.

north-western wall of the open cut at the 45 feet level. Mica books occur abundantly here, and also in the 84 feet level crosscut and in the rise connecting the two levels. Mica books are estimated to compose about 15 per cent. of the dyke in these places.

As the dyke in the main open cut, passes from the deeper to the shallower section, there is a sudden change in strike and variations in dip occur. The dip is steep near the surface, and practically flat on top of the two benches, but it steepens again deeper down. This flattening in dip is in the form of a fold, which pitches flatly to the north-northeast near the surface, but which steepens with depth. The abundance of mica and the extent of replacement in the vicinity of this fold, suggest that it has been the principal channel of entry of the hydrothermal solutions.

Western Open Cut.

In this open cut the pegmatite dyke has been mined over a length of 90 feet, and an average width of about 15 feet. Mining has been carried out to a depth of 18 feet for a length of 60 feet from the eastern face of the cut, but to only about 3 feet for the remaining section.

The footwall side of the dyke has a coarse granitic texture and is composed mainly of oligoclase, quartz and small muscovite books, scattered through which are small microcline residuals, tourmaline, garnet and biotite. The hanging wall side of the dyke is coarsely crystalline and consists chiefly of large microcline crystals which are partly replaced by oligoclase, and scattered large muscovite books occurring in association with irregular mases of replacement quartz. No beryl was noted in the workings but a few pieces were picked up around the edges of the open cut.

Eastern Open Cut.

This open cut has a length of 60 feet, an average width of 20 feet, and a depth of 10 feet, and mining has been confined to the hanging wall side of the dyke. With the exception of a 15 inch zone on the hanging wall, which is coarsely crystalline, the exposed section of the dyke is mainly of granitic texture, and is composed of a mixture of oligoclase, quartz, small muscovite books, microcline residuals, tourmaline and garnet. The coarsely crystalline zone is composed of oligoclase, large muscovite books and scattered tourmaline.

MICA DRESSING.

The mica books are separated from the broken dyke rock in the open cut, and, with the exception of obviously useless books, are sent to the stock pile at the surface. The mica cutters sort and obtain their supplies as needed from the stock pile, after which the books are split, and the useful mica roughly sickle trimmed and packed in boxes. Sickle trimming has only been introduced at the mine from, and including, consignment 15. The earlier consignments were thumb trimmed, and the recovery of thumb trimmed mica from crude mica was about 5.2%. The proportion of sickle trimmed mica to crude mica should be less, but the actual figure has not been obtained, as the quantity of crude books trimmed since consignment 15 is not known.

Final trimming and grading of the mica is not attempted at the mine, as under existing arrangements this is done at the Central Mica Store of the Minerals Production Directorate, in Melbourne.

Tests carried out by Mr. H. B. Owen and the writer, on two cases of rough sickle trimmed mica from consignment 21, indicated that a fairly high quality product is being despatched from the mine. The results of these tests were as follows:—

Weight of Sample.	Clear and/or Commercial Clear.	Stained or Spotted.	Scrap.	Test by.
	%	%	%	
4 lbs. ...	26·5	47·0	26·5	H.B.O.
3 lbs. 4 ozs.	34·5	34·5	31·0	R.S.M.
Average ...	30·5	40·75	28·75	...

By bulking and grading the clear and/or commercial clear mica obtained from the two samples the relative proportions of the different sizes of this quality mica were found to be as follows:—

Grades 3 and 4	26%
Grade 5	54%
Grade 6	20%

Also consignment 20 was inspected and appeared to be similar in quality to the consignment tested.

Earlier tests carried out by Clarke and Glover on the thumb trimmed consignments indicated that the recovery of commercial sheet mica should have been 26.5% and 30% respectively.

At the time of inspection results had been received from Melbourne up to consignment 16, and the actual recovery of commercial sheet ranged from 5 to 20%*, and averaged 14.4%. Results which have come to hand since that time however, have shown a marked improvement in recovery, but still compare unfavourably with the results from tests made at the mine. All the sheet mica so far recovered, has been classed in Melbourne as of commercial clear quality.

The mica referred to as stained or spotted in the above tests contains minute mineral inclusions, and occasionally small flat tourmaline crystals, between the lamina. Although this mica is of inferior quality to the clear and commercial mica, it is still of commercial use as spotted mica.

CONCLUSIONS.

1. The proportion of crude mica recovered to dyke rock mined would have been greater and the cost of its recovery probably less had the normal practice of selectively mining the mica shoots been followed.

2. A better recovery and an increase in output of rough trimmed mica could probably be effected at the mine by employing a sorter on the stock pile, and allowing the cutters to concentrate their efforts entirely on trimming. Other minor improvements in the mica dressing process could also be made, but there is little incentive to make them while between 80 and 95 per cent. of consignments to Melbourne are being discarded as scrap.

3. The low recovery of commercial sheet mica to date is believed to be due chiefly to too severe grading at the Melbourne store, not to the mica consignments being of poor quality. The reasons for this are as follows:—

(a) To the time of inspection, little difference in recovery of commercial sheet mica had occurred whether the consignments were thumb trimmed or sickle trimmed. A marked increase in recovery would normally be expected with an improvement in dressing.

(b) Results from Melbourne are incomparable also, in regard to sizes and quality, with all tests, which have been carried out at the mine. Some of these tests were actually carried out by the Minerals Production Directorate's own mica experts.

(c) No mica from the mine has ever been graded in Melbourne as clear mica, although numerous apparently clear, flawless sheets were noted during the recent investigations.

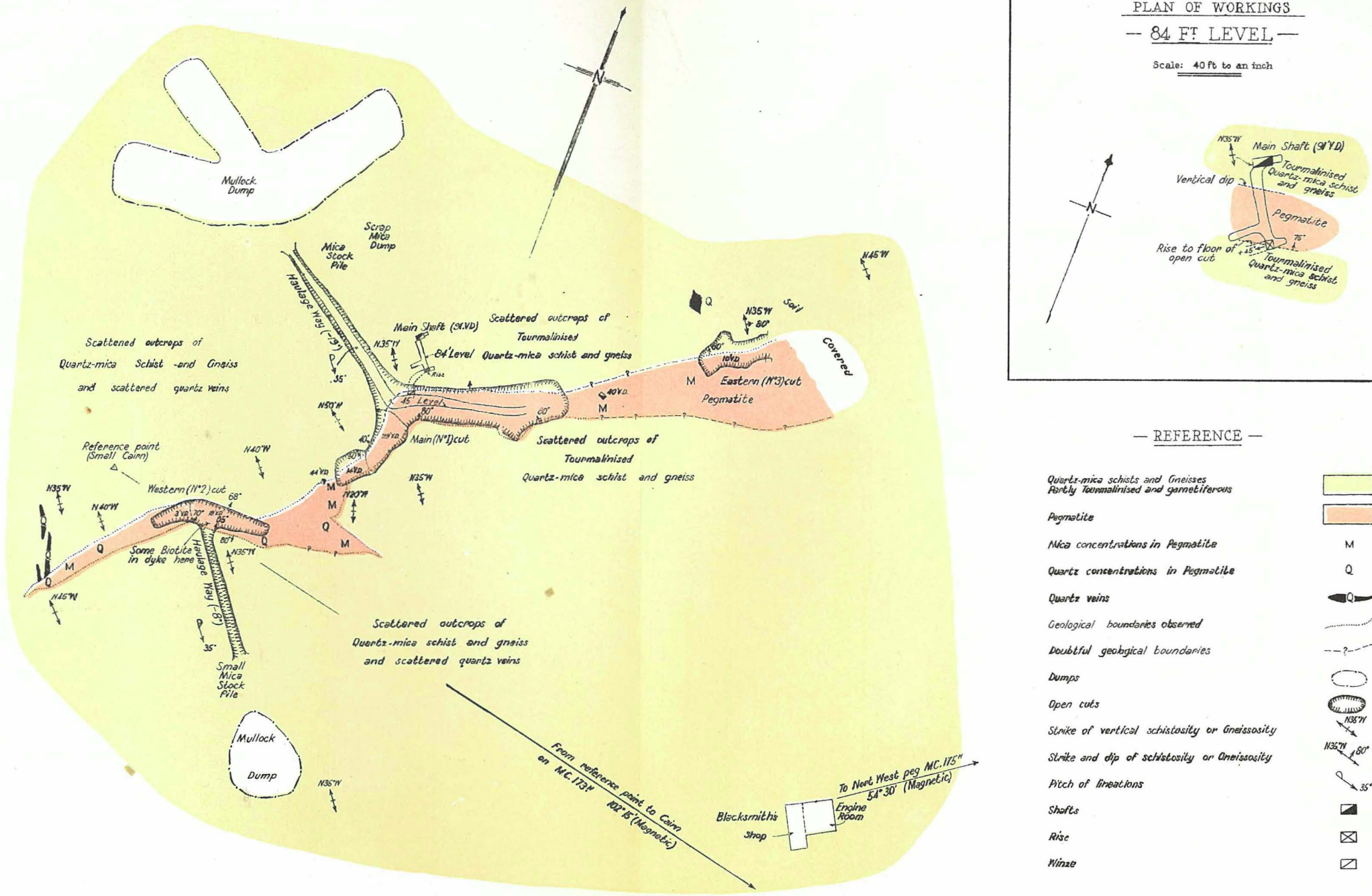
(d) No allowance has ever been made for any stained or spotted mica in the mica consignments produced from the mine, although recent tests indicate that 34.5 per cent. of the sickle trimmed consignment should be graded as such. It would appear that mica of this quality is being discarded as scrap, or being ruthlessly trimmed to obtain very small sheets of commercial clear mica.

*See Table I.

PLATE XII

PLAN OF WORKINGS
— 84 Ft LEVEL —

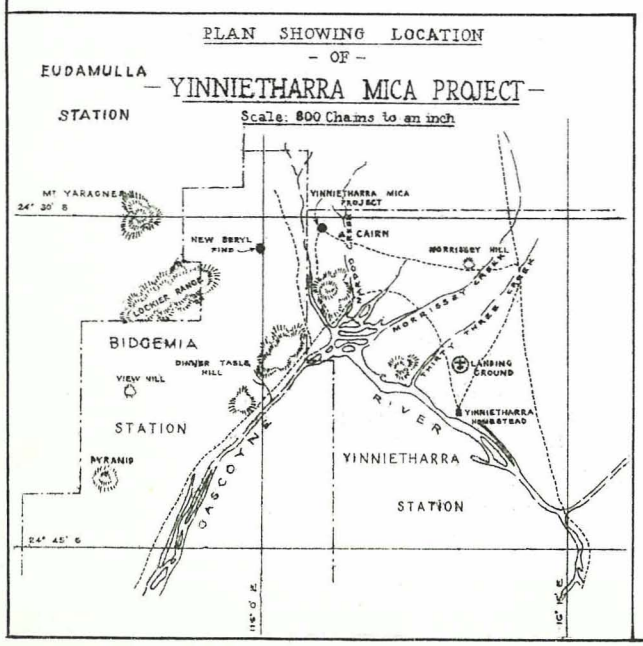
Scale: 40 ft to an inch



— REFERENCE —

Quartz-mica schists and Gneisses Partly Tourmalinised and garnetiferous	
Pegmatite	
Mica concentrations in Pegmatite	M
Quartz concentrations in Pegmatite	Q
Quartz veins	Q
Geological boundaries observed	
Doubtful geological boundaries	---?---
Dumps	
Open cuts	
Strike of vertical schistosity or Gneissosity	N35°W
Strike and dip of schistosity or Gneissosity	N35°W 80°
Pitch of lineations	35°
Shafts	
Rise	
Winze	

PLAN SHOWING LOCATION
- OF -
— YINNIETHARRA MICA PROJECT —
Scale: 800 Chains to an inch



Compass and Tape Survey and Geology by R.S. Matheson and H.T. Owen June 1941.

— GEOLOGICAL PLAN —
VICINITY WORKINGS
YINNIETHARRA MICA PROJECT
LYONS DISTRICT
NORTHWEST DIVISION

Scale: 100 feet to an inch

(e) Satisfactory results have been obtained for a few small parcels of Yinnietharra mica, which received final trimming in Perth, or at the mine, prior to their despatch to Melbourne. This shows that what constitutes commercial mica is known locally, and there is little reason therefore to doubt the authenticity of local tests, which in some instances were carried out by the persons who trimmed these parcels of mica.

4. Approximately 150 tons of crude mica books have so far been obtained from the Main Open Cut, and judging from abundance of mica showing in the workings at present, it is not unreasonable to expect that at least an equal quantity of crude mica will be obtained by completely mining this section of the dyke to the 84 feet level. Mica books also occur in sufficient abundance in a few unworked sections of the dyke to warrant some attention.

5. The large mica books generally occur in the coarsely crystalline portion of the dyke around the margins of irregular, lenticular masses of replacement quartz. The lenticular quartz masses are often connected by narrow quartz veinlets. These facts should be borne in mind while prospecting.

6. The north north-easterly pitching fold in the pegmatite should be followed if mining is undertaken to any depth, as present indications suggest that it has been the principal channel of entry of the hydrothermal solutions. The best mica shoots occur in the vicinity of this fold in the present workings, and may continue to do so to depth.

7. The practice of forwarding rough trimmed mica to Melbourne for final trimming and grading is not favoured, and, under normal conditions, it is recommended that this be done at the mine. The present practice entails high freight on the low value scrap content of consignments and more handling of the mica, and the producers have little idea of the value of consignments.

REPORT ON M.C. 291H FOR BERYL, YINNIETHARRA.

North-West Division.

By R. S. Matheson, B.Sc.

During my recent visit to the Yinnietharra Mica Project I made a brief inspection of this mineral claim. The short time spent at Yinnietharra did not allow for more than very superficial inspection of the beryl occurrence on M.C. 291H, but was sufficient to confirm the existence of a beryl deposit with reasonable mining prospects. The results of the inspection are given below.

The beryl deposit occurs on the north-eastern slope of a low hill situated about 200 yards N. 25° W. of the Cairn on M.C. 291H (late M.C. 175H). The deposit was noted during my previous investigations in the district in December, 1942, when it was estimated that the quantity of large fragments of eluvial beryl crystals scattered on the hillside amounted to about 10 tons. Consignments of eluvial beryl, consisting of both large and small fragments, to date, have exceeded this figure amounting to about 30 tons. In addition sampling of two parcels of mixed lode and eluvial beryl, amounting to about 10 tons, is reported to be in progress.

The beryl occurs near the north-eastern wall of a wide pegmatite dyke, which in this section varies from coarsely crystalline to granitic in texture, and which contains irregular masses of quartz. The coarsely crystalline portion consists largely of microcline felspar which, in some places, is being replaced by albite. Small, irregular pockets and seams of spotted muscovite are scattered erratically through the dyke. Fragments of eluvial beryl were found distributed in a north-westerly direction over a length of 3 to 4 chains. Beryl was only seen in place in the pegmatite in the floor of the shallow workings, averaging 8in. deep, shown on Dr. Moss' plan, but as has been mentioned above time did not permit a thorough detailed examination of the pegmatite. The largest accumulations of eluvial beryl occurred in the vicinity of these workings suggesting that the concentration of beryl crystals has been greater in this part of the pegmatite than elsewhere. Observations of lode beryl occurrences in other pegmatite dykes in the district have shown that beryl is generally closely associated with mica, and occurs as single crystals or small groups of crystals, which are sporadically distributed, around the margins, but not within, irregular lenticular masses of replacement quartz. The lateral dimensions of the concentrations of beryl crystals in the pegmatite on M.C. 291H are exceptional, but in my opinion it is unlikely that the concentration represents the outcrop of a pipe of beryl crystals which will persist continuously to any depth.

Provided that the price of beryl is favourable to mining, the prospects are sufficiently encouraging, however, to warrant prospecting, particularly around the margins of the irregular lenticular masses of replacement quartz. It should be anticipated that the beryl concentrations will have a sporadic distribution and that selective mining would have to be adopted. It is possible that commercial mica, columbite or other commercial minerals may be associated with the beryl in some places, and the recovery of any of these minerals in addition to the beryl would assist in the success of mining operations.

BERYL DEPOSIT, BIDGEMIA STATION.

Lyons District, North-West Division.

By R. S. Matheson, B.Sc.

During investigations at the Yinnietharra Mica Project in June, 1944, a brief visit was made to a beryl deposit on Bidgemia Station, which had been located a few weeks previously by prospectors. The deposit is situated on a low rise about two miles on a bearing of 295 degrees from the west peg of old M.C. 45H. Its approximate position is shown on the locality plan accompanying the writer's report on the Yinnietharra Mica Project.

At this locality, broken portions of beryl crystals, up to about 18 inches between crystal faces, are scattered about on the surface near a coarsely crystalline, lenticular, pegmatite dyke. The pegmatite dyke strikes N. 40° W., and outcrops over a length of about 6 chains, and has a maximum width of 20 feet. The enclosing country is biotite gneiss, which has a general north-west strike and a vertical dip. The dyke is composed chiefly of large, irregular, unimineral masses of felspar, quartz and spotted and stained muscovite mica, but also contains beryl, columbite and tourmaline as minor constituents. The mica concentrations occur around the margins of the quartz masses, and the beryl also appears to be closely associated with the quartz masses, as eluvial beryl is most abundant in their vicinity. Judging from observations made elsewhere in the district, the lode beryl is likely to have a sporadic distribution around the irregular lenticular masses of quartz. Eluvial columbite which assays 31.3% Ta_2O_5 and 50% Nb_2O_5 (G.S.W.A. No. 2/2941, Lab. No. 3230) occurs fairly abundantly at the southern end of the dyke, and in the event of there being a demand for columbite of this grade, some prospecting in this vicinity is warranted.

At the time of inspection, it was estimated that about 3 tons of large beryl fragments were lying about on the surface, and about 1 ton had already been removed from the deposit.

Eluvial beryl is reported to be associated with a few other pegmatite dykes, occurring south-east of the one examined, but these deposits were not visited.

YANDANOOKA MICA DEPOSIT.

By R. S. Matheson, B.Sc.

This mica deposit, which is situated near the north-east corner of Location 19, about 2½ miles north north-east of Yandanooka Siding, was inspected on

17th September, 1944. It occurs on Mr. T. K. Bickle's property, and was first reported to the Mines Department by Mr. J. L. Crozier in December, 1943*.

The deposit occurs in a tourmaline-bearing pegmatite which strikes in an east-west direction, and has a width of 90 feet. The country rocks consist of steeply dipping mica schists, which have a general north-west strike. The pegmatite has a central quartz core, and a pocket of clay stained muscovite mica, which is exposed in a few potholes over a length of about 20 feet, occurs along the north-eastern boundary of the quartz. The muscovite is clear and fairly abundant, but the excessive flawing and warping of the books precludes any possibility of the deposit being successfully mined for sheet mica.

REPORT ON SOAPSTONE DEPOSIT.

Approx. 7 Miles E.S.E. of Moora.

Melbourne District, South-West Division.

By R. S. Matheson, B.Sc.

An inspection of this deposit, which is exposed in an old quarry for road material, situated on the western side of a low hill about ¼ mile south-southeast of the north-west peg of location M 394, was made on the 20th September, 1944.

The deposit is lenticular, and has a length of 250 feet and a maximum width of 27 feet. It has a general N.-S. strike and a dip 75° W., which are parallel to the strike and dip of the enclosing gneisses. The soapstone lens is sheared and intruded by quartz veinlets.

The gneisses are mainly of granitic composition, but a few thin bands of hornblende gneiss occur in a few places. These rocks are intruded by quartz and pegmatite veins, and also by bouldery dolerite dykes. In the vicinity of the quarry one dolerite dyke occurs 110 feet east of the soapstone lens, and another 115 feet west. These two dykes appear to connect with one another a few chains south of the quarry.

In the fresh state, the soapstone is a fine grained, light green foliated rock, composed of talc with some finely disseminated magnetite (Lab. No. 4018), associated with which are thin seams of anthophyllite and chlorite, and small irregular masses of silicified compact sericite with intergrown chlorite and quartz. On weathering the soapstone becomes yellowish or reddish-brown in colour.

Due to its highly schistose character, which makes it unsuitable for obtaining blocks, and due also to its lack of purity, the deposit is not likely to be of commercial grade.

REPORT ON TESTING FOUNDATIONS ON PROPOSED SITE FOR NEW GOVERNMENT BUILDINGS, RESERVE A↑1149, GOVERNMENT HOUSE GROUNDS, PERTH.

By R. S. Matheson, B.Sc.

CONTENTS.

* *vide* Mines File 160/43, p. 105.

GENERAL INFORMATION.

During the periods 21st August to 5th September, 1944, and 9th October to 20th October, 1944, two bores and three auger holes were drilled for the Principal Architect's Branch, to test the foundations on the proposed site for the new Government Buildings. The operations were carried out under the writer's supervision, and as well as determining the nature and attitude of the country, it was requested that representative samples of the clay beds encountered in the two bores be collected at approximately 2 feet intervals, for use in tests connected with determining their compressive strength and shrinkage under pressure.

GENERAL DESCRIPTION OF BORING OPERATIONS.

The two bores were drilled by boring contractors using a light mobile, percussion plant. Bores Nos. 1 and 2 were drilled 6 inches in diameter to depths of 64 feet and 57 feet 4½ inches respectively, below which the diameter of the holes was reduced to 5 inches. Bore No. 1 was cased to 72 feet and Bore No. 2 to 57 feet 4½ inches. Drilling was commenced in both holes with a shell auger bit, after which the first lengths of casing were put into the holes, and the percussion plant brought into operation. During the later stages in drilling a sand pump was used when passing through sand layers, and as a general rule, it was necessary to keep the casing about 1 foot in advance of the drilling bit to prevent sand from rising up the bore. When the clay layers were encountered the casing was driven into the clay for a few feet to seal off the ground water in the overlying sand layer. Any water present was then bailed out of the hole, and the hole carefully cleaned out to the top of the clay, after which drilling was resumed using a 4 inch or 5 inch socket and jar bars. Drilling was carried out with these tools ahead of the casing, until the next sand layer was encountered. The socket allowed for the recovery of about a 1 foot plug of clay after each run of the bit, and, as it was possible to remove the plug intact from the socket with the use of a jack, the equivalent of a core of the clay layers was obtained. The jar bars were used to drive the socket, and to ensure that the socket was always working in new ground, not reaming the hole as would be the case if it was continually rising and falling. After drilling through the clay layers, the casing was then driven down to the bottom of the hole, after which the clay reamings resulting from driving the casing were cleaned out and discarded. Drilling was then resumed with the sand pump using the method described above.

In a few instances slight water seepages occurred in the clay layers, and any overnight water accumulations in the holes, resulting from these seepages, were bailed out before drilling commenced the next morning.

The auger drilling was done by hand labour using a 2½ inch auger bit, a shell bit, a sand pump and 1 inch piping for drilling rods. About 35 feet of 3 inch piping in various lengths, were available for use as casing. It was necessary to case auger holes A and B over their entire depth, but auger hole C was mainly in clay and the hole only had to be cased through the top sand. The auger holes were drilled to provide geological information, and no samples were required.

SAMPLING.

As the tests to be carried out on the samples are largely dependent on the moisture content of the clay in its natural state, great care had to be exercised to prevent moisture loss, or contamination with water, of the samples. It was also necessary to avoid contamination of the clay with sand, as this would affect its strength.

From the previous section, it can be seen that every practicable precaution was taken during boring operation, to ensure against contamination of the samples with sand or ground water. Also, where any of the plugs recovered showed signs of contamination from slight water-seepages, which in a few instances occurred in the clay layers, the contaminated exterior of the plug was excluded from the sample.

The samples were about 2 lbs. in weight, and, where the clay was uniform in character, they were collected

at approximately 2 feet intervals. Where variations in character occurred, samples were collected more frequently.

To avoid moisture loss by evaporation, each sample was placed in an air tight glass jar immediately after it had been collected.

At the completion of boring operations the samples were delivered to the Government Mineralogist and Analyst, where it is understood the following determinations will be made:—

Absolute specific gravity (and voids ratio).
Moisture content.
Lower plastic limit.
Lower liquid limit.
Shrinkage limit.

The methods of carrying out these determinations are described in a publication by Hogentogler.*

It is reported that the compressive strength and the amount of shrinkage under pressure of the clay, can be determined by a comparison of the results of these tests, with standard tables.

GEOLOGY.

By reference to the accompanying geological section, which has been compiled from the results of the recent drilling and of a few of the previous auger holes (drilled 1936) it will be seen that the country rocks in area investigated are composed of interbedded layers of clay and sand. Except at their boundaries with the water-bearing sand beds, and in proximity to intercalated water-bearing sandy seams, the clay beds are fairly dry and compact. There is a fall of about 30 feet from north to south on the line of section.

A large dump of yellow sand filling occurs at the northern end of the area, and this rests on a shallow layer of sand and old filling which is continuous over the whole of the area.

The top clay occurs immediately below this sandy layer, and consists mainly of grey clay with zones containing yellowish, brownish and/or red patches and streaks. In some places however, the clay is gritty, and contains a few sandy seams from which there are slight water seepages. Traces of organic matter are present.

Below the top clay a lenticular water-bearing sandy bed occurs, which consists of interbedded layers of fine to coarse grained sand and waterworn pebbles. A few thin clay seams are also present, in particular, near the upper and lower boundaries of the bed. The thickness of the waterworn pebble layers is indefinite as it is probable that some of the pebbles remained in the hole for a few feet before being picked up by the sand pump. The pebbles consist of quartz, aplite, quartzite and fuchsite-bearing quartzite, and are of variable size up to 1½ inches long by 1 inch diameter. This bed lenses out between Bore No. 2 and Auger Hole B, and judging from results obtained during the 1936 auger drilling campaign, the lensing out occurs fairly regularly on both sides of the section, on a line trending approximately east and west.

A second clay bed occurs underneath the lenticular sand bed, and it is similar in character to the top clay. It is difficult to determine the junction between the two clay beds in Bore No. 2, as the intervening sand bed has lensed out, but it may possibly be at 33 feet 6 inches bore depth.

A sandy, sub-artesian water-bearing bed, with a pressure head of approximately 37 feet, occurs at the base of the second clay. It varies in thickness from 3 feet in Bore No. 1 to 5 feet in Bore No. 2, and is composed of medium to coarse grained sand, intercalated with which are thin clay seams. The presence of sub-artesian water in this bed suggests that it must have a dip, but the information obtained from Bores Nos. 1 and 2, and Auger Hole C, shows that it is fairly horizontal in the area investigated.

Below the sub-artesian water horizon, a third clay bed occurs, which consists of dark grey clay with green, yellow, and brown patches and streaks, and a few red, and white patches and streaks. The patches and streaks occur in vertical cracks, which may possibly represent old mud cracks. Occasional sandy layers and micaceous layers are present, and there is a slight water seepage from some of the sandy layers, and down some of the vertical cracks.

The third clay bed gives place at depth to a dark green, finely laminated, fossiliferous, clay shale, which contains occasional sandy seams and marl nodules. The thickness of the bed is not known, but it has been intersected for 43 feet in Bore No. 2. The bottom 25 feet in this bore was highly fossiliferous. With the exception of the samples for chemical work and a few representative specimens all the highly fossiliferous plugs from Bore No. 2 and also a few samples of fossiliferous material from Bore No. 1 have been handed to the University Geology Department for palaeontological investigations. The results of this work must be awaited to determine accurately the age of the clay shale but it appears likely that it will prove to be of Tertiary age.

From the available information, the strata appear to be conformable, but the difference in manner of deposition above and below the sub-artesian water horizon suggests to the writer that a disconformity may occur in the section.

*Hogentogler, C. A., Engineering Properties of Soil, First Edition, 1937.

BORES.

Log of Bore No. 1.

Commenced 21.8.1944. Finished 28.8.1944.

Location: Bearing 273 degrees, distance 3·25 chains, from the east corner of Reserve A↑1149, Government House Grounds.

Reduced Level of Site: 35.77 feet.

Bore Depth: 101 feet 9 inches.

Bore Depth.				Description.	Sample No.	Remarks.
ft.	in.	ft.	in.			
0	0—	9	3	Yellow sand with fragments of blue metal, brick and limestone	... ...	Filling.
9	3—	13	0	Medium grained black sand	... ...	*Water* at 13 ft.
13	0—	16	0	Medium grained grey sand		
16	0—	17	6	Sandy grey clay (fine grained sand)	No. 1, between 16 ft. and 17 ft.	Sample may be contaminated with sand from above.
17	6—	19	0	Sandy, yellowish clay	No. 2, between 17 ft. 6 in. and 18 ft.	
19	0—	19	6	Greenish grey clay	No. 3.	
19	6—	20	0	Grey clay with yellowish bands	No. 4.	
20	0—	20	6	Greenish grey sandy clay	No. 5	
20	6—	24	0	Greenish grey clay with yellow and brown seams and some organic matter	No. 6 between 22 ft. and 22 ft. 6 in.	Drier than No. 5.
24	0—	24	6	Greenish grey clay with brown seams	No. 7	Drier than No. 6.
24	6—	27	0	Greenish grey clay with brown seams	No. 8, between 25 ft. 6 in. and 26 ft.	Moister than No. 7.

BORES—*continued.*

Bore Depth.		Description.	Sample No.	Remarks.
ft. in.	ft. in.			
27 0	27 6	Sandy grey clay with brown seams	No. 9	
27 6	28 0	Sandy grey clay with yellow seams	No. 10	Sample contaminated with ground water.
28 0	28 2	Yellowish, clayey, sand	... ...	*Water seepage.*
28 2	30 9	Sandy grey clay with yellowish seams	No. 11, between 29 ft. and 29 ft. 6 in.	Sample contaminated with ground water.
30 9	31 6	Sandy grey clay with brownish seams	No. 12	
31 6	31 8	Medium grained grey sand	... ...	*Water seepage.*
31 8	33 5	Sandy grey clay seams alternating with grey clay seams	No. 13, sandy clay; No. 14, clay only	Changes to clayey sand at 33 ft. 5 in.
33 5	37 0	Coarse grained clayey grey sand (with thin clay seams)	... ...	*Water seepage* in this section.
37 0	38 0	Coarse grained clayey grey sand (with thin clay seams)		
38 0	40 3	Coarse white sand	... ...	Water added for boring.
40 3	44 0	Coarse white sand with medium grained seams		
44 0	46 0	Very coarse white sand with scattered waterworn pebbles	... ...	Pebbles consist of granitic quartz and quartzite up to $\frac{1}{2}$ in. x $\frac{1}{4}$ in.
46 0	48 0	Very coarse white sand with abundant waterworn pebbles (some very thin clay seams present)	... ...	Pebbles up to $1\frac{1}{2}$ in. x 1 in.
48 0	49 7	Coarse white sand with thin clay seams and scattered waterworn pebbles		
49 7	50 0	Medium grained sand with thin clay seams and scattered waterworn pebbles		
50 0	53 6	Fine to medium grained clayey sand with scattered waterworn pebbles	... ...	Some ground *water* between 50 ft. and 51 ft.
53 6	54 0	Coarse grained clayey sand		
54 0	54 6	Very coarse grained clayey sand with abundant waterworn pebbles		
54 6	56 0	Fine grey clayey sand with a few waterworn pebbles		
56 0	57 0	Very coarse sand		
57 0	57 6	Sandy grey clay	No. 15	
57 6	58 3	Grey clay with red patches and streaks, occasional greenish streaks	No. 16	
58 3	59 0	Grey clay with red patches and streaks, occasional greenish streaks	No. 17	Drier than No. 16.
59 0	61 0	Grey clay with red patches and streaks, occasional greenish streaks	No. 18, between 60 ft. and 61 ft.	
61 0	63 0	Grey clay with red patches and streaks, occasional greenish streaks	No. 19, between 62 ft. 6 in. and 63 ft.	
63 0	63 6	Grey clay with red patches and streaks, occasional greenish streaks		
63 6	64 0	Grey clay with yellowish and brownish patches and streaks	No. 20	
64 0	65 6	Sandy grey clay with brownish streaks	No. 21	
65 6	66 0	Very sandy grey clay	No. 23	Sample may be contaminated with ground water.
66 0	66 6	Very sandy grey clay	... ...	Water at 66 ft.
66 6	67 6	Very sandy grey clay with brownish patches		
67 6	68 0	Coarse grained clayey sand	... ...	Abundant sub-artesian *water*. Head approx. 37 ft.
68 0	69 0	Coarse grained clayey sand	... ...	
69 0	70 0	Coarse grained sand	... ...	
70 0	70 6	Coarse grained clayey sand	... ...	
70 6	71 6	Grey clay with yellowish-brown patches and streaks	No. 24, between 71 ft. and 71 ft. 6 in.	
71 6	71 8	Clayey sand	... ...	Slight *water* seepage.
71 8	72 6	Grey clay with yellowish-brown and red patches and streaks		
72 6	73 6	Grey clay with yellowish-brown and red patches and streaks	No. 25	
73 6	76 6	Grey clay with brown patches and streaks ...	No. 26, between 75 ft. and 75 ft. 6 in.	
76 6	78 6	Grey clay with brown patches and streaks ...	No. 27, between 77 ft. and 77 ft. 6 in.	
78 6	81 0	Grey clay with greenish-brown patches and white spots	No. 28, between 79 ft. and 79 ft. 6 in.	A few brownish nodules.
81 0	82 0	Grey clay with greenish-brown patches and white spots	No. 29, between 81 ft. 6 in. and 82 ft.	
82 0	83 0	Grey clay with greenish-brown patches and white spots and streaks	... ...	Streaks and patches in vertical cracks.
83 0	85 0	Grey clay with greenish-brown patches and red spots	No. 30, between 83 ft. 6 in. and 84 ft.	Water seepage between 84 ft. and 85 ft. Sample may be contaminated with ground water.
85 0	86 6	Grey clay with greenish-brown spots and streaks	No. 31, between 86 ft. and 86 ft. 6 in.	May be contaminated with ground water.
86 6	87 0	Grey clay with greenish-brown streaks		
87 0	88 0	Greenish-grey clay shale	... ...	A few marl nodules.
88 0	90 6	Greenish-grey clay shale	No. 32, between 89 ft. and 89 ft. 6 in.	Finely laminated.

LOG OF BORE No. 1—*continued.*

Bore Depth.	Description.	Sample No.	Remarks.
ft. in. ft. in.			
90 6—92 0	Greenish-grey clay shale	No. 33, between 91 ft. 6 in. and 92 ft.	Finely laminated.
92 0—93 0	Greenish-grey clay shale with whitish seam at 92 ft. 6 in.	... ...	Finely laminated.
93 0—95 6	Dark green clay shale	No. 34, between 95 ft. and 95 ft. 6 in.	
95 6—96 9	Dark green clay shale with shell fragments		
96 9—98 6	Dark green clay shale with shell fragments—shells more abundant	No. 35, between 98 ft. and 98 ft. 6 in.	
98 6—100 3	Dark green clay shale with shells and echinoid spines. A few sandy spots		
100 3—101 9	Dark green clay shale with a few thin sandy seams	No. 36, between 101 ft. and 101 ft. 9 in.	

End of Bore at 101 feet 9 inches.

OPERATIONS BORE No. 1.

From the surface to 9 feet 3 inches, drilling was carried out with a shell auger bit. At this depth a 10 feet 3 inch length of 6 inch casing was driven into the hole, and drilling was then continued ahead of the casing to 16 feet. An additional 7 feet 8 inches of casing was connected, and the casing driven to 18 feet, where it bottomed on clay and sealed off the ground water occurring at 13 feet. The hole was then cleaned out and drilling was continued with the shell auger bit to 30 feet 9 inches. An additional 14 feet 5 inches of casing was then connected and the casing driven to 31 feet. After cleaning the hole drilling was resumed with a 4 inch socket instead of the shell bit, and continued to 37 feet bore depth. A further 13 feet 11 inches of casing was then connected and the casing driven to 40 feet. Drilling was then resumed with the sand pump, and it was found that the casing had to be kept about 1 foot in advance of the drilling bit to make progress. If this was not done, sand rose up the bore. Some water was added at this stage to facilitate the work of the sand pump. Additional lengths of casing measuring 5 feet 4 inches and 11 feet 4 inches were connected at bore depths of 47 feet and 52 feet, respectively. Work ceased for the day with the bore 57 feet deep, at which stage 62 feet 11 inches of casing had been used and driven to 58 feet 9 inches. At the commencement of operations the next morning there were 10 feet of water in the bore. The casing was driven to 59 feet 6 inches, the bore was cleaned out and drilling was resumed using the socket.

Drilling was continued to 64 feet and then casing was driven to 63 feet 6 inches. Drilling was then continued to 69 feet. At commencement of operations the following morning there were about 37 feet of water and about 8 feet of sand in the bore. At this stage the casing was reduced from 6 inches diameter to 5 inches diameter. To commence with 69 feet 6 inches of 5 inch casing were lowered into the bore and drilling was continued with the sand pump. At 70 feet bore depth an additional 6 feet of 5 inch casing was connected and the casing driven to 72 feet. Drilling was then continued to 76 feet. At the commencement of operations the next day there was 2 feet of water in the bore, apparently from the seepage between 71 feet 6 inches and 71 feet 8 inches. Drilling was resumed with the socket and continued through fairly dry, compact clay to 84 feet, below which the clay became moister and there was an increase in water in the bore. Drilling ceased for the day at 86 feet 6 inches. At commencement of operations after the week-end there was about 48 feet of water in the bore which was bailed out before drilling was resumed with the socket. As drilling progressed it was found that the water rose about 8 feet in the bore in half an hour. The water was frequently bailed from the hole, and drilling was continued with the socket to 101 feet 9 inches.

LOG OF BORE No. 2.

Commenced 30/8/44. Finished 5/9/44.

Location: Bearing 1 degree, distance 2.25 chains, from the south corner of Reserve A↑1149, Government House Grounds.

Reduced Level of Site: 6.46 feet.

Bore Depth: 103 feet.

Bore Depth.	Description.	Sample No.	Remarks.
ft. in. ft. in.			
0 0— 2 3	Black sand with fragments of limestone, brick, and glass	... ...	Filling. *Water* at 2 ft.
2 3— 4 6	Coarse grey sand		
4 6— 5 0	Clayey sand		
5 0— 6 0	Yellow, clayey sand		
6 0— 7 0	Grey, very clayey sand		
7 0— 7 6	Light grey clay	No. 37	Fairly dry.
7 6— 9 6	Grey clay with yellow patches	No. 38 between 9 ft. and 9 ft. 6 in.	Fairly dry.
9 6—11 0	Grey clay with red spots		
11 0—11 6	Do.—with red patches	No. 39	Moister than No. 38.
11 6—12 2	Do.—with red patches more abundant		
12 2—12 4	Very sandy seam		
12 4—13 0	Sandy grey clay	No. 40, between 12 ft. 9 in. and 13 ft.	Moist.
13 0—16 0	Do.—with yellow and red patches	No. 41, between 14 ft. 9 in. and 15 ft.	
16 0—17 0	Do.—with yellow patches	No. 42, between 16 ft. 9 in. and 17 ft.	
17 0—17 9	Do.—with yellow patches	... ...	Becomes less sandy below 17 ft. 9 in.
17 9—19 0	Greenish-grey sandy clay with yellowish-brown patches and streaks	No. 43, between 18 ft. 9 in. and 19 ft.	

LOG OF BORE No. 2—*continued.*

Bore Depth.	Description.	Sample.	Remarks.
ft. in. ft. in.			
19 0—20 0	Greenish-grey sandy clay	... ...	Less sandy between 19 ft. 6 in. and 20 ft.
20 0—21 9	Greenish grey clay (practically no sand)	No. 44, between 21 ft. 6 in. and 21 ft. 9 in.	
21 9—23 0	Grey clay		
23 0—24 0	Grey clay with brown patches and white streaks	No. 45, between 23 ft. 9 in. and 24 ft.	
24 0—26 0	Grey clay with brown patches and white streaks	No. 46, between 25 ft 9 in. and 26 ft.	
26 0—27 0	Grey clay with reddish-brown and yellowish patches		
27 0—30 6	Greenish-grey clay with red, brown, and yellow patches, and white streaks	No. 47, between 28 ft. 9 in. and 29 ft.	
30 6—31 6	Greenish-grey clay with red patches	No. 48, between 31 ft. 3 in. and 31 ft. 6 in.	
31 6—33 9	Greenish-grey clay with bright red and yellow patches	No. 49, between 33 ft. 6 in. and 33 ft. 9 in.	Sandy seam with *water* seepage, 33 ft. 3 in.—33 ft. 6 in.
33 9—34 9	Grey clay with bright red patches (slightly gritty)		
34 9—35 9	Grey clay with bright red patches (not gritty)		
35 9—36 9	Grey clay with bright red and a few yellowish patches	No. 50, between 36 ft. 6 in. and 36 ft. 9 in.	
36 9—37 9	Grey clay with bright red and a few yellowish patches (slightly gritty)		
37 9—39 0	Grey clay with bright red and a few yellowish patches (gritty)	No. 51, between 38 ft. 3 in. and 38 ft. 6 in.	Becomes very sandy below 38 ft. 6 in.
39 0—41 0	Greyish, medium grained, clayey sand	... ...	Abundant sub-artesian water. Head: approx. 37 ft.
41 0—42 0	Coarse grained sand	... ...	
42 0—44 0	Medium grained sand with thin clay seams	... ...	
44 0—45 0	Greenish-grey sandy micaceous clay (fine grained sand)	No. 52, between 44 ft. 9 in. and 45 ft.	Moist.
45 0—45 6	Grey sandy micaceous clay	No. 53	Moist. Less sandy than No. 52.
45 6—47 0	Greenish-grey sandy micaceous clay	... ...	2 in. sandy seam with *water* seepage, between 46 ft. 7 in. and 46 ft. 9 in.
47 0—48 0	Dark greenish-grey sandy micaceous clay	No. 54, between 47 ft. 9 in. and 48 ft.	Moist. Less sand than between 45 ft. and 47 ft.
48 0—49 0	Dark greenish-grey micaceous clay with yellowish-brown streaks and a few sandy spots	... ...	Less sand than between 47 ft. and 48 ft.
49 0—51 0	Dark greenish-grey micaceous clay with yellowish-brown streaks but no sandy spots	No. 55, between 50 ft. 9 in. and 51 ft.	
51 0—52 0	Dark greenish-grey micaceous clay with yellowish-brown streaks and a few hard brown nodules		
52 0—54 0	Grey clay with yellowish-brown spots and streaks. Some greenish patches and white streaks below 53 ft. 9 in.	No. 56, between 53 ft. 6 in. and 54 ft.	Patches and streaks occur in vertical cracks.
54 0—56 0	Grey clay with yellowish-brown, green, and white patches and streaks		
56 0—57 0	Grey clay with yellow, brown, and red streaks ...	No. 57, between 56 ft. 9 in. and 57 ft.	
57 0—58 0	Grey clay with yellow, brown, and red streaks, with some white streaks	... ...	Moist, probably *water* seepage down vertical cracks.
58 0—59 0	Grey clay with yellow, brown, and red streaks but no white streaks	No. 58, between 58 ft. 9 in. and 59 ft.	Moist.
59 0—60 0	Grey clay with yellow, brown, and red streaks but no white streaks	... ...	Becomes greenish at 60 ft.
60 0—61 0	Dark green finely laminated clay shale	No. 59, between 60 ft. 9 in. and 61 ft.	No cracks.
61 0—63 0	Do. do. do. do.	No. 60, between 62 ft. 9 in. and 63 ft.	Moist.
63 0—66 0	Do. do. do. do.	No. 61, between 64 ft. 9 in. and 65 ft.	
66 0—67 0	Do.—with a little pyrite (?) and brown scales ...	No. 62, between 66 ft. 9 in. and 67 ft.	
67 0—70 0	Do. do. do. do.	No. 63, between 68 ft. 9 in. and 69 ft.	
70 0—71 0	Dark green finely laminated clay shale, with brown scales and a few gritty spots	No. 64, between 70 ft. 9 in. and 71 ft.	
71 0—73 0	Do.—with some carbonaceous matter	No. 65, between 72 ft. 9 in. and 73 ft.	
73 0—76 0	Do.—with some thin white bands	No. 66, between 75 ft. 9 in. and 76 ft.	Small coiled fossils between 75 ft. 9 in. and 76 ft.
76 0—79 0	Do.—no white bands	... ...	First gasteropod shell at 78 ft.
79 0—81 0	Do.—with scattered shell fragments	No. 67, between 79 ft. 9 in. and 80 ft.	
81 0—83 0	Do.—shells becoming more abundant. Some bluish bands at 83 ft.	No. 68, between 82 ft. 9 in. and 83 ft.	
83 0—85 0	Do.—a little pyrite (?) at 84 ft.		

LOG OF BORE No. 2—*continued.*

Bore Depth.	Description.	Sample.	Remarks.
ft. in. ft. in.			
85 0—88 0	Do.—abundant fossils	No. 69, between 85 ft. 9 in. and 86 ft.	
88 0—89 0	Do.—abundant fossils, including echinoid spines ...	No. 70, between 88 ft. 9 in. and 89 ft.	Tooth from between 89 ft. and 90 ft.
89 0—91 0	Do. do. do. do.		
91 0—92 0	Do. do. do. do.	No. 71, between 91 ft. 6 in. and 91 ft. 9 in.	
92 0—95 0	Do. do. do. do.	No. 72, between 94 ft. 9 in. and 95 ft.	
95 0—97 8	Do. do. do. do.	... ...	
97 8—98 0	Black micaceous clay shale, fossils less abundant, only brown scales		1 in. blue seam at 95 ft.
98 0—99 0	Very dark green clay shale with scattered shell fragments and white marl nodules		
99 0—100 0	Do.—with small fossils and carbonaceous matter. Some sandy spots and marl nodules	No. 73, between 99 ft. 9 in. and 100 ft.	Marl nodules formed around fossils.
100 0—102 0	Do.—with shells and carbonaceous matter	... ...	Sandy to 100 ft. 6 in., less sandy below.
102 0—103 0	Do.—with shells, carbonaceous matter and scattered marl nodules		

End of Bore at 103 ft.

OPERATIONS BORE No. 2.

Drilling was carried out between the surface and 2 feet 3 inches with a shell auger bit, at which stage 6 feet 11 inches of 8 inch casing was lowered into the hole and driven to 5 feet. A sand pump was then used to drill the hole to 4 feet and the casing was then driven to 7 feet. The hole was cleaned out to the top of the clay and drilling was continued with a 5 inch socket to 24 feet. At the commencement of operations, the following day, there was 4 feet of water in the bore, which was bailed out before drilling was resumed. Drilling was continued with the socket to 39 feet, at which depth abundant water was encountered which rose rapidly to about 6 feet from the surface. Drilling ceased for the day at 39 feet. At the commencement of operations the next day there were 37 feet of water and 3 feet of sand in the bore. The hole was cleaned out with the sand pump, and then 42 feet 4½ inches of 6 inch casing was lowered into the hole and driven to 42 feet 6 inches. The hole was then drilled to 44 feet with the sand pump. At this stage, an additional 6 feet 8½ inches length of casing was connected, and the casing driven to 47 feet. Drilling was then carried out to 47 feet with the 5 inch socket, and at this depth the casing was driven to 49 feet 6 inches. The hole was cleaned out and drilling was then carried out with socket to 57 feet bore depth. At the commencement of operations after the week-end, there was 52 feet of water in the bore. Two additional lengths of casing totalling 8 feet 3½ inches were then connected, and the casing was driven to 57 feet 4½ inches. The hole was then cleaned out, and drilling was continued with the socket to 91 feet. At the commencement of operations the next day there was 25 feet of water in the bore, which was bailed out before drilling was resumed. Drilling was then continued with the socket to 103 feet.

AUGER HOLES.

Log of Auger Hole A.

Drilling carried out in October, 1944.

Location: Bearing 360 degrees, distance 362 feet from the south corner of Reserve A↑1149, Government House Grounds.

Reduced Level of Site: 9 feet approximately.

Bore Depth: 28 feet.

Bore Depth.	Description.	Remarks.
ft. in. ft. in.		
0 0— 1 6	Brown sand with organic matter and limestone fragments ...	Filling. Water level at 1 ft. 6 in.
1 6— 3 0	Fine grey sand	
3 0— 4 10	Grey sand	Lighter in colour.
4 10— 6 0	Yellowish sandy clay with grey patches	
6 0— 7 0	Sandy grey clay	Slight water seepage between 6 ft. 6 and 7 ft.
7 0—11 0	Very sandy grey clay	
11 0—14 6	Sandy grey clay with brown patches and streaks	Less sandy than above.
14 6—17 4	Sandy grey clay	Sand content increases with depth.
17 4—21 0	Alternating layers of medium-grained and fine grained clayey sand	Water present.
21 0—22 0	Coarse sand with a few waterworn pebbles up to ¼ in. in size ...	
22 0—28 0	Alternating layers of medium-grained and coarse grained sand ...	

End of Bore at 28 feet.

Log of Auger Hole B.

Location: Bearing 358 degrees 30 minutes, distance 280 feet from south corner of Reserve A ↑ 1149, Government House Grounds.
Drilling carried out in October, 1944.

Reduced Level of Site: 7.5 feet approximately. *Bore Depth*: 30 feet.

Bore Depth.	Description.	Remarks.
ft. in. ft. in.		
0 0— 2 3	Black sand	Filling.
2 3— 4 0	Coarse grey sand	Water level at 2 ft. 5 in.
4 0— 6 0	Sandy grey clay with yellowish patches and organic matter	
6 0— 8 0	Grey clay with yellowish patches	
8 0—10 0	Grey clay with yellowish patches. Slightly sandy	
10 0—12 8	Grey clay with yellow and brown patches	Very yellow at 10 ft.
12 8—14 0	Coarse sand (slightly clayey)	Water seepage.
14 0—17 9	Brownish grey, micaceous clay	
17 9—18 0	Brownish grey, micaceous clay—has become sandy	Water seepage.
18 0—20 0	Sandy grey micaceous clay	
20 0—20 6	Sandy grey micaceous clay, very sandy	
20 0—22 6	Very coarse sand with waterworn pebbles up to ½ in. size ...	Water present.
22 6—24 0	Very coarse sand with waterworn pebbles up to 1 in. size ...	
24 0—26 0	Clayey sand	
26 0—30 0	Alternating layers of clayey sand and sandy clay	Water present. Probably top of clay layer at 30 ft.

End of bore at 30 feet.

Log of Auger Hole C.

Drilling carried out in October, 1944.

Location: Bearing 320 degrees, distance 375 feet from south corner of Reserve A ↑ 1149, Government House Grounds.

Reduced Level of Site: 6 feet approximately. *Bore Depth*: 39 feet.

Bore Depth.	Description.	Remarks.
ft. in. ft. in.		
0 0— 3 0	Sand with limestone fragments	Filling. Water level at 1 ft. 6 in.
3 0— 6 0	Coarse grey sand	
6 0— 8 0	Grey clay with yellow and brownish patches	A few red patches at 8 ft.
8 0— 9 0	Grey clay with red and yellow patches	
9 0—13 0	Red gritty clay with grey patches	
13 0—14 0	Gritty grey clay with yellowish, and a few red patches	
14 0—14 6	Very sandy grey clay	Water seepage.
14 6—15 6	Sandy grey clay	
15 6—17 0	Light grey, sandy clay with brownish and yellowish patches	
17 0—20 8	Light grey clay with brownish streaks	
20 8—23 6	Light grey clay with yellowish and brownish patches and streaks	
23 6—26 0	Light grey clay with yellowish and brownish patches and streaks, and with some red patches	
26 0—30 6	Grey clay with red and yellowish brown patches	
30 6—35 2	Very red clay with grey and yellow patches	
35 2—37 6	Gritty grey clay with brown patches	Grit increasing with depth.
37 6—39 0	Medium grained clayey sand	Abundant water which rose rapidly in bore. (Sub-artesian water horizon.)

End of bore at 39 feet.

SUMMARY AND CONCLUSIONS.

Drilling operations have shown that the area under investigation is composed of interbedded layers of sand and clay. The beds occurring above the sub-artesian water horizon are of lenticular habit, while those below are fairly uniform in thickness and flatly bedded. Ground water is abundant in all the sand beds, and slight seepages from sandy seams in the clay beds, occur in a number of places. In general the clay beds are fairly dry, hard and compact, but become moist and soft near their boundaries with the water-bearing sand beds, and in proximity to intercalated water-bearing sandy seams.

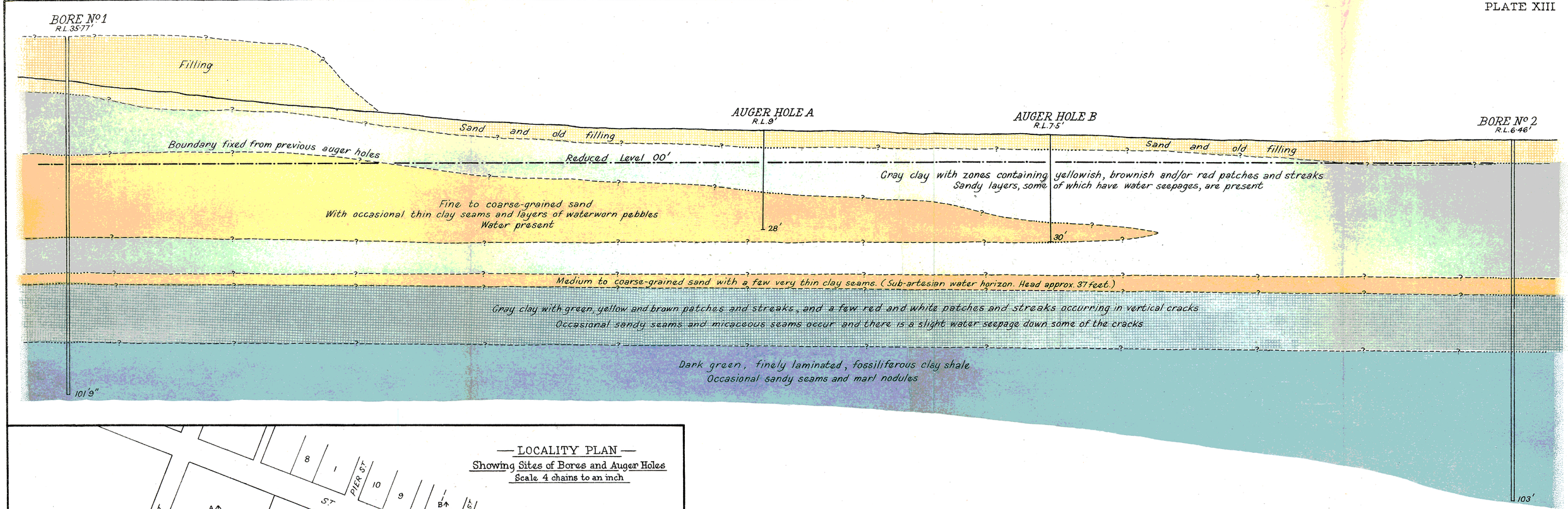
As the compressive strength and shrinkage under pressure of the clay beds will be determined as a result of tests carried out on the various samples collected, there is no need to discuss the suitability of the site from this aspect.

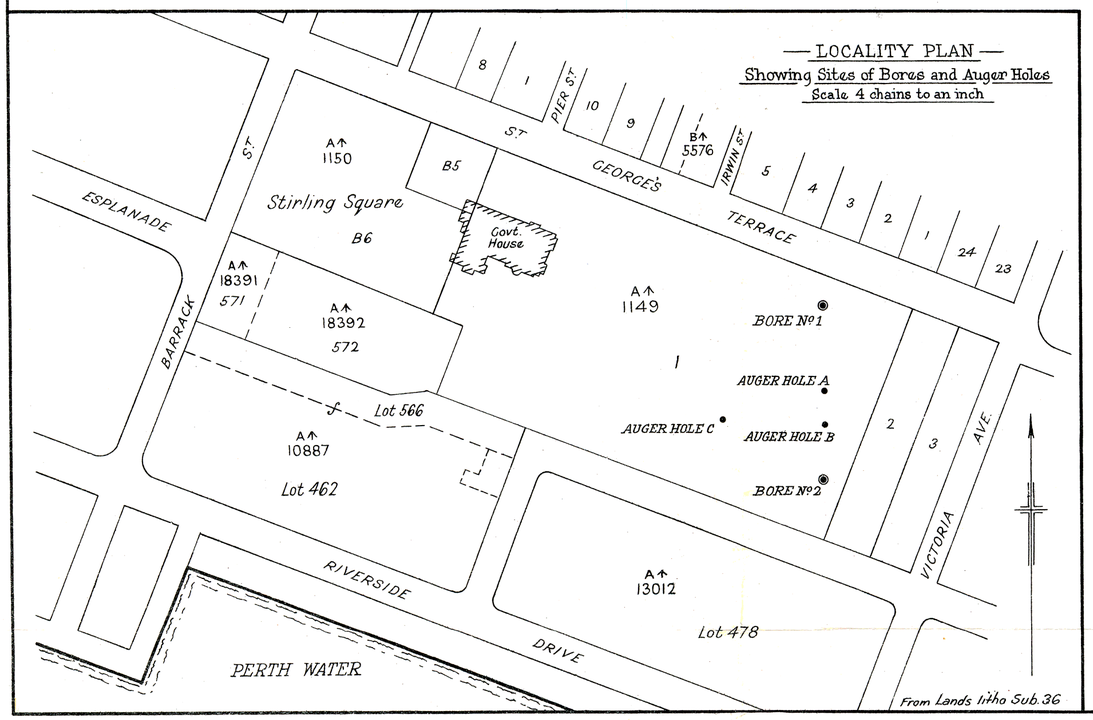
Only two other factors appear to be worthy of consideration:—

1. As described above, the clay layers become moist and soft in contact with ground water. When under pressure a slip may occur at any of these places, either internally or at the boundaries of the clay beds. This tendency will be greatest in the top clay which has the greatest dip.

2. Some settlement may result from drainage of the lenticular sand bed or the sub-artesian water horizon.

PLATE XIII





PROPOSED SITE FOR NEW GOVERNMENT BUILDINGS

GEOLOGICAL SECTION BETWEEN BORES Nos 1 AND 2

A↑1149 GOVERNMENT HOUSE GROUNDS

Scale: 20 feet to an inch

Geology and Section by R.S. Matheson, Oct., 1944

In conclusion, the writer would like to point out that too much reliance should not be placed on the results of the 1936 auger drilling, as the logs have been at fault in a few instances. It should be obvious that careless logging of the holes will lead to a misinterpretation of the attitude of the strata, and this is undesirable, particularly when a slip factor may be involved.

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NOTES ON AN INSPECTION OF QUARTZ CRYSTAL DEPOSITS, GOOMALLING, MORAWA AND PAYNE'S FIND.

By K. R. Miles, D.Sc., F.G.S.

Acting on instructions, during 22nd-24th January, 1944, I accompanied Mr. M. D. Garretty, a representative of the Department of Supply and Shipping, on an inspection of several localities, viz., Goomalling, Morawa and Payne's Find, from which quartz crystal suitable for piezo-electric purposes was said to have been obtained.

Goomalling.

One large crystal and a number of smaller crystals had been found on the property of Mr. J. A. White, of Oak Park, about 8-9 miles N.N.E. of Goomalling. One of these crystals, though somewhat cracked was considered of sufficient size and quality to be sent to Amalgamated Wireless (A'sia) Ltd., for testing. The crystals were picked up in a ploughed paddock. They were all worn and roughened on the surface, suggesting that they had undergone some transport and abrasion. A few floaters of vein quartz were seen in an adjacent paddock but during inspection no further fragments of crystal quartz were noticed. No probable source for the crystals was detected.

Morawa.

Two localities in this district were inspected. The first, the dump of a well about 14 miles west of Morawa on the property of Mr. J. Heitman on Vict. Loc. 7596. Abundant good quality quartz crystal is reported by a Mr. H. A. Frank to occur in a flat seam about 57 to 60 feet down in the well. Mr. Frank holds a Prospecting Area (PA2PP) including this ground and he intends to open up this seam. Crystal fragments in the dump of the well indicate the presence of crystal quartz *in situ*, i.e., a lode vein formation. No outcrops occur in the immediate vicinity. A crystal purported to have come from this well is said to have been accepted by A.W.A.'s local representative.

The second locality inspected was on the property of Mr. A. Stokes, about 2-3 miles N.W. of the first deposit. This (PA3PP) proved to be small crystal quartz stringers in outcrops of quartzite in a broad belt of interbedded metamorphosed quartzite, slates and lavas. Several crystals up to 6 inches in length are reported to have been found in a narrow gully at the foot of a quartzite hill, but during the inspection only very small fragments of clear crystal were seen. The prospects of obtaining suitable crystal sufficient to repay the cost of a detailed search in this locality appear very remote.

Payne's Find.

A good crystal is reported to have been obtained from a dump on the Orchid lease (late G.M.L. 615) at Payne's Find, Yalgoo G.F. The dump surrounds a shaft on the northern end of the lease. During inspection the only crystal quartz seen was one broken milky fragment, the dump being largely covered by broken stone (gneiss with pegmatite and vein quartz). A local prospector intimated his intention of removing this overlying stone and opening up older portions of the dump to search for further crystals.

PRELIMINARY REPORT ON LIMESTONE PROSPECTS—COMMONWEALTH LAND SOUTH OF FREMANTLE.

By K. R. Miles, D.Sc., F.G.S.

INTRODUCTION.

Reconnaissance investigations of the geology of four areas held in reserve by the Commonwealth Authorities in the coastal regions to the immediate south of Fremantle were carried out during the period 6th-20th June, 1944. A geological sketch map was prepared indicating the essential geological features and the general topography of the several areas. Samples were collected in a number of localities, and rapid field tests carried out to determine the approximate carbonate content of the dune sands and some of the limestone samples. From this preliminary material final samples were selected and submitted to the Government Chemical Laboratories for more exhaustive testing.

The four areas examined have been called (I.) Coogee Beach Area, (II.) Cockburn Sound Area, (III.) Jandakot Reserve, (IV.) Cape Peron Area. It is proposed to deal with each of these areas separately. Their distribution is indicated on the accompanying map.

(I.) COOGEE BEACH AREA.

Location.

This comprises a narrow strip lying between Fremantle-Rockingham Coast Road and the coast, and extends northwards from the northern boundary of the Woodman Point Explosive Reserve for a distance of about a mile. Maximum width of this strip of land is about 10 chains. The area lies about 4¼ miles by road south of Fremantle.

Geology and Physiography.

This area consists entirely of low rolling, recently formed sand dunes fringing the sea shore. These dunes are partly covered by branching scrub and grass. On the eastern boundary of the Commonwealth land the dunes give way to outcrops of limestone extending eastward in rising ground.

Sampling.

Three samples of dune sands were dug from this area—from near the north and south boundaries, respectively, and from about the centre of the area. Field tests indicated approximately 75 per cent. total carbonates (calcium and magnesium carbonate) in all three samples with possibly a slightly higher carbonate content in the central and southern samples. The sample from the centre of the area was forwarded for further testing and gave the following analysis:—

	%
Lime Carbonate $CaCO_3$	64.58
Magnesium Carbonate $MgCO_3$ ..	4.00
Acid Insolubles	28.61
Total	97.19

Remarks.

It appears obvious that Coogee Beach Area can be ruled out as a possible source of high-grade lime sands suitable either for agricultural purposes or for use in the manufacture of Portland cement. No further work in connection with the present investigation is justified in this area.

(II.) COCKBURN SOUND AREA.

Location.

This area extends southwards from Hamilton (Mayor) road, opposite the Woodman Point Explosives Reserve following the coast for a distance of about 9½ miles to a point just south of Kwinana. The area is bounded to the west by the sea from the southern boundary of the Explosives Reserve southward. The eastern boundary follows the eastern margin of Coogee (Koojee) Lake thence due south for about ½ a mile, and then runs due east for ¾ mile to the Main Rockingham-Mandurah road. Southwards of this point the Cockburn Sound area is bounded to the east

by the Main Rockingham road, except for a small area immediately south of Mt. Brown (see accompanying map). The whole area covers about 6 1-3 square miles and extends from 5 to 14 miles by road south of Fremantle.

Geology and Physiography.

Physiographically this area may be divided into two distinct regions—an upper or northern section down to the junction of the Coast Road with the Mandurah-Rockingham road, and a lower or southern section southward of this point. The northern section contains two main zones or belts—(a) a western belt of high land running north and south for the full length of the section and ranging from about 10 chains to half a mile wide, and (b) an eastern belt of low land including Coogee Lake and the swamp land extending southward from the lake, as indicated on the sketch map.

The highland belt is composed for the greater part of sandy limestone which outcrops in successive parallel elongated north-south ridges rising steadily from the coast eastward to an average height of about 120 feet above sea level except at the southern end of the section where they culminate in Mt. Brown and a broad hill some 50 chains east of the coast, which rises to about 220 feet, the highest point in the area. These bare limestone hills are strewn with boulders of capstone (limestone containing a large proportion of secondary re-deposited lime carbonate) and covered by low prickly scrub. The coast line fringing this belt consists for the most part of low cliffs from about 5-15 feet in height composed of rugged, fantastically shaped, weathered sandy limestone. In the northern end immediately south of Woodman Point is a narrow strip ¾ mile long and less than 10 chains wide of recent sand dunes piled up over the limestone.

The eastern lowland belt consists largely of drift sand through which project occasional small scattered outcrops of limestone. The country is flat or gently undulating and averages rather less than 25 feet above sea level. It is fairly thickly covered with low scrub and small trees, with heavier timber fringing the paper bark swamps. To the east of the Main Road outside the Commonwealth land, the country rises once more to form limestone capped ridges.

The southern section of the Cockburn Sound area consists entirely of flat or very slightly undulating lowland seldom rising more than 25 feet above sea level. The coastline consists of a sandy beach fringed for the entire length of the section by a strip of recent sand dunes ranging from about 3 to 6 chains wide and having a maximum height of about 27 feet. East of these dunes the country consists of grey drift sand, covered with abundant low scrub. No outcrops of limestone were seen in any part of this section.

Sampling.

Samples of recent dune sand were collected at irregular intervals from the strip fringing the beach from opposite the old Naval Base Hotel southwards to the wreck at Kwinana, in the southern section, and from the high dunes south of the Explosives Reserve in the northern section. Field tests carried out on these samples indicated total carbonate contents ranging from about 55 per cent. up to more than 90 per cent. One sample (No. 4) taken of the drift sand fringing the sand dunes showed approximately 60 per cent. total carbonate. Five samples (numbers 1, 2, 3, 5 and 10) were sent to the Chemical Laboratory for further testing. Localities of these samples are shown in the accompanying plan.

Results of analyses are as follows:—

Dune Sands, Cockburn Sound Area.

	% $CaCO_3$.	% $MgCO_3$.	Acid insol.	Total %
No. 1 ...	65·28	3·79	27·42	96·49
No. 2 ...	63·55	4·73	28·87	97·15
No. 3 ...	80·38	4·18	10·57	95·13
No. 5 ...	81·75	4·93	9·44	96·12
No. 10 ...	84·12	2·87	7·07	94·06

Samples of limestone were obtained from several localities within the limestone outcrop belt already described in the northern section of the Cockburn Sound Area, and delineated and coloured blue in the accompanying geological plan. In all cases these were profile channel samples taken to varying depths from such cuttings, pits, wells or natural cliffs as could be found within the area. No specimens of capstone or outcrops were taken alone as, due to the inevitable surface leaching and re-deposition of lime carbonate produced in outcrops by the action of weathering agents, it was considered that the lime content of weathered outcrops does not give a true indication of the lime content of the immediately underlying rock material.

Two samples were obtained from the south side of a road cutting in Hamilton (or Mayor) Road, the northern boundary of Cockburn Sound Area. The samples were cut out from a point about seven chains E. of the junction of Hamilton Road and Rockingham (Coast) Road. The cutting was about 13 feet deep. Details are:—

		% $CaCO_3$.	% $MgCO_3$.	% Insol.	Total %
0–2 ft.	Soil and rubble (not sampled)	....	....	....	....
2 ft.–7 ft. 6 in.	Sandy limestone	80·52	4·60	11·15	96·27
7 ft. 6 in.–13 ft.	do.	69·26	4·31	24·24	97·81

From a point some five chains west of the intersection of Russell Road with the Coast Road a natural cliff in the limestone runs southward for some ¾ mile to opposite a small groyne or breakwater built out from the shore (see plan). This cliff at its northern end is little more than 4-5 feet high but gradually increases in height to the south until opposite the groyne it reaches a height of about 30-35 feet. Stone for the groyne has evidently been quarried from this locality, the cliff face having been cut back into the rising ground to the east a distance of several chains. Excellent exposures of fresh limestone are thus to be found along this cliff face and profile samples were cut from the south face of the quarry and from three points on the eastern cliff face at progressive distances of 4 chains, 13 chains, and 22 chains north of the first sample (see plan). The cliff here appeared to consist of a rather sandy, very friable limestone of medium to medium-coarse grain size. Owing to a mantle of talus the base of cliff could seldom be seen and sampled. Near the base of the cliff at the No. 3 north sample locality however, it was seen that the rock graded into a very coarse shelly horizon of indeterminate thickness. Details of the samples are:—

A. *South Face Groyne Quarry*—Height 17 feet.

	ft.	% $CaCO_3$.	% $MgCO_3$.	% Insol.	Total %
1	0— 5	84·57	3·26	5·72	93·55
2	5—10	83·84	3·51	8·07	95·42
3	10—15	84·41	2·99	9·18	96·58
	15—17	Sand and rubble.			

Average (0—15 ft.)—84·27% $CaCO_3$.

B. *No. 1 North Face. (Face Quarry 4 chains N. of A.)* Height 35 feet.

	ft.	% $CaCO_3$.	% $MgCO_3$.	% Insol.	Total %
	0— 2	Capstone and rubble.			
1	2— 9	84·14	3·78	8·40	96·32
2	9—15	87·30	2·03	7·47	96·80
3	16—23	85·82	1·74	10·61	98·17
4	23—28	85·84	1·65	10·57	98·06
5	28—33	83·41	1·17	12·84	97·42
	33—35	Sand and rubble.			

Average (2—33 ft.)—85·30% $CaCO_3$.

C. *No. 2 North Face (Face Cliff 13 chains N. of A).* Height 34 feet.

		% $CaCO_3$.	% $MgCO_3$.	% Insol.	Total %
1	0— 5	87·34	2·51	7·04	96·89
2	5—10	87·92	2·20	6·63	96·75
3	10—15	85·34	2·76	8·65	96·75
4	15—20	86·00	1·84	9·91	97·75
5	20—25	88·88	1·99	7·55	98·42
6	25—28	84·72	1·28	11·75	96·75
	28—34	Sand and rubble.			

Average (0—28 ft.)—86·71% $CaCO_3$.

D. *No. 3 North Face (Face Cliff 22 chains N. of A).*

	ft.	% $CaCO_3$.	% $MgCO_3$.	% Insol.	Total %
1	0— 5	71·15	2·59	22·43	96·17
2	5—10	71·90	2·41	22·11	96·42
3	10—15	61·80	1·07	35·03	97·90
4	15—20	67·46	0·65	29·67	97·78
5	20—25	68·40	1·63	28·22	98·25
6	25—28	43·44	1·28	53·32	98·04
	28—32	Sand and rubble.			

Average (0—25 ft.)—68·16% $CaCO_3$.
Average (0—28 ft.)—64·02% $CaCO_3$.

One sample was cut from the north-western side of an old pit, dug to a depth of 8-10 feet at the top of one of the many limestone ridges east of the Coast Road. The

PLATE XIV

GEOLOGICAL SKETCH MAP OF COMMONWEALTH LAND, COOGEE, COCKBURN SOUND & CAPE PERON AREAS.

SCALE 40 CHAINS = 1 INCH

Magnetic North

EXPLANATION

Recent Dune Sand

Soil overlying Limestone (scattered Limestone outcrops)

Predominant Limestone Outcrops

Boundaries of Commonwealth Land

Assays % $CaCO_3$; Field Tests % Carbs.

Suggested reconnaissance Bore Sites (Approx. only) ⊕5

COOGEE AREA

To Fremantle

Railway

Sample 75% Carbs.

Sample 64·6 % $CaCO_3$

Sample 80% Carbs

2 Samples (2-13) Av. 74·9 % $CaCO_3$

HAMILTON RD.

Explosives Reserve

LIGHTHOUSE

KOOJEE LAKE

Woodman Point

Quarantine Stn

Sample (11) 90% Carbs.

Sample (10) 84·1% $CaCO_3$

Obelisk

RUSSELL RD.

sample (9) 87% Carbs

Limestone Cliffs

Swamp

Limestone Samples from Cliff Face.
5th Face 1-3 (0-15') 84·3%
No 1 Nth 1-5 (2-33') 85·3%
No 2 Nth 1-6 (0-28') 86·7%
No 3 Nth 1-6 (0-28') 64·0%
$CaCO_3$ Croyne

5TH FACE. NTH No3 NTH No2 NTH No1.

Sample (3-8') 41·5% $CaCO_3$

Swamp Land

Scattered limestone floaters.

JANDAKOT RESERVE

WIRELESS MASTS.

Sand Covered Ridge.

No Outcrops

COCKBURN SOUND

Low Ridges capped with Limestone. Readily accessible both East and West of Main Road.

SHAFT 77' V.D.

10 Samples (0-50') Av. 48·8% $CaCO_3$

Flat Land Sandy, overlying Limestone.

Scattered floaters

Mt BROWN 224 ft.

Naval Base Hotel.

Sample (6) 55% Carbs.

AREA

Sample (5) 81·7 % $CaCO_3$

Samples (3)·(4) 80·4% $CaCO_3$ 60% Carbs.

Flat Country

Sand covered,

Abundant low scrub

James Point

Sample (2) 63·5 % $CaCO_3$

Track

To Rockingham

Sample (1) 65·3 % $CaCO_3$

KWINANA

MANGLES BAY

Sample C (Limestone Cliff) 80% Carbs.

John Pt

Sample B (Road Cutting) +85% Carbs.

Sample A (from soak) +85% Carbs.

C. Peron

Sample D (Sand dune) 90% Carbs.

CAPE PERON AREA

Sample E (Old dune) +80% Carbs

Mt ATOM

LAKE

To Fremantle

ROCKINGHAM

(W) WIRELESS MASTS

Geology by K.R.Miles, June 1944.

hill lies approximately 1¼ miles south of the Obelisk and about 20 chains east of the road. The limestone exposed in this pit seemed rather coarse and very sandy. The sample was dug from depths 3-8 feet below the top of the pit. Analysis showed 41·54% $CaCO_3$, 2·38% $MgCO_3$, 53·54% insoluble, total 97·46.

On the western slopes of an isolated limestone hill in the centre of the area and situated nearly two miles south of the Obelisk, slightly over ¾ mile west of north from Mt. Brown and over 30 chains due east of the Coast Road, is an old shaft sunk to a depth of some 77 feet. This shaft is six feet by three feet, is boarded by a few sets at irregular intervals and is quite dry. Channel samples were cut in the north face from the surface to 50 feet vertical depth and bagged at 5ft. intervals. The limestone was medium grained and rather sandy throughout with occasional very loosely consolidated sandy bands Details of the samples are:—

Shaft Samples.

		%$CaCO_3$	%$MgCO_3$	%Insolubles	Total%
1.	0-5 ft.	52.54	0.23	44.85	97.62
2.	5-10 ft.	50.02	0.71	47.58	98.31
3.	10-15 ft.	45.59	1.07	51.78	98.44
4.	15-20 ft.	49.13	0.21	48.72	98.06
5.	20-25 ft.	48.06	0.44	50.06	98.56
6.	25-30 ft.	49.43	0.46	48.81	98.60
7.	30-35 ft.	47.57	0.98	50.64	99.19
8.	35-40 ft.	47.88	0.42	50.20	98.50
9.	40-45 ft.	49.22	0.40	48.83	98.45
10.	45-50 ft.	48.92	0.82	48.87	98.61

Average (0-50 ft.) 48.83% $CaCO_3$.

Remarks.

The insolubles indicated in all the foregoing analyses both of dune sands and of limestone may be considered to consist almost entirely of quartz with a few rare felspar grains. The figures for calcium and magnesium carbonates were obtained by independent determinations of the carbon dioxide, CO_2, and acid soluble lime, CaO, from which the calcium carbonate, $CaCO_3$, content was calculated. The remaining CO_2 was calculated to magnesium carbonate, $MgCO_3$.

From the account of the general geology of the Cockburn Sound Area given above it should be clear that any search for lime in the form of limestone must be prosecuted in the relatively highland limestone outcrop belt forming the western portion of the upper or northern section of the area. There is no doubt that limestone rock does occur underneath the drift sand covering the lower regions of the northern section and all of the southern section, but the cost of investigating these unfavourably situated regions by means of a detailed deep boring programme seems hardly justified, whilst even if high grade limestone were located in this way the costs of exploiting the material would be quite prohibitive.

Some attention was paid to the recent dune sands fringing the coast, however, because this material is for the most part readily accessible and consequently may have possibilities for use, should the composition be suitable, in a number of industries.

Generally speaking it may be said that there is an increase in the lime content of the recent dune sands in the southern section of the Cockburn Sound Area as one proceeds northward from Kwinana to the Naval Base Hotel. At a mile north of James Point the dunes are comparatively rich in lime (80% $CaCO_3$) and though unsuitable for the manufacture of portland cement, may be very useful for certain agricultural purposes.

The small dune sand belt immediately south of the Woodman Point Explosive Reserve contains abundant sand uniformly high in lime (84% $CaCO_3$, 87-90% total carbonates) and again although not rich enough for cement manufacture this material should be eminently suitable for use as a lime dressing for sour lands, and could probably be used in the smelting of iron ores.

None of the limestone faces so far sampled in this area are of grade equivalent to the material worked in the Swan Portland Cement Co.'s Douro Road quarry. The highest grade stone so far located occurs in the groyne quarry, towards its southern end where samples over heights of 15, 31 and 28 feet respectively average 84·3%, 85·3% and 86·7% $CaCO_3$. It is noticeable also that samples dug from locations further from the coast have distinctively lower lime contents e.g. from the shaft ½ a mile east of the coast the average grade is less than 50% $CaCO_3$ over 50 feet. This suggests that further search for limestone of suitable grade should be concentrated along the coastal fringe.

(III) JANDAKOT RESERVE.

Location.

The Jandakot Wireless Station Reserve consists of a block of 133 acres lying just west of Jilbup Lake and bounded on its western side by portion of Henderson Road (see plan).

Geology and Physiography.

Towards the northern end of the reserve the country rises steadily to the crest of a flat-topped ridge about 250 feet above sea level—one of the highest points in the district. To the east it slopes down fairly sharply to Jilbup Lake. The country on this Reserve consists entirely of drift sand and is fairly heavily timbered. No rock outcrops of any type were observed and a random sample of surface sand proved almost devoid of carbonates.

No further samples were taken as it was obvious that there is no lime available in this area.

(IV) CAPE PERON AREA.

Location.

This Reserve embraces all the western end of the long peninsular stretching westward from Rockingham. The eastern boundary of the area extends southward from about a mile west of Rockingham Townsite for a distance of about ¾ mile to the western shore of Lake Richmond, and thence due west to the coast. The total area is about 0.6 sq. miles.

Geology and Physiography.

The only rock exposures in this area are around the coastline fringe of the northwestern, western and southern portions of the peninsular tip itself. Here are broken, weather—and sea—etched cliffs of sandy limestone up to 20 feet high, at whose feet lie boulders and remnants of sea-worn shingle. Slightly further inland, capping the limestone are piled recent sand dunes partly fixed by reeds and scrub. Sandy beaches backed by recent sand dunes stretch along the rest of the northern and western coast lines, giving way as the distance from the coast increases to a low rolling, bare, grassy plain of older drift sand. The highest point in the area is in the south-western corner where there are 2 parallel lines of sand dune ridges bordering the coast. The first line consists of recent sand heaped up on the edge of the beach whilst the second line of higher ridges consists of older of "fixed" dunes rising a few chains further inland. The highest point on this line, Mt. Atom, is about 50 feet above sea level.

Sampling.

Samples of the recent dune sand were dug from several points around the tip of the peninsula, whilst one profile sample of limestone was cut from a west facing cliff face approximately 27 chains north of Cape Peron. One sample of older dune sand was dug from the southern slopes of Mt. Atom (for localities of samples see accompanying plan). Field tests only were carried out upon these samples. Details are:—

Sample A (Spoil from soak foot of dunes): + 85% Carbonates.

Sample B (Dune sands, edge of road cutting): + 85% Carbonates.

Sample C (Limestone from cliff face 0-6 ft.): 80% Carbonates.

Sample D (Large sand dune 8chs. E. of Cape Peron): 90% Carbonates.

Sample E (Older dune sand, Mt. Atom): + 80% Carbonates.

Remarks.

The very limited extent of the limestone exposures in this area taken together with their isolated situation (Cape Peron is 33 miles by road from Perth) constitutes a severe handicap which must be given due consideration when assessing the value of the area. From the general appearance of the limestone and dune sand and from the field tests it appears that none of the material in this locality is any richer in lime than the limestone or dune sand of the more accessible Cockburn Sound Area. Furthermore the tests indicate that none of this material attains the specifications of lime suitable for the production of Portland cement.

SUMMARY AND CONCLUSIONS.

As a result of the preliminary investigation of the limestone prospects of Commonwealth land in the district immediately south of Fremantle, the following conclusions have been drawn:—

(1) The Coogee Beach Area contains only dune sand of moderate lime content—of no value to the present investigation.

(2) No limesand or limestone is to be found on the Jandakot Reserve.

(3) The Cockburn Sound Area contains two possibly exploitable sources of lime within its boundaries, viz.:—

(a) Lime rich sand dunes occurring at several points fringing the coast line—from tests so far carried out the most promising sand being in the Naval Base area immediately south of Woodman Point and between James Point and the Naval Base Hotel. No sand suitable for cement manufacture was found, though much of the material would be useful for special agricultural purposes and possibly would be suitable for use in smelting certain ores such as copper and iron.

(b) Limestone, occurring within a belt of high land some 5 miles long by less than half a mile wide. Samples taken from the limited number of available exposures in depth have not revealed any stone as rich in lime as that from the Douro Road Quarry, nor any material suitable for cement manufacture. Three points should be noted regarding this area: (1) that the samples taken were very few in number and are representative of only a small part of the total limestone area; (2) that from the samples collected, it would appear that in general there is a progressive diminution in lime content of the limestone as the distance from the coast increases. This circumstance has been noted for the Fremantle district generally; (3) that the limestone exposed in the southern end of the groyne quarry, Naval Base area, has quite a high lime content and that the limestone country to the immediate south and east of this region would be well worth further prospecting by boring.

(4) The Cape Peron Area—least favourably situated of the four areas examined—contains very few exposures of limestone. The presence of abundant recent dune sand of relatively high lime content—suitable for agricultural purposes but not for cement manufacture—should be noted, but no further investigation is recommended for this area.

BORING RECOMMENDATIONS.

In order to arrive at a satisfactory conclusion as to the prospects of the entire limestone belt in the Cockburn Sound Area some 8-10 bore holes at least should be sunk at selected localities. These would be in the nature of reconnaissance bores to test the quality of the stone in the most likely areas and in the positions most suitable for quarries from the point of view of topography, geology and general accessibility, etc. Should any of these bores indicate the presence of high-grade lime suitable for cement manufacture, further closely spaced bores would be required to delineate the area of rich stone and to determine the quantity of such material available.

A number of tentative reconnaissance bore sites have been approximately located on the accompanying plan and numbered in approximate order of priority. Final sites could be selected at a future date by myself in company with a Departmental Surveyor who could fix the sites accurately. It is suggested that sites 1-4 should be bored to a minimum of 30 feet and sites 5-9, etc., to a minimum of 50 feet. It would be necessary to keep continuous samples, broken, say, into 5-foot intervals, these samples to be assayed for $CaCO_3$, $MgCO_3$ and Acid Insolubles as has been done with the samples already collected.

NOTES ON SAMPLING DOURO RD. LIMESTONE QUARRY, SOUTH FREMANTLE.

By K. R. Miles, D.Sc., F.G.S.

At the request of the Director, Allied Works Council, I sampled the faces of the limestone quarry at the corner of Douro and Rockingham roads, South Fremantle, on August 10th and 11th, 1944. Profile samples were cut from top to bottom of the quarry faces in five different sections of the western and southern sides, and the samples were bagged at 7 or 8 ft. intervals and numbered consecutively. The exact localities from which the profile sections were cut are shown in the attached plan. The samples were submitted to the Laboratory of the Customs Department, William street, Perth, for analysis.

Full details of the samples are as follows:—

Profile Section 1. (Height 38 feet.)

		Total Carbonate by titration on dried sample. %
Sample 1.	0—8ft.	92.0
2.	8—16ft.	92.0
3.	16—24ft.	89.9
4.	24—32ft.	90.4
5.	32—38ft.	92.0
	Average total carbonates	91.3

Section 2. (Height 43 feet.)

Sample 6.	0—7ft.	91.7
7.	7—14ft.	94.8
8.	14—21ft.	93.6
9.	21—28ft.	88.2
10.	28—35ft.	89.6
11.	35—43ft.	91.6
	Average total carbonates	91.6

Section 3. (Height 40 feet.)

Sample 12.	0—7ft.	90.8
13.	7—14ft.	91.3
14.	14—21ft.	92.2
15.	21—28ft.	93.6
16.	28—35ft.	89.5
17.	35—40ft.	86.8
	Average total carbonates	90.7

Section 4. (Height 28 feet.)

Sample 18.	0—7ft.	89.0
19.	7—14ft.	89.8
20.	14—21ft.	90.0
21.	21—28ft.	90.8
	Average total carbonates	89.9

Section 5. (Height 43 feet 6 inches).

Sample 22.	0—7ft.	94.0
23.	7-14ft.	93.0
24.	14—21ft.	86.7
25.	21—28ft.	86.0
26.	28-35ft.	89.9
27.	35—43ft. 6in.	92.2
	Average total carbonates	92.2

Average total carbonate content of western face of quarry, 90.7%.

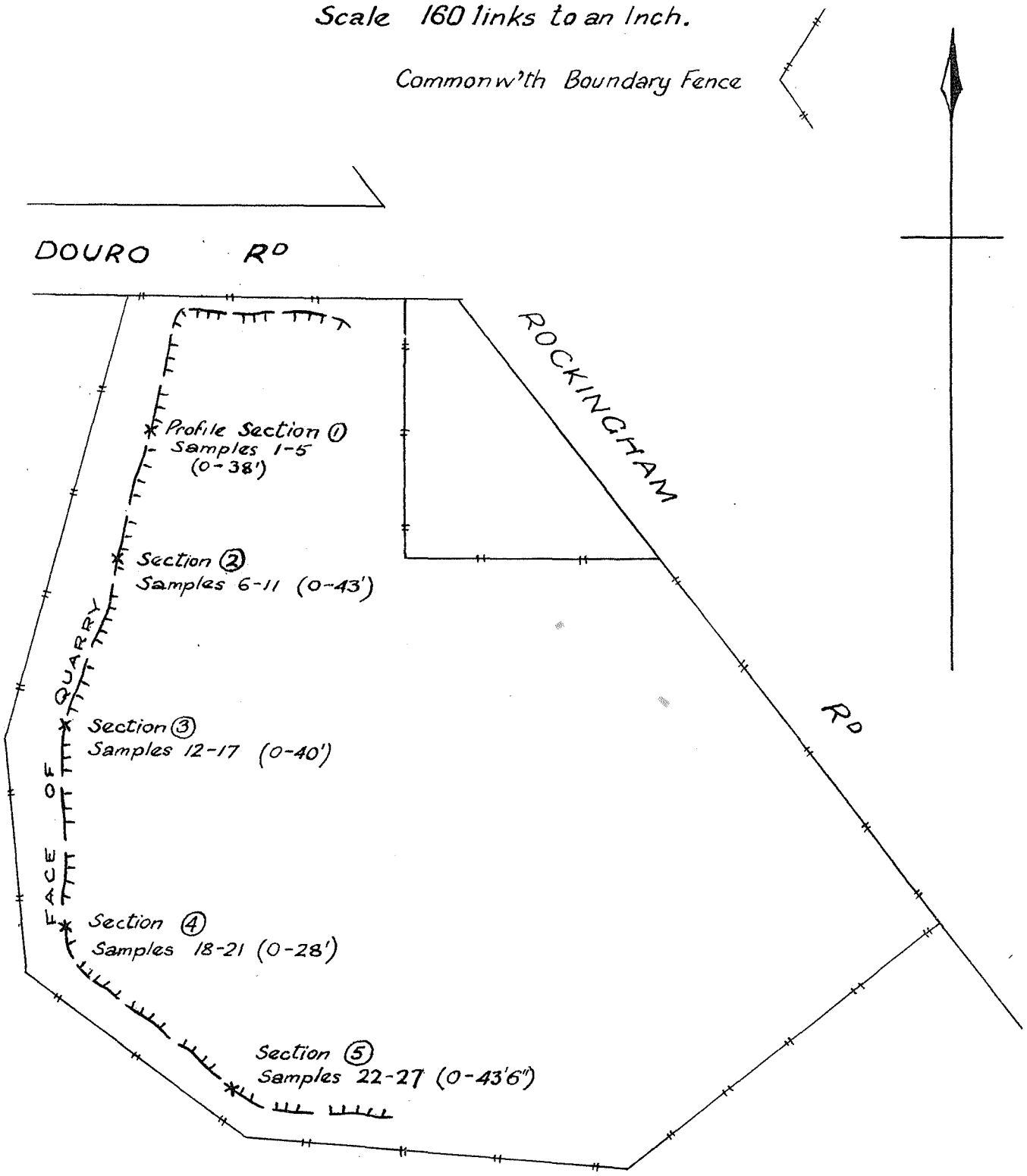
A composite sample of section 3 (samples 12-17) was found to contain 89.0% $CaCO_3$ by precipitation. The difference between this and the average total carbonates for section 3, viz., 1.7%, can be considered as Magnesium Carbonate. As this was quite a representative section it can be seen the $MgCO_3$ content of the deposit is thus very small.

No samples were taken in the lower lying ground on the eastern side of the area, which is admitted by the company to be distinctly lower in lime than required for the production of Portland cement. The average $CaCO_3$ content of the western face of the quarry is then estimated to be about 89% from the above analyses. As it is claimed that 88-89% $CaCO_3$ is required for the production of Portland cement it appears probable that only a small proportion of the lower grade stone on the eastern half of the area could be used to dilute the higher grade western stone as the margin above minimum requirements is apparently very small.

SKETCH PLAN OF DOURO RD. LIMESTONE QUARRY,

SHOWING LOCATION OF SAMPLES COLLECTED
AUG. 10TH-11TH 1944.

Scale 160 links to an Inch.



K.R.Miles, Aug. 1944.

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INDEX TO GEOLOGICAL SURVEY ANNUAL PROGRESS REPORT—*continued*

Division V.

School of Mines of W.A.

The Under Secretary for Mines.

I forward hereunder for the information of the Hon. Minister for Mines, my Annual Report for 1944.

1. KALGOORLIE SCHOOL OF MINES.

Enrolments.

The total number of individual students enrolled during the year was 383, made up as follows:—

	Class Enrolments.	Individual Enrolments.
First Term	744	351
Second Term	604	313
Third Term	506	308

Correspondence Course Enrolments.

Civilian	12
Service	28

Commonwealth Reconstruction Trainees .. 5

These were discharged service personnel who desired to undertake courses of technical training, either full-time or part-time, and were assisted to do so by weekly payments provided by the Commonwealth under the Commonwealth Reconstruction Training Scheme.

R.A.A.F. Personnel.

These were R.A.A.F. personnel from the Kalgoorlie R.A.A.F. station who were admitted to classes under special concession fees approved by the Hon. Minister for Mines in 1943. These men have taken full advantage of the courses of instruction offered, while they remained in Kalgoorlie, but in many cases posting to other stations where similar facilities are not available, has prevented them from completing a full year's work. Nevertheless, they have derived considerable benefit from attendance at classes and have expressed their appreciation of the very generous conditions under which they were admitted.

State School Students.

Elementary Chemistry 14

These were boys from the senior classes of the Kalgoorlie Central School, who were admitted free to a special elementary class in Chemistry conducted by Mr. H. C. Dod, in an endeavour to promote in them an interest in science and to encourage them to continue technical training after leaving primary school. This scheme has proved successful and many of the boys who attended similar special classes in 1943 enrolled for the ordinary preparatory classes of the School of Mines in 1944.

Revenue.

The revenue from fees, not including Correspondence Course and Metallurgical Laboratory fees, has been £324 6s. 5d.

Correspondence Course fees amounted to £21, and fees received for investigations conducted in the Metallurgical Laboratory have amounted to £51.

The fees received from Correspondence Course students and for investigations conducted in the Metallurgical Laboratory have been paid into special trust funds which are used to defray the cost of conducting the Correspondence Courses and for the purchase of supplies for the Metallurgical Laboratory.

Public Assays and Mineral Determinations.

The number of free assays and mineral determinations carried out by members of the staff for prospectors during the year was as follows:—

Assays for gold and other metals ..	64
Mineral determinations	75

Assistance and information of a practical nature have also been supplied to prospectors, particularly in connection with the development and utilisation of mineral deposits of special importance during war time.

Post-War Reconstruction.

The Post-War Reconstruction Technical Training Committee, appointed to make recommendations for the coordination of all technical training after the war, has completed the work for which it was formed and the final report has now been printed.

Recommendations have been made in this report for anticipated expansion of the work of the School of Mines and for the expected influx of a large number of students.

Staff.

Early in the year Mr. J. B. A. J. Rane, who had capably temporarily occupied the position of Lecturer in Geology and Mining, resigned, in order to take up an appointment in Mexico. Mr. Rane's departure was keenly felt because he had proved himself not only an expert in his particular work but had also gained the unqualified respect and approval of his students and had in every way proved himself an enthusiastic member of the staff.

Unfortunately, owing to conditions brought about by the war, difficulty was experienced in obtaining a successor, but eventually the position was filled by the appointment of Mr. K. A. Beatson, A.O.U.S.M., who had previously held the position for three years during the absence on special leave of the permanent lecturer, Mr. G. S. Compton, B.Sc., A.W.A.S.M.

During the second term, Mr. D. A. Sivyer, A.W.A.S.M., Science Assistant, who had been on special leave for war work, returned to duty and consequently it became unnecessary to continue to make use of the services of part-time instructors who had conducted Mr. Sivyer's classes during his absence. These classes had for some time been conducted by Messrs. W. M. Manson, A. O. Clauson, A.W.A.S.M., R. G. Horseman, A.W.A.S.M., W. S. Cackett, and R. W. Wilson, all of whom had given excellent service and to whom the thanks of the school are due for their valuable assistance during a difficult period.

The members of the staff have continued to give excellent service to the school and have maintained the high standard of instruction for which the school is noted and on which its high reputation has been founded.

Correspondence Courses.

These courses have been continued but by arrangement with other similar institutions in Australia which offer correspondence courses and to avoid duplication of effort, all correspondence courses for service and ex-service personnel have been pooled and are now administered by a Technical Correspondence School. This system forms part of the Commonwealth Reconstruction Training Scheme for the technical education of service and ex-service personnel.

Correspondence courses for civilians are, however, still administered directly by the School of Mines.

The total number of students who enrolled for these courses during the year has been as follows:—

	Service and Ex-Service Personnel.	Civilians.
Mining I	21	3
Mining II	1	1
Metallurgy I	4	2
Assaying I	2	3
Ore Dressing	3	3

Commonwealth Assistance to Students.

Efforts to have the Commonwealth Scheme of Assistance to Students, which is controlled by the Universities Commission, applied to the School of Mines have now been successful with respect to the three Diploma courses in Mining, Metallurgy and Engineering. During the year one student has received assistance under the Scheme.

Commonwealth Reconstruction Training Scheme.

Under this scheme of assistance to discharged service personnel three full-time trainees have been admitted to classes. These trainees attend full-time and receive financial assistance from the Commonwealth to enable them to continue their technical training. Students are also admitted for part-time training under this Scheme and it is expected that as men begin to be discharged from the different services in increasing numbers, so the number of students admitted for training under the Scheme will increase. A number of students have already enrolled for this year and for 1945 under this part-time scheme.

Metallurgical Laboratory—Ore Dressing Investigations.

During the year 17 applications for investigations were received, and, in addition, two comprehensive investigations which had not been completed in 1943 were also finalised. Of the 16 investigations commenced this year all have been completed and reports thereon have been issued to the interested parties.

The classes of investigation conducted or applied for have been as follows:—

Graphite	2
Beach Sand	1
Gold	12
Tin-tantalum Minerals	2

The investigations to establish a method of treatment of graphite ores from Munglinup, one for Perth Modelling Works and one for the Government Geologist, have determined commercial methods of production of high grade "flake" and "amorphous" graphite of high market value and should enable production of graphite to be successfully undertaken when an Australian market is assured.

The investigation into the composition of beach sand from the South Coast of the State has proved the existence of considerable quantities of the valuable minerals ilmenite, rutile, nigrine, and zircon, all of which can be recovered commercially as is now being done at Byron Bay in northern New South Wales.

The work on tin-tantalum mineral concentrates from Greenbushes has had for its object the determination of a method of separating the tantalum minerals from cassiterite so as to produce a tantalite concentrate sufficiently free from cassiterite to make it acceptable to purchasers of the former and also to produce a cassitertie concentrate as free as possible from tantalum minerals. This separation is rendered difficult by the complexity of the tantalum minerals and also by the intimate association of those minerals with the cassiterite, all experimental evidence up to the present having pointed to the probability that the only solution of the problem lies in a chemical method of separation of the tin-bearing minerals from the tantalum minerals. This investigation is still in progress and progress reports have been issued on the work so far as it has enabled some conclusions to be drawn.

Mr. M. A. Moore who had had experience on Great Boulder, Pty., Ltd., Wiluna Gold Mines, Ltd., Boulder Perseverance, Ltd., and Emperor and Loloma Gold Mines in Fiji, was appointed to the position of Assistant, a C.S.I.R. appointment, which had been rendered vacant by the appointment of Mr. W. M. Manson to the position of Metallurgist on Norseman Gold Mines, N.L. Mr. Moore has carried out his duties conscientiously and satisfactorily.

In connection with the work of the Laboratory 461 assays for gold have been carried out, as well as 261 chemical analyses and 61 grading analyses, not including routine tests on cyanide solutions, etc.

The extension of the laboratory building to provide accommodation for special equipment and also dust-free conditions when crushing and sampling dry ores, has been under consideration for some time and Treasury approval for the necessary expenditure has been obtained. It is hoped that this extension will be put in hand and completed during the coming vacation so that work may be carried out under less congested conditions and so that more hygienic and comfortable conditions may be provided for the operating staff.

During December, at the request of the Council for Scientific and Industrial Research, in my capacity of Officer in Charge of the Kalgoorlie Metallurgical Laboratory, I shall be attending in Melbourne conferences with Dr. Wark, Chief of the Division of Industrial Chemistry, and the officers of the Division and with representatives of the Melbourne and Adelaide Laboratories for the purpose of discussing all classes of ore dressing investigations, utilisation of the lesser-used minerals, the need for a more scientific attack on the recovery of gold from its ores, researches of a fundamental nature to assist the mining industry during the post-war period, and closer collaboration between the Ore Dressing Laboratories and the Physical Chemistry and Minerals Utilisation Sections of the Division of Industrial Chemistry.

A report on these conferences will be supplied later for the information of the Hon. Minister for Mines.

Buildings.

Stoves have been installed in all the large class rooms of the school to replace the open fireplaces which have done duty more or less inefficiently for forty years and thus to provide more efficient heating and more comfortable conditions for students and lecturers during the cold winter period. These stoves have resulted in a very marked improvement in conditions, particularly for the evening classes.

External and internal renovation and painting of the school buildings has been asked for for many years but shortage of manpower, increased cost, and other factors due to war-time conditions have so far militated against the carrying out of this necessary work which is long overdue. Many parts of the school buildings have not received any attention since the erection of the school in 1903 and naturally these parts are showing the urgent need for renovation, not only on aesthetic and efficiency grounds but also for the purpose of preservation of the structures. Unless some action is taken in this direction in the near future the cost of replacement and repair, particularly of iron roofs, will entail a very much greater expenditure than that involved in painting at the present time to prevent further deterioration and decay. It must be realised that the cost of renovations now required should be charged to maintenance over a period of forty years and should not be considered as an expenditure suddenly rendered necessary by rapid deterioration during the past year.

During the year the Under Secretary for Works visited and inspected the school buildings and appeared to be quite convinced of the necessity for carrying out this work which has been asked for ever since my appointment as Principal, and later as Director, but which has been put off from year to year and now appears as far off realisation as when it was first asked for.

Advisory Committee.

The Advisory Committee, on which there have been no changes of personnel during the year, has held regular meetings and members have taken a keen interest

in the welfare and advancement of the School and have also given valuable assistance to myself and the Registrar, Mr. G. M. Lumb, in all matters pertaining to the progress of the School. In this connection, I desire particularly to express my appreciation of the assistance and advice given me by the Chairman of the Advisory Committee, Mr. L. W. Stotter.

Diplomas and Certificates.

Diplomas and certificates have been issued during the year as follows:—

Diploma in Mining	2
Mine Surveyor's Certificate	2
Geologist's Certificate	2

Scholarships, Prizes and Donations.

In addition to the valuable Scholarships made available by the Mines Department, viz., the Junior, Entrance and Senior Scholarships and the Scholarships in Mining and Metallurgy donated by the Chamber of Mines of W.A. (Inc.), two additional Scholarships have been available for students of the School of Mines.

These are the W.A. School of Mines Students' Association Scholarship of Fifteen pounds awarded annually to the part-time student over the age of 21 who obtains the best record at the annual examinations and the Institute of Mining Surveyors' Scholarship of Ten pounds to be awarded to the best student of the year in the Mining course. This latter Scholarship replaces the valuable prizes which have for many years been made available by the Institute to students of the Mining course and is further evidence of the Institute's practical interest in the encouragement of mining students.

The proprietors of the Industrial Australian and Mining Standard have continued their donation of a year's subscription to that journal for two deserving students recommended by the Director on the results of the annual examinations.

Prizes to defray the cost of purchase of technical books have again been donated by the Kalgoorlie Wesley Ladies' Guild and by Mr. C. A. Hendry, an ex-student of the School, who has maintained his practical interest in the School for many years.

The action of the donors of Scholarships and prizes is greatly appreciated, but the fact that there are usually very few entrants for the valuable Scholarships awarded by the Mines Department raises the question whether, on account of the comparatively small number of full-time students who are eligible for the Entrance and Senior Scholarships, some modification of the conditions pertaining to these Scholarships should not be seriously considered. The Junior Scholarship for boys wishing to commence training at the School also does not bring forth the number of applications it might be expected to do, partly because of the lack of instruction in algebra and geometry at the central schools and the consequent restriction of competition to students of the Eastern Goldfields High School and the Christian Brothers' College, the only two educational institutions on the Goldfields which carry their students to the standard in these subjects which is required for the Scholarship examination.

Royal Australian Air Force.

Members of the staff, with myself as Chairman, have again acted as a Recruiting Committee for Kalgoorlie and districts outside Kalgoorlie and have co-operated with the Air Force not only in recruiting activities but also in assisting, wherever possible, in the training of cadets in the Air Training Corps and in obtaining publicity for recruiting purposes.

Use of the School of Mines.

The School of Mines has always assisted the University and the Education Department by making accommodation available for the conduct of the University Degree, Leaving Certificate, Junior Certificate, and Music Examinations and the Secondary School Scholarship Examinations, respectively. Accommodation has also been regularly provided for the Departmental examinations for Underground Supervisors' Certificates of Competency and for Engine Drivers' Certificates.

Examinations of Accountancy Institutes have also always been conducted at the School of Mines under the supervision of members of the Staff.

In addition, rooms are always made available for the monthly meetings of the Kalgoorlie branch of the Australasian Institute of Mining and Metallurgy.

Examinations of other bodies such as the Institution of Engineers, Australia, the Electrical Workers' Board, etc., are also held at the School of Mines under supervision of members of the staff.

In these various ways the School of Mines provides valuable assistance to other educational bodies, and acts as the leading educational institution on the Goldfields.

2. WILUNA SCHOOL OF MINES.

Enrolments.

The enrolments for 1944 were as follows:—

	Individual Enrolments.	Class Enrolments.
First Term	41	74
Second Term	38	62
Third Term	37	60

Classes have been conducted in Elementary and Preparatory Mathematics, Mathematics I., Workshop Practice I. and II., Surveying II., Preparatory Geology, Preparatory Physics, Physics I., Preparatory Mechanical Drawing, and Mechanical Drawing I. and II.

Fees collected during the year amounted to £68 2s. 6d.

Staff.

During the year Mr. H. H. Giltrap found it necessary through pressure of other work, to resign the position of Instructor in Workshop Practice I., which class has been taken over by Mr. J. B. Gill who has now fitted up a small workshop in the School buildings. Mr. Giltrap, however, continued as Instructor in Workshop Practice II.

Apart from this, there has been no change in the teaching staff during the year and I am very pleased to pay a tribute to the instructors who have spared no effort to maintain the interest of students in their work at the School and have carried out their duties enthusiastically and successfully, as is shown by the results obtained at the annual examinations.

Advisory Committee.

The Advisory Committee has held regular monthly meetings throughout the year and has done much to maintain local interest in the School.

Two changes in personnel took place during the year. Mr. H. Edmondson, who had represented the Wiluna Road Board on the Committee, resigned in consequence of his having resigned his seat on the Road Board and was succeeded by Mr. B. M. Rowe, who had previously been one of the mines representatives, while Mr. G. Ley was appointed a mines representative in place of Mr. B. M. Rowe.

Under the capable direction of the Chairman, Mr. L. R. Nowland, the Advisory Committee has been of much assistance to the School and the Registrar, Mr. G. M. Hickey, and myself, assistance which I greatly appreciate.

General.

During the year I paid a visit to the School and discussed with the Advisory Committee, the Registrar, and the instructors matters affecting the work of the School. I also inspected those classes that were in operation during my visit and had the pleasure of making direct personal contact with many of the students whom I found keenly interested in their work, particularly the older students.

I found that, without exception, the instructors take a very live interest in the progress of their students and it is very pleasing to place on record my appreciation of the valuable assistance they are giving to the School.

Unfortunately, owing to the uncertainty regarding the probable life of the mines at Wiluna, the number of students has been comparatively small which is to be regretted because the education received at Wiluna will be just as valuable at other centres as at Wiluna.

The Registrar, Mr. G. M. Hickey, has maintained his enthusiasm in the work of the School of Mines and I cannot refrain from tendering him my sincere thanks for his valuable assistance to the School and to myself.

To the members of the Advisory Committee and to the teaching staff I desire to express my sincere thanks for the interest they have taken in the welfare of the School and its students and for the very valuable assistance they have given to the Registrar and myself. I should also like to say how much I appreciate and enjoy the round table conferences arranged by the Registrar, between the Advisory Committee, the instructors, the Registrar, and myself which are such a valuable and important feature of each of my visits when all matters affecting the School are discussed in a pleasant and informal manner.

Examination Results.

At the annual examinations of the School of Mines students of the Wiluna School of Mines gained 32 pass certificates.

3. NORSEMAN SCHOOL OF MINES.

Enrolments:

The enrolments for 1944 were as follows:—

	Individual enrolments.	Class enrolments.
First term	47	110
Second term	38	72
Third term	35	66

Classes have been held regularly throughout the year in Elementary and Preparatory Mathematics, Mathematics I., Applied Mathematics, Preparatory Chemistry, Workshop Practice I. and II., Preparatory Mechanical Drawing, Mechanical Drawing I. and II., and Practical Electricity.

Fees received during the year amounted to £24 15s., indicating that the majority of the students are under the age of 21 and come under the regulations governing free attendance.

Staff.

The only change in the teaching staff has been the appointment of Mr. W. G. Lewis as Instructor in Chemistry in place of Mr. W. M. Manson, who resigned in consequence of his departure from the district. In addition, Mr. T. Stewart of Norseman Gold Mines, N.L., has undertaken the duties of Instructor of the recently formed class in Practical Electricity.

All members of the staff have carried out their duties enthusiastically and very often at considerable inconvenience to themselves. It is a decided advantage for students to have the same instructors, with but few changes, year after year and I am pleased to tender them all my sincere thanks for their work for the School and its students.

Advisory Committee.

Unfortunately, during the year, Mr. L. G. Cant, who had held the position of Chairman of the Advisory Committee, resigned in consequence of his departure from Norseman. Mr. Cant had been a strong supporter of and a good friend to the School and the necessity of his resignation is a matter for sincere regret. To fill the position rendered vacant by Mr. Cant's resignation Mr. W. D. Dutton was elected Chairman by the members of the Committee.

Mr. W. M. Manson, who had only recently joined the Advisory Committee as a representative of Norseman Gold Mines, N.L., also resigned on account of his departure from Norseman.

The vacancies on the Committee, caused by the resignation of Messrs. Cant and Manson as representatives of Norseman Gold Mines, N.L., were filled by the appointment of Messrs. F. H. Wray and J. A. Rose.

The Committee has held regular meetings and has been of great assistance to the School in many practical ways.

General.

During the year I paid two visits to the School and attended meetings of the Advisory Committee and also discussed with the Registrar and the members of the teaching staff matters connected with the administrative duties of the former and the class work of the latter.

Members of the teaching staff, who are either members of the technical staffs of the mines, officers of the Education Department or professional business men, have taken a keen interest in the work of the School and the managements of Central Norseman Gold Corporation and Norseman Gold Mines, N.L., have shown their practical interest by continuing to make their workshops available for practical classes. To the members of the teaching staff and also to the members of the Advisory Committee my thanks are due for the valuable assistance they have given to the School since its foundation.

The Registrar, Mr. K. H. Hogg, has carried out his duties with the same enthusiasm and success that he had always shown and my own cordial thanks are due to him for much valuable assistance throughout the year.

Examination Results:

At the Annual Examinations of the School of Mines students of the Norseman School of Mines gained 44 pass certificates.

B. H. MOORE,
Director, School of Mines.

CLASS ENROLMENTS, 1944.

Subject	1st. Term.	2nd. Term.	3rd. Term.
Elementary Mathematics ..	69	53	41
Elementary Chemistry	15	14	14
Preparatory Chemistry ..	73	47	36
Preparatory Physics	48	33	27
Preparatory Drawing	63	54	44
Preparatory Mathematics ..	70	50	42
Preparatory Geology	24	16	14
Mathematics I.	31	25	21
Applied Mathematics	7	6	5
Mathematics II.	6	6	6
Physics I.	11	9	7
Chemistry I.	13	13	10
Engineering Chemistry I. ..	10	9	9
Assaying I.	7	8	8
Assaying II.	2	2	2
Metallurgy I.	4	6	6
Geology	6	5	4
Mineralogy	6	6	5
Petrology	5	4	4
Mining I.	3	3	2
Mining II.	5	4	4
Ore Dressing	6	8	7
Surveying I.	5	5	5
Surveying II.	1	1	1
Mechanical Drawing I.	41	32	23
Mechanical Drawing II. ..	19	16	12
Applied Mechanics	7	7	6
Mechanical Engineering I. ..	6	6	6
Mechanical Engineering II. ..	3	2	2
Workshop Practice I.	35	39	31
Workshop Practice II. ..	44	35	28
Internal Combustion Engines ..	59	44	39
Building Construction ..	4	4	5
Machine Design	2	2	2
Electrical Engineering I. ..	11	6	6
Electrical Engineering II. ..	3	2	2
Engine Driving I.	16	16	14
Engine Driving II.	7	6	6
Total Class Enrolments, 1944	747	604	506
Total Class Enrolments, 1943	549	531	475
Individual Students, 1944 ..	351	313	308
Individual Students, 1943 ..	289	305	284

SCHOOL OF MINES OF W.A.

ANNUAL EXAMINATIONS, 1944.

PASS LIST.

(T) denotes Terminal Pass Only.
Names are in order of merit.
* Denotes equal.

ELEMENTARY MATHEMATICS.

All Sections.

Credit—
Quadrio, J. S.

Pass—
Brown, L. C.
Falconer, D. (T)
Alcock, R. S.

Arithmetic Section.

Credit—
Quadrio, J. S.
Torpy, J.
Brown, L. C.
Stillman, W. J.
Millard, J. T.

Pass—
DeBoer, W. D.
Alcock, R. S.
Woo, B. V.*
Bassett, A.*
Dawson, J. F.
Jones, K. D.
Toy. I.
McCahon, H. A.
Beange, A. M.
Falconer, D.
Selkirk, R. A.
Nankiville, W.
Bovell, K.

Algebra Section.

Credit—
Quadrio, J. S.
Falconer, D.

Pass—
Brown, L.
Stillman, W. J.
Lawson, G. C.*
DeBoer, W. D.*
Sharp, R.
Field, E. G.*
Whitchurch, R. A.*
Alcock, R. S.
Collins, S. J.*
Munns, J. E.*
McCahon, H. A.*
Woo, B. V.*
Jones, K. D.*
Annear, R. J.*

Geometry Section.

Credit—
Quadrio, J. S.

Pass—
Falconer, D.
Taaffe, J. M.
Alcock, R. S.
Fyfe, H. L.
Dawson, J. F.
Braithwaite, A.
Brown, L.*
Torpy, J.*

PREPARATORY MATHEMATICS.

All Sections.

Credit—
Thomas, R. P.
Jones, C.

Pass—
Cockram, C. C.
Forster, E. T. (T)
Ford, T. H.
Hooker, L. F.
Busch, E. H.
Bain, M. A.

Algebra Section.

Credit—
Thomas, R. P.
Lathlain, W. B.
Cockram, C. C.
Jones, C.
Toms, A. J.
Barber, W. D.
Hooker, L. F.

Pass—
Forster, E. T.
Ford, T. H.
Bain, M. A.
Bell, R. P.
Harper, D. G.
Lamotte, J. A.*
Brennan, Miss R.*
Wood, J. J.

Geometry Section.

Credit—
Thomas, R. P.
Jones, C.
Crowley, P. J.
Cockram, C. C.

Pass—
Bain, M. A.
Toms, A. J.
Lathlain, W. B.
Busch, E. H.
Hooker, L. F.*
Forster, E. T.*
Ford, T. H.*

Trigonometry Section.

Credit—
Crowley, P. J.
Erbe, W. V.
Thomas, R. P.
Forster, E. T.
Jones, C.*
Trethewey, A. S.*
Busch, E. H.*
Ford, T. H.*

Pass—
Cockram, C. C.
Hooker, L. F.
Bain, M. A.*
Chapman, G. M.*
Davey, F. G.
Rogers, J. I.

PREPARATORY GEOLOGY.

Credit—
Thomas, R. P.
Boyd, J. P.

Pass—
Forster, E. T.
Cockram, C. C.
Fisher, E. W.
Thomas, W. W.*
Crowley, P. J.*
Melville, R. J.*
Ion, C. E.*

Pass in Practical Section only—
Hooker, L. F
Brennan, Miss R. C.

PREPARATORY PHYSICS.

Credit—
Erbe, W. V.
Hooker, L. F.

Pass—
Ford, T. H.
Cockram, C. C.
Armstrong, L. H.
Chapman, J. M.
Kelly, K. W.
Warren, R. G.
Crowley, P. J.

Pass in Theory only—
Jones, C. G.

PREPARATORY CHEMISTRY.

Credit—
Jones, C.
Thomas, R. P.
Ryder, K. N. (T)*
Crowley, P. J.*
Cockram, C. C.

Pass—
Harris, J. E.
Warren, R. E.
Armstrong, L. H.
Melville, R. J.
Hooker, L. F.

PREPARATORY MECHANICAL DRAWING.

Credit—
Ford, T. H.
Cockram, C. C.
Morey, D. V.
Quadrio, J. S.
Morey, B. S.
Crowley, P. J.

PREPARATORY MECHANICAL DRAWING—*continued.*

Pass—
Kelly, K. W.
Quadrio, D. M.
Long, W.
Brennan, Miss R. C.
Armstrong, L. H.
Scott, J. F. (T)*
Horan, C. B.*
DeBoer, W. D.
Gianni, L.
Taaffe, J. Mc.
Torpy, J.
McCahon, H. A.*
Hunter, C.*
DeCampi, R.
Nicoli, E.
Griffiths, C. E.
Hooker, L. F.
Dunstan, D. W. (T)
Annear, R. J.
Bain, M. A.*
Dawson, J. F.*
Williams, A. K.*

MATHEMATICS.

(First Course)
All Sections.

Credit—
Crough, K. S.

Pass—
Walton, A. H.
Thomas, W. W.
Thomson, A. W.*
Chilvers, J. E.*

Algebra Section.

Credit—
Thomas, W. W.
Crough, K. S.
Jones, C. G.
Thomson, A. W.

Pass—
Harris, J.*
Stevens, R. G.*
Walton, A. H.
Speering, W. J.
Conway, G. C.
Chilvers, J. E.
Anderson, J. F.

Geometry Section.

Credit—
Walton, A. H.
Horan, C. B.
Crough, K. S.
Thomas, W. W.
Chilvers, J. E.

Pass—
Morey, D. V.
Stevens, R. G.
Conway, G. C.
Anderson, J. F.
Harris, J. E.

Trigonometry Section.

Credit—
Chilvers, J. E.
Harris, J. E.
Thomson, A. W.
Horan, C. B.
Walton, A. H.
Crough, K. S.

Pass—
Jones, C. G.
Christopher, L. F.
Thomas, W. W.

PHYSICS.

(First Course)

Credit—
Thomas, W. W.

Pass—
Wallis, F.

Pass in Practical only—
Greenwood, I. H.
Green, K. C. B.
Jones, K. L.
McDonald, A. J.

CHEMISTRY.

(First Course)

Credit—
Thomas, W. W.

Pass—
Hamilton, F. G.
Long, W.
Anderson, J. F.
Inman, E. G.
Green, K. C. B.
Lee, G. S.

ASSAYING.

(First Course)

Credit—
Martin, J. D.
Cockram, C.
Smith, A. D.
Green, K. C. B.

Pass—
Anderson, J. F.
Horan, C. B.*
McDonald, A. J.*
Alcock, R. S.

ASSAYING.

(Second Course)

Credit—
Martin, J. D.

Pass—
Canning, D. G.

ENGINEERING CHEMISTRY.

(First Course)

Credit—
Cockram, C.
Cox, E. J.

Pass—
Martin, J. D.
Dainton, R.
Moore, M. A.

Pass in Practical only—
Canning, D.
Crowe, I.
Ibbotson, R.

METALLURGY.

(First Course)

Credit—
Chilvers, J. E.
Green, K. C. B.
Martin, J. D.
Morey, B. S.

Pass—
Horan, C. B.
Canning, D. G.

METALLURGY.

(Second Course)

Thesis Accepted—
Airey, J. A.

MATHEMATICS.

(Second Course)

Credit—
Cox, E. J.

Pass—
Dainton, R.*
Gobbart, W. G.*
Boyd, J. P.
Moore, M. A.*
Ryder, K. N.*

GEOLOGY.

(First Course)

Pass—
Martin, J. D.
Horan, C. B.

PETROLOGY.

Pass—
Hamilton, F. G.
Crowe, I. F.

MINERALOGY.

Pass—
Martin, J. D.
Anderson, J. F.
Horan, C. B.

MINING AND ECONOMIC GEOLOGY.

Thesis Accepted—
Cockram, C.

MINING.

(First Course)

Credit—
Ryder, K. N. (T)

MINING.

(Second Course)

Credit—
Cackett, W. S.
Peek, K.

Pass—
Oldfield, L.
Irving, J. R.
Ion, C. E.

ORE DRESSING.

Credit—
Chilvers, J. E.
Cockram, C.

Pass—
Martin, J. D.
Morey, B. S.
Green, K. C. B.
Horan, C. B.
Lee, G. S.

SURVEYING.
(First Course)

Pass—
Weedon, R. P. J.
Turner, J. L.
Dainton, R.
Busch, E. H.

SURVEYING.
(Second Course)
(Provisional, pending plan)

Pass—
Boyd, J. P.

Plan Accepted—
Cackett, W. S.

MECHANICAL DRAWING.
(First Course)

Credit—
Martin, D.
Chilvers, J. E.

Pass—
Gobbart, W. C.
James-Wallace, W. (T)
Thomas, W. W.
Hevron, K. J.
Warren, R. E.
McDonald, A. J.
Greenwood, I. H.
Beck, A. J.
Mitchell, A. J.

MECHANICAL DRAWING.
(Second Course)

Credit—
Ryder, K. N.
Cockram, C.
Cox, E. J.
Hill, J. C.

Pass—
Busch, E. H.
Turner, J. L.
Coombs, A.
Moore, M. A.
McKean, R. F.
Melville, R. J.

APPLIED MATHEMATICS.

Credit—
Thompson, A. W.

Pass—
Jones, C. G.

APPLIED MECHANICS.

Credit—
Cockram, C.

Pass—
Hamilton, F. G.
Weedon, R. P. J.
Dainton, R.
Fisher, E. W.*
Turner, A. R.*
Cackett, W. S.

BUILDING CONSTRUCTION.

Credit—
Weedon, P. H. G.
Cockram, C.
Weedon, R. P. J.

Pass—
Ibbotson, G. R.
Moore, M. A.
Turner, J. L.

WORKSHOP PRACTICE.
(First Course)

Credit—
Jones, C.
O'Brien, A. R.
Fisher, E. W.
Morey, D. V.
Jones, K. L.
Parin, J.

Pass—
McKean, R. F.
Greenwood, I. H.
Nicoli, E.
Ritchie, H. G.
Toms, A. J.
Doyle, J. A.
Mitchell, A. J.
Yuill, E. M. (T)
Still, W. L.
Hunter, C.
Morgan, J. L.
DeCampi, R.*
Annear, R. J.*

WORKSHOP PRACTICE
(First Course)—*continued.*

Pass in Practical only—
McInnes, E. C.
Lonsdale, C. T.

WORKSHOP PRACTICE.
(Second Course)

Credit—
Seinor, K.
Cox, E. J.
Bickell, J. K.
Williams, L.
Anstey, R. W.
Kennedy, M. A.*
Tamblyn, L. F.*

Pass—
Griffiths, J. T.
Randall, T. A.
Jones, C. G.
McDonald, M. W.
Falconer, D.
Poletti, J. A.
Gard, V. J.
Sexton, G. J.
Graham, R. J.
Thompson, A. J.
Beck, A. J.
Browner, H. R. (T)
Garlick, A. J.

Pass in Practical only—
Bassett, R. J.
Softley, A. E.

MECHANICAL ENGINEERING.
(First Course)

Credit—
Cockram, C.
Dainton, R.

Pass—
Thomson, A. W.
Cox, E. J.
Fisher, E. W.
Ibbotson, G. R.

MECHANICAL ENGINEERING.
(Second Course)

Pass—
Weedon, R. P. J.
Turner, J. L.

ELECTRICAL ENGINEERING.
(First Course)

Credit—
Jones, C. G.

Pass—
Cox, E. J.
Cockram, C.
Turner, J. L.
Walker, G. A.
Dainton, R.
Crowe, I. F.
Ibbotson, G. R.

ELECTRICAL ENGINEERING.
(Second Course)
(Provisional, pending Thesis)

Pass—
Weedon, R. P. J.
Walker, G. A.

MACHINE DESIGN.
(Provisional, pending Thesis)

Pass—
Weedon, R. P. J.
Turner, J. L.

INTERNAL COMBUSTION ENGINES.

Credit—
Murdock, J. P.
McKean, R. F.
Allen, R.*
Todd, H. A.*
Henderson, P. B.
Pearce, C. J.*
Willis, F. C.*
Thompson, A. J. R.*
Fairall, P. E.*
Delamotte, S. E.
Turner, Jas. G.

Pass—
Beckwith, M. E.*
Heron, J. H.*
Parin, J.*
Still, W. L.*
Jones, K. D.
Trethewey, A. S.
Ashdown, H. F.
Oldfield, L.*
Tooth, J.*
Turner, J. V.*
Moyle, H. L.
Woo, B. V.
Coleman, R. J.
Doyle, J. A. (T)
Smythe, E. T.

ENGINE DRIVING.
(First Course)

Credit—
Burley, E. J.

Pass—
Andrijasevich, A.
Tooth, J.
Trethewey, A. S.
Turner, J. V.*
Werndley, S. R.* (T)

ENGINE DRIVING.
(Second Course)

Credit—
Clarke, R. A.

Pass—
Carr, J. G.

SUPPLEMENTARY EXAMINATIONS, 1944.

PREPARATORY CHEMISTRY.
Jones, K. L.

APPLIED MATHEMATICS.
Christopher, L. F.

MATHEMATICS.
(First Course)

Trigonometry Section.
Griffin, A. F.

PREPARATORY PHYSICS.
Greenwood, I. H.
McDonald, A. J.
Long, W.
Jones, K. L.

PHYSICS.
(First Course)
Ryder, K. N.
Franklyn, P. D.
Gobbart, W. G.

WORKSHOP PRACTICE.
(Second Course)
MacGregor, P. J.

PREPARATORY MATHEMATICS.
Algebra Section.
Busch, E. H.
Whitely, J.
Ion, C. E.
Greig, T.

YEAR'S FEE SCHOLARSHIPS.

ELEMENTARY MATHEMATICS.
Quadrio, J. S.

PREPARATORY MATHEMATICS.
Thomas, R. P.

PREPARATORY DRAWING.
Ford, T. H.

PREPARATORY GEOLOGY.
Thomas, R. P.

PREPARATORY PHYSICS.
Erbe, W. V.

PREPARATORY CHEMISTRY.
C. G. Jones,

MATHEMATICS.
(First Course)
Crough, K. S.

MATHEMATICS.
(Second Course)
Cox, E. J.

PHYSICS.
(First Course)
Thomas, W. W.

CHEMISTRY.
(First Course)
Thomas, W. W.

MECHANICAL DRAWING.
(First Course)
Martin, D.

MECHANICAL DRAWING.
(Second Course)
Ryder, K. N.

MINING.
(First Course)
Ryder, K. N.

MINING.
(Second Course)
Cackett, W. S.

ORE DRESSING.
Chilvers, J. E.

ASSAYING.
(Second Course)
Martin, J. D.

METALLURGY.
(First Course)
Chilvers, J. E.

ENGINEERING, CHEMISTRY.
(First Course)
Cockram, C.

MECHANICAL ENGINEERING.
(First Course)
Cockram, C.

BUILDING CONSTRUCTION.
Weedon, P. H. G.

APPLIED MECHANICS.
Cockram, C.

ELECTRICAL ENGINEERING.
(First Course)
Jones, C. G.

WORKSHOP PRACTICE.
(First Course)
Jones, C. G.

WORKSHOP PRACTICE.
(Second Course)
Seinor, K.

INTERNAL COMBUSTION ENGINES.
Murdock, J. P.

ENGINE DRIVING.
(First Course)
Burley, E. J.

ENGINE DRIVING.
(Second Course)
Clarke, R. A.

WILUNA SCHOOL OF MINES.

ELEMENTARY MATHEMATICS.
All Sections.

Pass—
Marr, D.

Arithmetic Section.

Credit—
Satchell, J. H.
Hall, M. C. (T)
Marr, D.

Pass—
Stewart, T. (T)
Ainsworth, L.
Lush, H. (T)
Pettit, K. J. (T)*
Watson, K.*

Algebra Section.

Credit—
Hall, M. C. (T)
Pettit, K. J. (T)
Satchell, J. H.

Pass—
Payne, H. J.
Marr, D.
Stewart, T. (T)*
Watson, K.*

Geometry Section.

Pass—
Marr, D.

* Denotes equal.

WILUNA SCHOOL OF MINES—Continued.

PREPARATORY MATHEMATICS.

Algebra Section.

Credit—
Hille, T.

Pass—
Hughes, H. (T)
Ramsay, I. G.

Geometry Section.

No Passes.

Trigonometry Section.

Pass—
Hille, T.
Ramsay, I. G.

PREPARATORY DRAWING.

Pass—
Hille, T.
Lush, H.
Watson, K.
Marr, D.

PREPARATORY PHYSICS.

Credit—
Hickey, B. M.

Pass—
Hille, T.

PREPARATORY GEOLOGY.

Credit—
Coleman, W. P.

Pass—
Rose, H. J.
Smith, A. D.
Taylor, E.
Sims, A. J.

MATHEMATICS. (First Course)

All Sections.

Credit—
Smith, A. D.

Pass—
Forward, H. G.

Algebra Section.

Credit—
Smith, A. D.
Forward, H. G.

MATHEMATICS. (First Course)

Geometry Section.

Credit—
Smith, A. D.

Pass—
Forward, H. G.

MATHEMATICS. (First Course)

Trigonometry Section.

Credit—
Smith, A. D.

Pass—
Forward, H. G.

PHYSICS. (First Course)

Credit—
Smith, A. D.

Pass—
Forward, H. G.
Chapman, J. (T)

Pass in Practical only—
Sims, A. J.

MECHANICAL DRAWING. (First Course)

Credit—
Smith, A. D.

Pass—
Sims, A. J.

MECHANICAL DRAWING. (Second Course)

Credit—
Forward, H. G.

SURVEYING. (Second Course)

Pass—
Henley, E. K.
Browne, G.
McCarthy, R. J.
Taylor, E.

WORKSHOP PRACTICE. (First Course)

Pass—
Dawson, G. J. (T)
Satchell, J. H.
Groessler, G. H.

WORKSHOP PRACTICE. (Second Course)

Credit—
Hunter, R. S.
Hackshaw, C. J.

Pass—
Ramsay, I. G.

SUPPLEMENTARY EXAMINATIONS, 1944.

PREPARATORY MATHEMATICS.

Trigonometry.

Pass—
Groessler, G. H.*
Jones, J. R.*

SURVEYING. (First Course)

Pass—
Hille, R. W.
Errington, W. N.

MINING. (First Course)

Pass—
Hawkins, T. G.

YEAR'S FEE SCHOLARSHIPS.

PREPARATORY PHYSICS.

Hickey, B. M.

PREPARATORY GEOLOGY.

Coleman, W. P.

MATHEMATICS. (First Course)

Smith, A. D.

PHYSICS. (First Course)

Smith, A. D.

MECHANICAL DRAWING. (First Course)

Smith, A. D.

MECHANICAL DRAWING. (Second Course)

Forward, H. G.

WORKSHOP PRACTICE. (Second Course)

Hunter, R. S.

NORSEMAN SCHOOL OF MINES.

ELEMENTARY MATHEMATICS.

All Sections.

Credit—
Meacock, E.

Pass—
Davey, B.
Mitchell, B.

Arithmetic Section.

Credit—
Meacock, E.
Davey, B.
Bennetts, L. (T)
Dehring, F.
Winner, E. (T)

Pass—
Mitchell, B.

Algebra Section.

Credit—
Davey, B.
Cottrell, R. (T)
Mitchell, B.
Stubbs, J. (T)
Meacock, E.
Kerr, W. (T)

Pass—
Kerr, A. (T)
Bennetts, L. (T)

Geometry Section.

Credit—
Meacock, E.

Pass—
Cottrell, R. (T)
Stubbs, J. (T)
Mitchell, B.
Davey, B.
Kerr, W. (T)

PREPARATORY MATHEMATICS.

All Sections.

Pass—
Joplin, W.
Cottrell, K.

Algebra Section.

Credit—
Joplin, W.
Cottrell, K.

Pass—
Horsham, J.

Geometry Section.

Pass—
Joplin, W.*
Cottrell, K.*

Trigonometry Section.

Credit—
Joplin, W.
Cottrell, K. K.

PREPARATORY PHYSICS.

Credit—
Cottrell, K. K.

Pass—
Joplin, W.*
Scholey, J. W.*
Dehring, H.
Morton, J. L.

PREPARATORY DRAWING.

Credit—
Morton, J. (T)
Mitchell, B. A.

Pass—
Lord, S. J.
Meacock, E.
Davey, B. C.

PREPARATORY CHEMISTRY.

Pass—
Dodd, K.
Dowglass, R.

MATHEMATICS. (First Course)

Algebra Section.

No Passes.

Geometry Section.

Credit—
Dodd, K.

Pass—
Scholey, J.
Baker, Ivor.

Trigonometry Section.

Pass—
Scholey, J.

APPLIED MATHEMATICS.

Pass—
Peek, K.

MECHANICAL DRAWING. (First Course)

Pass—
Morton, J.
Baker, I.
Trotter, E. J.
Dodd, L.
Dehring, D.
Dehring, R.
Butler, E. (T)

MECHANICAL DRAWING. (Second Course)

Credit—
Bach, D. J.
Scholey, J. W.
Peek, K.

Pass—
Radosevich, J. (T)

WORKSHOP PRACTICE. (First Course)

Credit—
Dodd, L. C.

Pass—
Forgan, F. A.
Trotter, E.
Benson, D.
Dehring, F. A.
Lord, S. J.

WORKSHOP PRACTICE. (Second Course)

Pass—
Baker, I.
Carey, L. J.
Dehring, R. F.
Harvey, J. W.*
Kerr, A. A. (T)*

YEAR'S FEE SCHOLARSHIPS.

ELEMENTARY MATHEMATICS.

Meacock E.

PREPARATORY PHYSICS.

Cottrell, K. K.

PREPARATORY DRAWING.

Morton, J.

MECHANICAL DRAWING. (Second Course)

Bach, D. J.

WORKSHOP PRACTICE. (First Course)

Dodd, L. C.

SCHOLARSHIPS, PRIZES, ETC.

The following have been recommended.

ENTRANCE SCHOLARSHIP (£60 per annum).
Cockram, C. C.

CHAMBER OF MINES SCHOLARSHIP (£15 per annum).
Metallurgy.
Thomas, R. P.

CHAMBER OF MINES SCHOLARSHIP (£20 per annum).
Mining.
Thomas, W. W.

W.A. SCHOOL OF MINES STUDENTS' ASSOCIATION SCHOLARSHIP (£15 per annum).
Chilvers, J. E.

INSTITUTE OF MINING SURVEYORS' SCHOLARSHIP (£10 per annum).
Ryder, K. N.

C. A. HENDRY PRIZE.
Turner, J. L.

CRITCHLEY PARKER PRIZES.
Ibbotson, G. R.
Crowe, I. F.

WESLEY LADIES' GUILD PRIZE.
Hamilton, F. G.
Moore, M. A.

* Denotes equal.

Division VI.

Annual Report of the Inspection of Machinery Branch of the Mines Department for the Year 1944.

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, 1944, WITH STATISTICS.

The Under Secretary for Mines:

For the information of the Hon. Minister for Mines, I submit the report of the Deputy Chief Inspector of Machinery on the administration of the Inspection of Machinery Act, 1921, for the year ended 31st December, 1944.

JOHN S. FOXALL,
Chief Inspector of Machinery.

SECTION I.

Inspection of Boilers, Maintenance, Etc.

See Returns Nos. I, II, and III.

The term "Boiler" as defined in the Act includes any vessel in which steam is generated above atmospheric pressure for working any kind of machinery, or for any manufacturing purpose, also unfired pressure vessels, such as steam jacketed pans, stills, sterilisers, digesters, vulcanisers, air or gas receivers, montejus, etc.

The total number of registered boilers which were recorded as fit for use on 31st December, 1944, was 5,064, being 101 more than the previous year. The number of boilers added to the register was 120. which was 40 less than the previous year. Return No. I gives the number of boilers of each type, and the country of origin of the 114 new registrations; in addition 3 secondhand boilers were imported from other Australian States, and 3 were transferred from other departments in this State. The number of boilers removed from the register was 19, which was 29 less than in 1943. Of these one was converted to use as an oil tank, 13 were permanently condemned, three were sent out of this State, and two transferred to other departments in this State.

For many years the number of registered boilers out of use has been from 50 per cent. to 60 per cent. of the total boilers registered, but for various reasons the majority of these boilers will never be used again, although at the time they were discarded there was a possibility that they might be. There has been a steady demand for secondhand boilers, especially since the war started, but it is increasingly difficult each year to find boilers which are fit for use, or capable of being repaired economically. Boilers which have been exposed to the weather for a number of years sometimes become badly wasted, but on the other hand, if left clean and clear of brickwork or lagging, very little deterioration has been found in many cases even after 30 or more years of exposure in dry areas; so that it is hard to judge from the records what the present condition of a boiler may be. Actually there are very few useful boilers out of use in accessible localities.

New Construction.

It is gratifying to be able to record that eleven underfired multitubular boilers were built by local firms during the year. Five of the eight watertube boilers imported from other States were of small size, designed for dairy purposes, but the remaining three were of the four-drum Stirling type having 5,000 sq. ft. of heating surface, the working pressure being 200 lbs. per sq. in. Of the twenty-nine vessels built in this State, which are recorded under the heading of digester, twenty are steel vessels to be used in conjunction with the Stirling type boilers mentioned above, in the production of alcohol from grain. Nine of these vessels are hemispherical ended vertical fermenters, 22ft. diameter by 36ft. height, working at a pressure of 25 lbs. per square inch, and designed to carry 50,000 gallons of mash; when completed, there will be 12 of these vessels. Three smaller vessels of the same shape are 11ft. diameter by 16ft. height, designed to work at 30 lbs. per square inch, and to carry 4,800 gallons of mash; when completed there will be six of these vessels. These vessels are fabricated throughout by electric welding; the large ones, owing to their size, were erected and welded on the site. The two vertical stationary boilers from the United Kingdom were imported about 30 years ago as part of Titan Cranes, but as the undertaking they were ordered for was not gone on with, they were not put into use but were stored under cover. These cranes are now in use in connection with projects indirectly connected with defence.

Maintenance.

In spite of the manpower shortage and difficulty in obtaining plates, practically the whole of the steel work in three locomotives was renewed, and extensive repairs on other boilers were carried out.

Return No. 1.—Showing the Number of Boilers of each Type, and Country of Origin of New Registrations for the Year ended 31st December, 1944.

Type.	Country of Origin.					Total.
	United Kingdom.	U.S.A.	Eastern States.	Western Australia.	Unknown Sources.	
Vertical Stationary	2	....	....	....	....	2
Vertical Multitubular Portable	....	....	....	1	....	1
Return Multi. Stat. Underfired	....	....	3	11	....	14
Return Multi. Stat. Int. Fired	....	....	....	3	....	3
Water Tube	....	....	8	....	....	8
Saddle Back	....	....	....	6	....	6
Digester	....	....	1	29	....	30
Vulcaniser	....	....	2	1	....	3
Steam Jacketed Vessel	....	....	1	6	....	7
Steriliser	....	....	2	5	....	7
Air Receiver	2	....	7	17	6	32
Rectangular Under Fired	....	1	....	....	....	1
	4	1	24	79	6	114

Return No. 2.—Showing Classification of Various Types of Useful Boilers in Proclaimed Districts on 31st December, 1944.

Types of Boilers.	Districts worked from Perth.	Districts worked from Kalgoorlie.	Unproclaimed Areas.	Totals. 1944.	Totals. 1943.
Lancashire	42	57	....	99	99
Cornish	97	473	....	570	573
Semi-Cornish	11	37	....	48	48
Vert. Stat.	296	354	....	650	651
Vert. Port	71	15	....	86	84
Vert. Mult. Stat.	41	26	....	67	67
Vert. Mult. Port.	17	3	....	20	19
Vert. Pat. Tubular	49	....	....	49	49
Loco. Rect. Firebox Stat.	81	65	....	146	143
Loco. Rect. Firebox Port.	248	70	....	318	317
Loco. Circ. Firebox Port.	134	9	....	143	143
Locomotive	74	42	....	116	117
Water Tube	212	119	....	331	325
Return Mult. Underfired Stat.	178	61	....	239	228
Return Mult. Underfired Port.	....	8	....	8	8
Return Mult. Int. Fired Stat.	42	12	....	54	51
Return Mult. Int. Fired Port.	2	....	....	2	2
Egg ended and other types not elsewhere specified	228	24	71	323	311
Digesters	148	6	....	154	126
Air Receivers	546	444	....	990	959
Gas Receivers	7	....	....	7	7
Vulcanizers	285	10	....	295	293
Steam Jacketed Vessels	337	12	....	349	343
Total Registrations useful Boilers	3,146	1,847	71	5,064	4,963
Total Boilers out of use 31st December, 1944	1,560	1,528	....	3,088	2,963

Return No. 3.—Showing Operations in Proclaimed Districts during Year ended 31st December, 1944.

(BOILERS ONLY.)

——	Districts worked from Perth.	Districts worked from Kalgoorlie.	Unproclaimed Areas.	Totals. 1944.	Totals. 1943.
Total number of useful boilers registered	3,146	1,847	71	5,064	4,963
New boilers registered during Year	113	1	....	114	146
Boilers reinstated	....	....	....	....	2
Boilers converted	....	1	....	1	....
Boilers Inspected—					
Thorough	1,596	315	....	1,911	1,937
Working	209	6	....	215	178
Boilers condemned during year—					
Temporarily	13	....	....	13	19
Permanently	13	....	....	13	38
Boilers sent to other States during year	3	....	....	3	5
Boilers sent from other States during year	3	....	....	3	8
Transferred to other Departments	2	....	....	2	5
Transferred from other Departments	3	....	....	3	4
Number of Notices for Repairs issued during year	472	10	....	484	511
No. of Certificates issued, including those issued under Section 30 during the year	1,586	319	....	1,905	1,930

SECTION II.

Explosions and Interesting Defects.

A local resident designed and had constructed locally a small two-drum water tube boiler, which he intended to use in a steam launch, but owing to the war this project was abandoned and the boiler was sold and installed in a factory which manufactures stock and poultry feed. This boiler is of peculiar design; the ½in. diameter tubes are arranged in 15 layers, each layer being coiled in a deep wave or gridiron fashion, every alternate layer being placed at right angles to the adjacent one; there are also similar coils on each side of the combustion chamber; the two drums are connected in series through the coils which are connected in series parallel with the drums and a blow off header. The steam and water drums are at the same level on top of the boiler, they are 11 inches internal diameter by 5 feet long over the hemispherical ends, being connected to the stop valve by a breeches pipe. After the boiler had been working about 16 months the tubes became overheated and water could not be forced into the boiler which works at about 100 lbs. pressure. On examination it was found that molasses, which was heated in a tank by a steam jet, had been sucked back into the boiler, owing to the valves not being shut off when the factory closed at night, and a lack of a non-return valve on the steam line to the tank. All the tubes and blow off header were choked with burnt molasses. The only damage caused was to the two bottom coils which had to be renewed; the remainder were blown through and replaced. The steam pipe has been disconnected from the molasses tank.

Owing to the temporary shortage of coal, a Babcock and Wilcox boiler was altered to oil firing without notification being given by the owner, to this office. The boiler damper was locked in the open position, but through the accidental closing of the butterfly type damper on the economiser, a blow back occurred which burned the boiler attendant, but fortunately his injuries were not very serious. The economiser damper is now locked in the open position, and the boiler damper connected to the oil burner in such a way that the damper must be opened before the burner can be lighted.

Slight damage was caused by fuel oil explosion to a boiler of American design which was intended to be fully automatic in operation. The boiler is rectangular 2ft. 7½in. wide by 5ft. 6in. long by 3ft. 6in. deep overall consisting of an inner and outer mild steel shell ¼in. thick forming a water space 4in. wide round the sides and ends, the top and bottom being open. All the seams in the inner and outer shell are welded, and the flat surfaces are stayed with ¾in. space stays at 7½in. vertical and horizontal pitch. There are a number of corrugated heating elements arranged inside the inner shell and attached to it at one end by two connecting pipes fitted at the top and bottom of each element to allow water to circulate. This boiler was intended to be used in connection with a plant for making Coca Cola for American Service men, but unfortunately, when it arrived, no drawings or instructions for its proper installation were sent with it, and many of the automatic controls were missing and had to be improvised. As originally installed no explosion doors were provided in the combustion chamber, and when the explosion occurred the mild steel casing of the combustion chamber was damaged and the boiler shifted sideways about four inches. The damage was so slight that the boiler was again working in 24 hours. The boiler is oil fired, and when the starting switch is closed, an ignition element is heated, and the fuel injection blower is started through a time relay, to ensure that the fuel is ignited immediately. When the fuel is fully ignited, the ignition is cut out. When the steam pressure reaches the working limit, the fuel is cut off, and the blower stopped. The blower is controlled by the steam pressure, the low water level and the temperature of the flue gases. The accident was caused through the blower injecting fuel before the ignition element was hot enough to ignite it, so that when ignition did take place an explosion occurred. Explosion doors have been fitted and the time relay on the blower overhauled to ensure that the ignition element will be at the correct temperature before the fuel is injected.

An all copper steam jacketed pan having a 5-32in. thick inner shell 13in. radius, and ⅛in. thick outer vessel 14in. radius, was imported in 1916, it was in fairly constant use until 1936 and again from August 1939 to November 1944. A slight leak, which appeared to be coming from the joint between the inner and outer vessel, was noticed at an inspection made on 21-7-1944, and the owner was advised to remake the joint but owing to pressure of work, the pan was not dismantled until 7-11-1944, when it was discovered that the outer shell was cracked at the heel of the flange, the cracks were visible from both the inside and outside of the shell and were nearly continuous for one half of the circumference. The inner and outer shells were connected at the bottom by a drain fitting which would relieve the top flange of some of the load, but even so it is remarkable that the crack did not extend, and cause the inner and outer shells to part. This shows the necessity for treating even slight leakage in the vicinity of the joint flange as a potential source of danger.

A new outer shell has been made of 6 gauge copper worked up without seams. Experience in this State with copper pans has proved the wisdom of the Standards Association of Australia in limiting the stress in compression and tension in the inner and outer shells respectively of hemispherical pans to 3,000 lbs. per square inch. Where the stress has exceeded this figure to any great extent, costly repairs have been necessary, particularly in the case of tipping pans fitted with mechanical stirrers, as the weight of the pan and its contents is carried on the trunnions alone, and the outer shell, if not stiff enough, cracks round the boss which forms the trunnion.

SECTION III.

Inspection of Machinery.

See Returns IV, V, and VI.

The number of groups of machinery inspected during 1944 was 433 less than in 1943. The only alteration in the lift return, No. 6, is that one lift previously classified as "passenger and goods" is now used solely as a "goods" lift.

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, 1944

Classification.	Districts worked from Perth.	Districts worked from Kalgoorlie.	Totals. 1944.	Totals. 1943.
No. of Groups driven by steam engines	485	527	1,012	985
No. of Groups driven by oil engines	1,323	809	2,132	2,111
No. of Groups driven by gas engines	68	188	256	257
No. of Groups driven by compressed air	....	60	60	60
No. of Groups driven by electric motors	11,189	3,559	14,748	14,109
No. of Groups driven by hydraulic pressure	5	....	5	5
	13,070	5,143	18,213	17,527

Return No. 5.—Showing Operations in Proclaimed Districts during Year ended 31st December, 1944.

(MACHINERY ONLY.)

	Districts worked from Perth.	Districts worked from Kalgoorlie.	Totals. 1944.	Totals. 1943.
Total registrations useful machinery	13,070	5,143	18,213	17,527
Total inspections made	8,865	2,416	11,281	11,714
Certificates (bearing fees)	2,891	366	3,257	3,599
Certificates (steam without fees)	37	8	45	48
No. of extension certificates issued under Section 42 of Act	....	....	....	....
Notices issued (Machinery Dangerous)	331	....	331	367

Return No. 6.—Showing Classification of Lifts on 31st December, 1944.

Types.	How Driven.	Totals. 1944.	Totals. 1943.
Passenger	Electrically driven	188	189
	Hydraulically driven	1	1
Goods	Electrically driven	96	95
	Hydraulically driven	3	3
	Belt driven	4	4
Service	Electrically driven	29	29
		321	321

Accidents to Machinery.

A horizontal gas engine direct coupled to an electric generator had been thoroughly overhauled, and was run for 24 hours, when it was shut down in order to check over all accessible working parts before restarting. Several hours after the engine had been again put on full load, without any warning or any unusual noises being heard, either by the engine room staff or the District Inspector who happened to be in the engine room, one trunk piston and connecting rod crashed through the crank splash guard, somersaulted across the engine room, falling on the floor beside the engine driver, without injuring any person or damaging any of the rest of the plant. Apparently the nut of one crank pin bearing bolt slacked off and sheared the 5-16in. split pin, thus allowing the nut to run off, the other bolt was badly bent, the outer half bearing and the cap broke, probably due to centrifugal force or by the pull due to the suction stroke or both combined. This engine is a secondhand one which was brought from South Australia many years ago, and by a peculiar coincidence a similar mishap occurred to the same cylinder when it was working in that State.

A three phase 230 h.p. electric motor driving an electric winder broke down through the binding wires which held the rotor coils in place becoming slack allowing the coils to move and a short circuit to form from them to the stator coils. At the time the accident occurred the Lilly speed and overwind controller was temporarily disconnected, and it is surmised that while lowering the cage in single gear the speed was permitted to become excessive. The rotor was rewound by the mine staff under the supervision of an engineer from the Sydney staff of the manufacturers of the motor.

The number of internal combustion engine crankshafts which fractured was an all time high, three 1,150 h.p. horizontal 8 cylinder engines, two 600 h.p. vertical 6 cylinder engines and one 800 h.p. vertical 7 cylinder engine each broke a crankshaft. All occurred on mining properties, and the settlement of the foundation was suggested as the probable cause, but the acute shortage of skilled labour was no doubt a contributory factor.

The regulating valve of a steam winding engine was prevented from closing by a small piece of brass, which it is presumed was portion of one of the boiler stop valves which was broken about four years before. At the time the regulating valve jammed, two men were on the top of one of the cages, examining the shaft timber. They gave the signal to lower the cage, and when the driver eased the brake, the engine accelerated rapidly. He naturally applied the brakes suddenly causing the cage to surge and the safety grippers to grip the skids, one man fell off the top of the cage on to one of the levels which the cage happened to be opposite, he only received minor injuries. The other man, when the winding rope slackened, was hit by the safety hook, shackle and chains, and he received injuries which laid him up for six months.

A drum drive passenger lift which was installed before the year 1905, overwound and the cage hit the top of the lift shaft with such force that the cage was badly distorted. The top over-run was only two feet, which made it very difficult to keep the limit switch in good adjustment. Luckily the cage was empty at the time.

SECTION IV.

There were no prosecutions for breaches of the Act.

SECTION V.

Accidents to Persons.

Return No. 7 records only those accidents caused by working machinery subject to the provisions of the Act, which are classified as serious, that is those which prevented the injured person from following his usual occupation for a period of two weeks or more, but does not include accidents on timber mills which are subject to the provisions of the Timber Industry Regulation Act, 1926.

There were nine more accidents recorded, and the number which resulted in the deaths of the injured persons was two more than in 1943. Of the 44 accidents notified, thirteen including three fatal, were caused by circular saws. This is the greatest number recorded as caused by circular saws, since accidents on timber mills were excluded from these returns.

The first fatal accident due to a circular saw happened when the owner, who was an apiarist, was cutting up small pine logs into boards for case making. He had just finished cutting a board about 1¼in. thick and 30in. long, when it fell on the back of the saw; the board was picked up by the saw and thrown forward, striking the deceased person on the head with such force that his skull was fractured, and he died the next day from his injuries.

The second fatal accident caused by a circular saw, happened to a man cutting bush timber into foot length blocks for firewood. The saw and kerosene engine driving it were on a portable frame. This plant was unregistered and therefore had not been inspected. The saw is carried by a radial arm which swings in a vertical plane. Between cuts the saw is returned to the top of its travel by a counter weight, the timber to be cut is held on to a tray with the left hand, and the saw is engaged by pulling down with the right hand a lever attached to the swinging arm. The deceased, when the accident happened, was attempting single handed to cut a foot block off the end of a badly bent branch which was about five inches diameter by six feet long; this branch was bent in two places nearly at right angles. When the cut was about two thirds through, the branch broke at the cut, probably through the branch twisting on the table. The deceased appears to have lost his balance and fallen on to the saw, which cut his head open, killing him instantly, and to make matters if possible worse, his wife and young children who were close at hand, witnessed the tragedy.

Another unregistered firewood saw caused the third fatality. This saw bench was solidly made of sound timber, the spindle and bearings were in good order, but the second-hand saw, 28 inches diameter had short radial hair cracks at the bottom of almost every gullet with several larger cracks which although very distinct after the saw broke may not have been easily seen when the saw was last sharpened a short time before the accident happened. The saw was driven by a model T Ford engine without any speed governing device. The engine speed was 1,400 revs. per minute giving a peripheral saw speed of 20,500 feet per minute when running free, but as the engine was run with a fixed throttle opening, the saw speed when cutting must have been very much less, but judging by the cracks in the saw the cutting speed was probably excessive. The saw was being operated by a lad aged 16 years 5 months, who was the son of the owner of the plant. He was cutting a dry piece of bush timber, about five inches diameter, and about six feet long which was split longitudinally, when about half way through, the saw broke into several pieces one of which penetrated the lad's forehead, and one remained on the saw spindle. The lad's father was assisting him at the time of the accident and witnessed the tragedy. The person who sharpened the saw had considerable experience with circular saws, so that it is strange that he did not notice the dangerous condition the saw was in, and it is almost certain that the cracks did not form after it was last sharpened because only two tons of firewood had been cut between then and the time of the accident, besides the larger cracks had all the appearance of having existed for a long time.

The owner of a firewood yard on the Goldfields built a saw bench, but before he registered it and had it inspected he decided to test it; the second-hand saw which he was using broke. A piece of the saw hit his head, causing a depressed fracture of the skull, which nearly proved fatal. A young boy playing 150 yards away was hit on the foot by a piece of the saw, but his injuries were not very serious. Portion of the saw which remained on the spindle hit the sliding bench top tearing away the bearings, the belt became entangled and pulled the spindle with the remains of the saw back to the oil engine which had been driving it.

Four of the other accidents caused by circular saws would probably not have happened had a riving knife been fitted or where one was fitted if it had been correctly adjusted. In two other cases, the saw was unsuitable for the work in hand, one was due to carelessness on the part of the injured person and two were pure mishaps.

The two fatal accidents recorded under the heading of belting were in each case caused by light belts. In the first case, the injuries were simple fracture of the left forearm, compound fracture of right forearm, abrasion of left side of chest and left ankle. The injured man died of shock five days after receiving the injuries. In the second case the deceased was greasing and oiling, and apparently either reached through a light belt or stepped over it, became entangled in the belt and was thrown against some hard object, causing cerebral haemorrhage, which caused his death. The plant was not registered, and there was no witness of the accident.

The two accidents recorded under the heading of rotary printing press, were caused by machines belonging to different newspaper proprietors, but otherwise the circumstances were almost identical. In both cases the machines were running at slow speed, feeding in the newsprint, in one case after a break in the paper and the other while changing to a new roll of paper; in each case the operator's right hand was crushed in the folder rolls, one while trying to remove a torn piece of paper, and the other when reaching over to straighten a copy of the paper which was not leading into the rolls correctly. Both men appear to have slipped while performing an operation each had carried out many hundreds of times.

In one of the accidents caused by a guillotine, the injured person maintained that he had been instructed to work at this machine, but the charge hand said that he was supposed to be working a stapling machine. At the time of the accident there was no work for the stapling machine, and he apparently decided to help the man who was working the guillotine, by removing the bundles of paper which had been cut to size, but not content to do this, he attempted to cut some paper during the temporary absence of the other man. He said that he placed some sheets against the stop and noticing that some sheets were out of place, he reached under the knife with

Return No. 7.—Showing Number of Accidents, both Fatal and Non-Fatal, which occurred in Proclaimed Districts during the year ended 31st December, 1944.

() Numbers within brackets denote Fatal Accidents.

Machines.	Woodworking.	Metalworking and Engineering.	Printing and Stationery.	Firewood Cutting.	Flour Milling.	Chemical.	Leather Ware.	Brewing and Allied Industries.	Agricultural.	Mining.	Other Industries.	Total Machines.
Circular Saw	3	....	1	3 (2)	1	1	....	2	1 (1)	....	1	13 (3)
Abrasive Wheel	....	2	....	....	....	....	....	....	....	....	....	2
Belting	....	1	....	....	....	....	....	1	....	....	2 (2)	4 (2)
Shafting	....	1	....	....	....	....	....	....	....	....	2	3
Lathe	....	1	....	....	....	....	....	....	....	....	....	1
Rolls	....	....	....	....	....	....	....	....	....	....	2	2
Rotary Printing Press	....	....	2	....	....	....	....	....	....	....	....	2
Guillotine	....	....	2	....	....	....	....	....	....	....	1	3
Press	....	3	....	....	....	....	....	....	....	....	....	3
Boiler	....	....	....	....	....	1	....	1	....	....	....	2
Winding Engine	....	....	....	....	....	....	....	....	....	1	....	1
Miscellaneous	....	2	....	....	2	....	1	....	....	....	3	8
Total (Industries)	3	10	5	3 (2)	3	2	1	4	1 (1)	1	11 (2)	44 (5)

both hands to square up the paper; while so doing he must have pressed the starting lever with his body, because the knife descended, cut off his right hand at the wrist and four fingers of his left hand. The safety catch was found to be out of adjustment; this has been rectified and other alterations made which should make it impossible to start the machine accidentally in future.

With the exception of the accident in connection with a winding engine, which has been dealt with under the heading of accidents to machinery, all the rest of the accidents to persons could have been avoided if the injured persons had obeyed instructions or used reasonable care, combined with a small amount of common sense.

SECTION VI.

Examination of Engine-drivers.

Examinations were held as follows:—Perth 4, Kalgoorlie 3, Bunbury 2, and Geraldton 1. Examinations were held at all advertised centres except Mt. Magnet, at which centre there were not sufficient candidates. The Board spent 10 days holding examinations, 28 days dealing with applications, examination papers, etc., and 12 days travelling.

Applications received, 217; Certificates granted, 192.

Return No. 8.—Showing Total Number of Engine Drivers' and Boiler Attendants' Certificates (all Classes) Granted in 1944, compared with 1943.

	Number Granted.	
	1944.	1943.
Winding Competency, including certificates issued under Regulation 40 and Section 60 of the Act	2	3
First Class Competency, including certificates issued under Regulations 40 and 45 and Sections 60 and 63 of the Act	5	6
Second Class Competency, including certificates issued under Regulation 40 and Section 60 of the Act	15	25
Third Class Competency, including certificates issued under Regulations 40 and 45 and Sections 60 and 63 of the Act	26	20
Locomotive Competency, including certificates issued under Regulation 40 and Section 60 of the Act	5	8
Traction Competency, including certificates issued under Regulation 40 and Section 60 of the Act	....	....
Internal Combustion Competency, including certificates issued under Regulation 40 and Section 60 of the Act	46	39
Crane and Hoist Competency, including certificates issued under Regulation 40 and Section 60 of the Act	6	15
Boiler Attendant Competency, including certificates issued under Regulation 40 and Section 60 of the Act	70	65
Interim	....	....
Copies	13	6
Transfer	4	1
	192	188

SECTION VII.

General, Staff, Revenue and Expenditure, Mileage, etc.

Staff: There were no changes to record.

Revenue and Expenditure, Return No. 9: A loss of £399 1s. 8d. is shown for the calendar year, but the records for the last six months of 1944 show a profit of £398 18s. 8d., so that conditions are improving.

Return No. 10: Shows the particulars of miles travelled, etc.

Return No. 9.—Showing Revenue and Expenditure for Year ending 31st December, 1944.

REVENUE.

	1944.	1943.
	£ s. d.	£ s. d.
Fees for Boiler Inspections	2,532 0 2	2,516 15 5
Fees for Machinery Inspections	5,055 19 10	5,415 13 10
Engine Drivers' Fees	236 4 6	245 15 6
Incidentals	70 13 8	65 12 2
Decrease—£348 18s. 9d.	7,894 18 2	8,243 16 11

EXPENDITURE.

	1944.	1943.
	£ s. d.	£ s. d.
Salaries	6,689 7 8	6,557 7 2
Incidentals	1,507 19 10	1,458 15 9
Engine Drivers	96 12 4	27 9 4
Increase—£250 7s. 7d.	8,293 19 10	8,043 12 3

Loss—£399 1s. 8d.

I wish to thank all those who helped in carrying out the work of this Branch, and to record my appreciation of the co-operation received from the officers of other departments both in this State and the Commonwealth. In particular, I desire to thank all the officers of this Branch for the good work they have performed, and also all other officers of the Mines Department for their unfailing courtesy and assistance.

J. MOORE,
Deputy Chief Inspector of Machinery.

Return No. 10.—*Showing Distances Travelled, Number of Inspections made and Average Miles Travelled per Inspection for Year ended* 31*st December*, 1944.

Areas Traversed.	Rail Miles.			Road Miles.			Water Miles.			Total Miles.			Total Number of Inspections.			Average Miles per Inspection.		
	1944.	As compared with 1943.		1944.	As compared with 1943.		1944.	As compared with 1943.		1944.	As compared with 1943.		1944.	As compared with 1943.		1944.	As compared with 1943.	
		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.
Districts worked from Perth	362	...	2,796	37,678	1,314	...	36	36	...	38,076	...	1,446	10,670	...	360	3·56	...	·02
Districts worked from Kalgoorlie	1,816	1,340	...	13,497	70	...	...	...	...	15,313	1,410	...	2,737	...	62	5·59	·63	...
Totals	2,178	1,340	2,796	51,175	1,384	...	36	36	...	53,389	1,410	1,446	13,407	...	422	3·98	= Average all Districts, 1944.	
																3·86	= Average all Districts, 1943.	
Increases or Decreases	Decrease 1,456		...	Increase 1,384		...	Increase 36		...	Decrease 36		...	Decrease 422		...	...	= Average Increase .12 miles per inspection	

ANNUAL REPORT OF THE GOVERNMENT MINERALOGIST, ANALYST AND CHEMIST FOR THE YEAR 1944.

Table of Contents.

Division VII.

Annual Report of the Government Mineralogist, Analyst and Chemist for the Year 1944.

The Under Secretary for Mines.

I have the honour to present for the information of the Hon. the Minister, my report on the operations of the Government Chemical Laboratories for the year ending 31st December, 1944.

STAFF.

Mr. H. E. Hill remained for the whole of the year with the Defence Foodstuff Laboratory in Melbourne to which he was seconded in 1943. Mr. J. C. Hood continued to act in the position of Supervising Chemist, Foods, Drugs and Toxicology Section temporarily vacated by Mr. Hill.

Messrs. F. F. Allsop, C. R. Le Mesurier, H. Sedgman and A. G. Turton had their status increased from Chemists, 2nd Class to Chemists, 1st Class.

Messrs. C. E. S. Davis, B.Sc., T. Haug, H. R. Limb, B.Sc., A.A.C.I., and E. C. Hodgson, B.Sc., A.A.C.I., were transferred from the temporary staff to the permanent staff.

To meet the expanding activities of this Branch the necessary authority was granted to appoint seven additional temporary chemists to the Laboratory staff. These chemists are to be allocated as follows:—Agricultural Section (3), Food Section (1), Mineral Section (2), Soil Mineralogy Section (1).

Miss J. McColl and Miss E. Kirk, temporary junior typists, were appointed to the permanent staff in June. The increasing volume of work necessitated additional clerical assistance and the temporary appointment of Miss C. Craig as junior typist was approved.

ACCOMMODATION.

The official opening of the recently erected laboratories in Adelaide terrace was performed by the Hon. A. H. Panton, M.L.A., Minister for Mines, on 17th November, 1944, in the presence of representatives of the Government, Parliament, Government Departments, Local Governing Bodies and professional and commercial interests.

The laboratories which were not fully equipped at the date of the opening owing to the difficulty in obtaining suitable specialised equipment under war conditions for which funds had been made available by the Government, were inspected by the visitors with a great amount of interest. Much favourable comment was expressed regarding the wide range of work performed by this Branch, particularly in respect to the development of the Mineral and Agricultural resources of the State and the establishment of Secondary Industries in Western Australia.

EQUIPMENT.

Our work has been retarded by the non-delivery by Eastern States manufacturers of the ordinary types of laboratory heating and drying equipment ordered in 1942. All attempts to date to expedite the delivery of a number of baths and ovens have proved unavailing.

In addition to this the failure to instal certain fixed equipment that was provided for in the original requirements and included in the design of the building, has been responsible for holding up important and urgent work. It is impossible to obtain any satisfactory explanation regarding this matter.

In other cases essential work has been held up indefinitely on account of the necessity of placing orders for new equipment with overloaded Government Departments who find it impossible to give any accurate estimate as to when delivery could be effected.

During the year the work of the laboratories has increased in complexity and owing to the lack of suitable equipment for dealing with certain problems by modern methods our difficulties have increased and much valuable time has been lost. In order to meet the position standard screens with an automatic shaker have been ordered from overseas. A Fagergren Flotation Cell for work on non-metallic minerals was ordered early this year but has not yet arrived.

In furtherance of our mineralogical work and to place this Laboratory in a position to advise prospectors and others as to the advisability of developing newly discovered deposits of economic minerals for which there will be an increasing demand in the post-war period, it is essential that we should be equipped to carry out experiments on their beneficiation and extraction. For this purpose it will be necessary to instal as soon as possible (1) Haultain Super-panner, (2) Magnetic Separator, (3) Laboratory type of concentrating tables.

The absence of a suitable furnace in our equipment for testing various types of refractory minerals and materials at high temperatures does not permit an expression of an opinion regarding them. In view of the known occurrences of these minerals in this State and the post-war requirement in this direction the need for this equipment could not be too strongly stressed.

It is to be recognised that the installation of equipment of this nature would require special housing which cannot be made available in the present buildings.

The Hilger Quartz Spectrograph that was taken over on the amalgamation of the Government Laboratories in 1922, being obsolete, will not meet present day requirements in spectrography. In view of the extensive application of spectrography in all branches of our work the early replacement of the obsolete instrument by a modern one will have to receive serious consideration.

REVENUE.

The revenue earned for the year under review amounted to £3,453 17s. 10d.

FIELD WORK.

Mr. H. P. Rowledge visited the Pilbara District in May for the purpose of obtaining additional information regarding the tantalum bearing minerals in that area and to advise producers as to the methods to be adopted in preparing parcels of these minerals for sale to the Commonwealth for despatch to the United States of America.

Dr. D. Carroll and Mr. J. N. A. Grace paid a short visit to Greenbushes in April to obtain information concerning the distribution of tin and tantalite ores in that district.

INTER-DEPARTMENTAL TECHNICAL COMMITTEES.

The interdepartmental Committees comprising technical representatives of this Laboratory and those Departments submitting work to the Laboratory formed for the purpose of bringing about closer understanding of each others' requirements and to collaborate in the study of the various problems have continued to function during the year.

The Committees established under this arrangement are:—

1. *Interdepartmental Soils Technical Committee* with Dr. L. J. H. Teakle (Chairman) and Mr. G. H. Burvill representing the Department of Agriculture; Dr. D. Carroll, Messrs. A. J. Hoare and B. L. Southern of this Laboratory; Mr. J. O'Donnell of the Forests Department, and Mr. R. Smith of the Division of Soils, Council for Scientific and Industrial Research.

2. *Interdepartmental Dairy Products Technical Committee* represented by Messrs. M. Cullity (Chairman), and K. Needham of the Department of Agriculture; Messrs. J. C. Hood (Convener), A. J. Hoare and Dr. D. Carroll of this Department; and Mr. D. A. Evans of the Department of Public Health.

3. *Interdepartmental Fruit Technical Committee* with Mr. H. R. Powell (Chairman) and Dr. T. C. Dunne of the Department of Agriculture; and Mr. J. C. Hood (Convener) and Dr. D. Carroll of this Laboratory.

4. *Interdepartmental Vegetable Research Committee* of which Drs. T. C. Dunne, E. J. Underwood, L. J. H. Teakle and Mr. E. T. Morgan represent the Department of Agriculture, and Messrs. J. C. Hood (Convener) and A. J. Hoare this Laboratory.

Committee on Fibrolite Pipes and Cement Lined Pipes.

A committee consisting of Messrs. R. J. Cavanagh (Engineer for Metropolitan Water Supply and Sewerage Department), B. S. Crimp (Principal Assistant, Hydraulics), E. Hammond (Principal Assistant, Goldfields Water Supply) and H. Bowley (Government Analyst), Chairman, was appointed to enquire into:—

(a) means of overcoming alkalinity of water in concrete-lined and cement asbestos pipes;

(b) causes of failure of cement asbestos pipes in the metropolitan area;

(c) external coatings of pipes, buried and unburied.

Mr. E. H. Oldham (Engineer, Metropolitan Water Supply and Sewerage Department) was co-opted as a member of the Committee.

The services of Mr. C. R. Le Mesurier (Research Chemist), H. Wilson (Engineer), and R. A. Hobson (Geologist) were made available for work under this Committee.

STATE INDUSTRIES.

State (W.A.) Alunite Industry.

In spite of the many difficulties experienced in establishing an industry under war conditions the production during 1944 of potash for fertiliser purposes expressed in terms of potassium oxide amounted to 355 tons. This made a valuable contribution to the Australian requirements of potash at a time when external sources of that material were cut off.

Charcoal, Iron and Wood Distillation Industry.

Considerable progress has been made in the erection of the plant for the production of charcoal iron at Wundowie.

Alumina Pilot Plant.

Work on the installation of the Pilot Plant to test the hydrochloric acid process for the extraction of alumina from the residues after leaching out the potash salts formed in the treatment of alunite at Chandler was commenced during the year.

Allied Services.

The Allied Services were responsible for submitting a considerable number of samples of various types of materials for examination in this Laboratory. This work being of an urgent nature was given a high priority. In all cases payment was made for any work done for them.

PUBLICATIONS.

D. Carroll—Mineralogy of some soils from South-Western Australia. Journal, Department of Agriculture, W.A., 1944.

TABLE SHOWING SOURCE OF SAMPLES FOR 1944.

	No. of Samples.
Mines—	
Chemical Laboratories	106
State Batteries	69
State Mining Engineer	53
Under Secretary for Mines	8
Government Geologist	382
Explosives Branch	3
Health Department	104
Hospitals	28
Agriculture	1,406
Police—	
Coroners	63
Criminal Investigation Branch	40
Liquor Inspection Branch	8
Government Stores and Tender Board	5
Metropolitan Water Supply	953
Works and Labour	107
Industrial Development	29
Treasury	3
Forests	58
Department of Labour—	
Chief Inspector of Factories	19
Free	288
Pay—	
Aeronautical Inspection Directorate	49
Royal Australian Air Force	13
Department of Navy—	
Royal Australian Navy	14
Royal Navy	1
Department of Army	44
Public	429
United States Defence Forces	1,327
Commonwealth Works	39
Allied Works Council	13
Department of War Organisation of Industry	4
Railways	30
Munitions	1
Agriculture Department	2
State Saw Mills	4
State Wool Committee	3
State Alunite Industries, Board of Management	4
Local Governing Bodies	17
Department of Shipping, Minerals Prod.	49
Government Printer	2
	5,777

NATURE OF WORK DONE.

GOLD.

The number of gold assays during the year was relatively small, comprising 16 umpire assays of gold ore tailings, 37 check assays of State Battery gold ore tailings, prospectors' free assays, and several pay ores and concentrates. One of the later contained 65 ozs. of gold per ton. Fifteen prospecting samples from Delaney's Well on Ninghan Station contained gold varying from 2 ozs. 7 dwts. per ton to a trace.

METALS AND ALLOYS.

During the year 50 samples of a special phosphor-bronze bearing metal were received from the Aeronautical Inspection Directorate for analysis. This metal is used for aeroplane replacement parts and has to conform to definite specifications for tin, copper, phosphorus and impurities. The alloy was within the chemical limits in almost all cases.

Several samples of steel turnings were assayed for carbon and manganese.

The Aeronautical Inspection Directorate forwarded a special type of bronze bush for identification. A polished section was prepared, which indicated a graphite impregnated type. This was confirmed by chemical tests.

Metal filings from pipes were submitted by the United States Navy Department as they had suspected corrosion in the drinking water systems. The filings were found to be of bronze and iron.

Portion of a special tungsten steel die used in the extrusion of antimonial lead wire was forwarded by the Munitions Department for tungsten determination.

The Government Printer forwarded two samples of linotype metal for analysis.

TANTALITE AND COLUMBITE.

Tantalum ores were given high priority among minerals required for war purposes. The Commonwealth Minerals Production took over control of Wodgina and surrounding areas installing crushing and concentrating facilities and ores were purchased by them from prospectors in the surrounding districts. This laboratory was charged with the responsibility of classifying, sampling, and assaying, and preparing for shipment to America the parcels of tantalum-bearing ores produced in Western Australia under an agreement entered into between the Governments of Australia and the United States of America. Each export lot was mixed, sampled, assayed for tantalum, niobium, tin, titanium, and rebagged in new marked bags, 100 lbs. of ore to each bag.

In all 24,731½ lbs. of ores were shipped under this arrangement made up as shown in the following tabulation:

TANTALITE SHIPMENTS TO U.S.A.

Shipment No.	Lot No.	Net Weight.	Assay.				Value per Short Ton.
		lbs.	Ta_2O_5 %	Nb_2O_5 %	SnO_2 %	TiO_2 %	£A.
1A	....	2,000	73·5	4·8	Present	....	1,966 4 11
2A	....	1,646	68·9	3·4	4·7	0·7	1,681 7 0
1	....	1,802	62·3	8·8	6·3	0·9	1,317 0 0
2	....	1,304	70·4	6·1	5·9	0·9	1,741 15 11
3	10	647	71·7	2·9	5·8	0·8	1,816 11 2
3	11	786	66·4	11·3	5·7	0·6	1,533 5 4
3	12	1,322	67·6	9·8	4·7	0·7	1,611 15 1
3	13	580	67·1	11·7	3·3	0·8	1,605 12 4
3	14	595	68·0	11·4	4·3	0·5	1,638 17 5
4	15	894	71·4	4·6	7·5	0·6	1,766 19 6
4	19	1,484	67·2	5·9	6·7	1·6	1,552 3 1
4	20	3,114	66·9	12·0	4·0	0·6	1,584 19 9
5	21	692	39·9	40·9	0·4	0·4	489 12 0
5	29	734	56·8	7·1	7·3	1·8	1,047 4 3
5	32	2,998	65·9	11·7	4·3	0·7	1,528 12 4
5	33	2,370	51·3	23·4	7·0	0·6	832 5 2
5	36	1,728	65·4	13·1	4·1	0·5	1,505 15 0

As in 1943 there were two main producing areas, the Wodgina district and Greenbushes. The concentrates received from these localities during 1944 were:—

	lbs.
North-West—	
Wodgina	10,332½
Strelley	3,541½
Pilgangoora	1,750
Tabba Tabba	400
Miscellaneous localities* and mixed parcels	3,605¾
	19,629½

* Includes Tantalite, Ltd., 788 lbs. and 1,808½ (?), and small parcels from Kangan as well as mixed parcels from two or more localities and some from more indefinite localities.

	lbs.	
South-West—		
Greenbushes	4,293	
Do.	15,206	
Tin-Tantalum (Ta, 30%		$Nb)_2O_5$
Do.	5,726	
Tin-Tantalum (Ta, 13%		$Nb)_2O_5$
Central—	lbs.	
Londonderry	692	
	(Ta_2O_5, 39%)	

With the exception of the low grade parcels from Greenbushes and Londonderry the average grade of the 12.36 short tons exported was:—

Ta_2O_5. %	Nb_2O_5. %	SnO_2. %	TiO_2. %
65·6	10·2	4·9	0·6

The assay values of the individual lots are shown in the table on pages 126 and 127.

During May Mr. H. P. Rowledge visited the Wodgina district and interviewed the smaller tantalite producers to examine their products and to give them technical and marketing advice. He also collaborated with Mr. H. A Ellis, Geological Survey, in an examination of a number of deposits in the producing areas of the district. A copy of his report is given in Appendix II, p. 144.

Mining operations at Greenbushes have produced some high grade ores from one lease, M.C.1, but from elsewhere the parcels have been tin-tantalum concentrates containing 10-30 per cent of tantalite and/or columbite. The mixed concentrates are examined visually at the laboratory, followed by sampling and assaying for tin and mixed tantalum and niobium oxides. They are then forwarded to the Eastern States for magnetic separation.

The difficulty of obtaining a reasonably clean concentrate of either tantalite or cassiterite by magnetic separator is greatly increased by the presence in these ores of stibiotantalite and (?) stibiomicrolite.

In connection with magnetic separation of the cassiterite-tantalite concentrates 46 samples were examined mineralogically and a number of assays were made. The concentrates consist of tantalite and tapiolite with or without columbite, cassiterite, stibiotantalite, an unknown antimony-bearing tantalate (possible stibiomicrolite) with a gangue of tourmaline, quartz and felspar. Considerable difficulty has been experienced in obtaining clean tantalite and clean cassiterite concentrates from this ore as the stibiotantalite is non-magnetic and remains with the cassiterite. Work was undertaken on methods of separation by Messrs. O. T. Lampriere Pty., Ltd., the Kalgoorlie School of Mines and the Adelaide School of Mines. Mineralogical examination has shown that any concentrates obtained at M.C.1, or M.C.9 at Greenbushes are liable to contain stibiotantalite and therefore a small but variable percentage of antimony (up to 3 per cent.) will be present. In concentrates from other parts of the field stibiotantalite has not yet been recorded.

Workings on M.C.9 Greenbushes were sampled, samples being collected from shafts and drives. The laboratory possesses no concentrating apparatus other than panning dish, unsuitable apparatus for minerals such as cassiterite which "flour" easily on crushing and wash over with the fines. Arrangements were made to have the samples concentrated on the "super-panner" at the K.S.M. Metallurgical Laboratory. Mr. Grace visited this laboratory in March to see this machine in operation and obtain instruction in its use. Concentration is somewhat time consuming but clean concentrates with very low loss of heavy mineral can be obtained. Rough concentration over a small laboratory type Wilfley table, followed by super-panner cleaning of the rough concentrate would no doubt yield a satisfactory product.

Massive columbite in radiating crystals intergrown with felspar made up a parcel of low grade tantalum ore obtained at Londonderry. The largest single mass of columbite weighed nearly 20 lbs. This parcel was crushed and concentrated at the Coolgardie State Battery before sampling and assay at this laboratory, this concentrate contained Ta_2O_5, 39.9 per cent, Nb_2O_5 40.9 per cent, SnO_2, 0.4 per cent, and TiO_2, 0.4 per cent.

Among the parcels received from Wodgina district was one from Tabba Station of 400 lbs. weight, consisting mainly of microlite. This parcel assayed Ta_2O_5, 67.3 per cent, Nb_2O_5, 6.5 per cent, SnO_2, 4.8 per cent. and TiO_2, 0.8 per cent.

Numerous samples of both tantalite and columbite were examined for prospectors. These came from:—

Yinnietharra Station.

(a) Various pieces of columbite were shown by specific gravity assay to contain Nb_2O_5, 50 per cent., Ta_2O_5, 32 per cent.

(b) Well crystallised columbite including one large flat tabular crystal weighing 1⅛ lb. This sample averaged by specific gravity assay Nb_2O_5, 57 per cent., Ta_2O_5, 24 per cent.

(c) From near Cairn Beryl deposit. This columbite was shown by specific gravity assay to vary from Nb_2O_5, 75 per cent., Ta_2O_5, 5 per cent. to Nb_2O_5, 62 per cent., Ta_2O_5, 20 per cent.

ANALYSIS OF TANTALITE SHIPMENTS TO U.S.A.

Project.	Net weight Received.	Producer.	Locality.	Shipment Nos.																	
				1A.	1B.	1.	2.	3.					4.			5.					
								Lot Nos.					Lot Nos.			Lot Nos.					
								10.	11.	12.	13.	14.	15.	19.	20.	21.	29.	32.	33.	36.	
Ex 83	400	Crawford	Tabba	....	....	....	400	....	....	....	....	....	....	....	....	....	....	....	....	....	....
,,	1,808½	?	?	....	....	1,808½	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
,,	97½	F. Eades	? Strelley	....	....	....	97½	....	....	....	....	....	....	....	....	....	....	....	....	....	....
,,	189½	J. Ball	Pilgangoora	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	189½	....	....
,,	118	A. Jones	Pilgangoora	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	118	....	....
,,	165½	W. Hall	Pilgangoora	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	165½	....	....
,,	695½	Project	Strelley	....	....	....	695½	....	....	....	....	....	....	....	....	....	....	....	....	....	....
,,	75½	Miscellaneous	?	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	75½	....	....
,,	169½	W. Hall	Pilgangoora	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	169½	....	....
,,	81½	Project	Strelley	....	....	....	....	....	....	....	81½	....	....	....	....	....	....	....	....	....	....
,,	82½	Project	Strelley	....	....	....	....	....	....	....	....	....	....	....	....	....	82½	....	....	....	....
,,	97½	Project	Strelley	....	....	....	....	....	....	....	97½	....	....	....	....	....	....	....	....	....	....
,,	89	Project	Wodgina	....	....	....	....	....	....	....	89	....	....	....	....	....	....	....	....	....	....
,,	81¾	Project, Norton, Kenny, Collins	Wodgina	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	81¾	....	....
,,	8¼	Sherlock	Strelley	....	....	....	....	....	....	....	....	....	....	....	....	....	8¼	....	....	....	....
,,	104	W. Hall	Pilgangoora	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	104	....	....
,,	244½	Project	Wodgina	....	....	....	....	....	....	....	244½	....	....	....	....	....	....	....	....	....	....
,,	38½	Webster, Rogers	Pilgangoora, Kangan	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	38½	....	....
,,	105½	Project, Webster, Rogers	Strelley, Pilgangoora, Kangan	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	105½	....	....
,,	303	Project, Project	Strelley, Wodgina	....	....	....	....	....	....	303	....	....	....	....	....	....	....	....	....	....	....
....	....	Project	Wodgina	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
....	254	Molloy, Sherlock	Tabba, Strelley	....	....	....	....	....	....	254	....	....	....	....	....	....	....	....	....	....	....
,,	....			....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
,,	788	Tantalite Ltd.	?	....	....	....	....	....	788	....	....	....	....	....	....	....	....	....	....	....	....
,,	766	Project	Wodgina	....	....	....	....	....	....	766	....	....	....	....	....	....	....	....	....	....	....
,,	50	Project	Strelley	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	50	....	....
,,	13½	F. Eades	?	....	....	....	....	....	....	....	....	....	....	....	....	....	13½	....	....	....	....
,,	70	Project	Strelly	....	....	....	....	....	....	....	70	....	....	....	....	....	....	....	....	....	....
,,	73	W. Hall	Pilgangoora	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	73	....	....
,,	6½	Sherlock	Strelley	....	....	....	....	....	....	....	....	....	....	....	....	....	6½	....	....	....	....
,,	597	Project	Wodgina	....	....	....	....	....	....	....	....	597	....	....	....	....	....	....	....	....	....
,,	156	Project	Strelley	....	....	....	....	....	....	....	....	....	....	156	....	....	....	....	....	....	....
,,	895½	Project	Wodgina	....	....	....	....	....	....	....	....	....	895½	....	....	....	....	....	....	....	....
,,	136	Project	Strelley	....	....	....	....	....	....	....	....	....	....	....	....	....	136	....	....	....	....
,,	222½	Webster	Pilgangoora	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	222½	....	....
,,	1,800½	Project	Wodgina	....	....	....	....	....	....	....	....	....	....	....	1,814	....	....	....	....	....	....
,,	13¾	Abdul	?	....	....	....	....	....	....	....	....	....	....	....	....	....	....	397	....	....	....
,,	397	Project	Wodgina	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
,,	461	Project	Strelley	....	....	....	....	....	....	....	....	....	....	461	....	....	....	....	....	....	....
,,	180	Webster	Pilgangoora	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	180	....	....
,,	1,300¾	Project	Wodgina	....	....	....	....	....	....	....	....	....	....	....	1,300¾	....	....	....	....	....	....
,,	871¼	Project	Strelley	....	....	....	....	....	....	....	....	....	....	871¼	....	....	....	....	....	....	....

....	....	Prospectors	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
		Willie																					
		Abdullah																					
,,	99½	Collins	?	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
		Dickenson																			99½	65¼	....
,,	65¼	W. Hall	Pilgangoora	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	94¼	....
,,	94¼	Webster	Pilgangoora	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	575	....	....
,,	575	Project	Wodgina	....	....	....	....	....	....	....	....	....	....	....	....	....	....	209	....	....	....	....	....
,,	209	Project	Strelley	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	83	....	....
,,	83	F. Eades	?	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	70	....	....
,,	70	Piesse, Ball, & Teague	Pilgangoora	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	57	....	....	....	....
,,	57	Project	Wodgina	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,699	....	....	....	....
,,	1,699	Project	Wodgina	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	21	....	....	....	....
,,	21	Castle	?	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	190	....	....	....
,,	190	Webster	Pilgangoora	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	111	....	....	....
,,	111	Eades	?	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	71	....	....	....	....
,,	71	Project	Wodgina	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	88	....	....	....	....
,,	88	Project	Wodgina	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	21	....	....	....	....
,,	21	Eades	?	....	....	....	....	....	....	....	....	....	....	....	....	....	....	68	....	....	....	....	....
,,	68	Project	Strelley	....	....	....	....	....	....	....	....	....	....	....	....	....	....	53	....	....	....	....	....
,,	53	Project	Strelley	....	....	....	....	....	....	....	....	....	....	....	....	....	....	14	....	....	....	....	....
,,	14	Green	?	....	....	....	....	....	....	....	....	....	....	....	....	....	....	144	....	....	....	....	....
,,	144	Project	Strelley	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	48½	....	....	....	....
,,	48½	Project	Wodgina	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	23½	....	....	....	....
,,	23½	Piesse	?	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	88	....	....	....
,,	88	Webster	Pilgangoora	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,622	....
,,	1,622	Project	Wodgina	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	20½	....
,,	20½	Webster	Pilgangoora	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	86½	....
,,	86½	Piesse	?	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
				....	....	1,808½	1,193	....	788	1,323	582½	597	895½	1,488¼	3,114¾	....	734¾	3,001	2,374¼	1,729			
			N. Territory	....	....	....	114	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....			
Sources	114	Richards	Londonderry	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
other	695	Aust, Glass Mfg. Co.	Greenbushes	....	....	....	....	....	....	....	....	....	....	....	....	695	....	....	....	....	....	....	....
than	2,000	Collett & Freeman	Greenbushes	2,000	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Project	1,646	Collett & Freeman	Greenbushes	....	1,646	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
83	647	Collett & Freeman	Greenbushes	....	....	....	....	647	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	24,731½			2,000	1,646	1,808½	1,307	647	788	1,323	582½	597	895½	1,488¼	3,114¾	695	734¾	3,001	2,374¼	1,729			
Less Samples, Loss and Moisture in Preparation				....	....	6½	3	....	2	1	2¾	2	1½	4¼	¾	3	¾	3	4¼	1			
				2,000	1,646	1,802	1,304	647	786	1,322	580	595	894	1,484	3,114	692	734	2,998	2,370	1,728			

Total	24,696
Total, Samples, and Loss	35½
	24,731½

Note.—Included in Shipment No. 2 was a parcel of Northern Territory Tantalite containing 114 lbs.

Greenbushes.

(a) Small samples of tantalite and columbite from North Greenbushes. The columbite contained Nb_2O_5, 48-62 per cent., Ta_2O_5, 33-19 per cent. The tantalite is high grade with Ta_2O_5, 72 per cent., Nb_2O_5, 13 per cent., and differs in appearance and composition from that at the southern end of the field, being higher in Nb_2O_5 content. It also has a crystal form more typical of tantalite than has that at the southern end which is probably tapiolite.

(b) Columbite which was associated with some cassiterite from near the North Greenbushes Station contained Nb_2O_5, 53 per cent. and Ta_2O_5, 28 per cent.

(c) Samples of concentrates from No. 1 Shaft Cornwall lease. These contained 80 per cent. cassiterite, with ilmenite, zircon, magnetite, kyanite, and tantalite or columbite.

(d) From No. 2 Shaft on Cornwall lease, containing 60 per cent. cassiterite and 35 per cent. of high grade tantalite (Ta_2O_5 75 per cent., Nb_2O_5 10 per cent.).

(e) A series of tin-tantalite concentrates from M.C. 48, D.C. 95, ranged up to 63 per cent. cassiterite and 10 per cent. high grade tantalite.

(f) Concentrates from Salt Water Gulley east of Greenbushes were found to contain columbite and cassiterite in variable amounts together with limonite, ilmenite, magnetite, and quartz.

Marble Bar.

Tantalite sent in from Marble Bar was found to be a mixture of manganotantalite, microlite and manganocolumbite.

Kangan Station.

A sample of columbite was forwarded from 12 miles east of Wodgina Mine, it contained Ta_2O_5, 49 per cent., Nb_2O_5, 34 per cent. This is a new locality.

Two hundred and seven samples of tantalite from the Tabba Tabba, Strelley, Pilgangoora areas submitted by the Government Geologist are described in Appendix I.

Because of the experience possessed by the Laboratory staff with regard to the composition and properties of tantalum ores this Laboratory was commissioned by the Commonwealth Government to assess the value of parcels from other States, viz., Barrow Creek, Finniss River, N.T., and Grant's Gulley, Queensland for disposal in America.

Tin-Tantalum Ores.

A visit was paid to Greenbushes in March by Dr. D. Carroll and Mr. J. N. A. Grace in order to assist in the interpretation of samples of ore coming from this area. The principal workings were inspected and advice given to lessees and prospectors. Material for future mineral investigations was collected. Later 46 samples of tantalum-tin concentrates were examined, principally in connection with magnetic separation.

The magnetic separation of the Greenbushes tin-tantalum alluvial ores has presented considerable difficulty. Several samples were examined mineralogically at various stages in magnetic and heavy liquid separation. One of the difficulties is that stibiotantalite is intimately associated with the tapiolite (tantalite) and fine grinding is necessary to separate these minerals. The following is the approximate mineral composition of some rough alluvial ore from M.C. 1:—(—60 +90 grade).

A. *Magnetic*, about 90 per cent.
Tapiolite and/or tantalite with some intergrown stibiotantalite.

B. *Non-magnetic*, about 10 per cent. which was subsequently divided into a "light" fraction (less than S.G. 4·5) and a "heavy" fraction with Clerici solution.

B1. *Heavy non-magnetic*, about 9 per cent.
Stibiotantalite, cassiterite, tourmaline, yellow-brown mineral (?stibiomicrolite).

B2. *Light non-magnetic*, about 1 per cent.
Quartz, felspar, etc.

It is evident from this and subsequent separations that by magnetic separation a clean separation cannot be made and that the cassiterite which could be used as a tin concentrate is contaminated with stibiotantalite which reduces its value. Nor can all the tantalum in the ore be removed magnetically for some remains in the stibiotantalite which contains 51-57 per cent. Ta_2O_5 with approximately 40 per cent. Sb_2O_3.

Mineralogical examinations were made of a series of samples from drives and cross-cut in a new shaft on M.C. 9. These concentrates were sent to the Kalgoorlie School of Mines for further concentration with the Super-panner. The concentrates consisted of variable proportions of cassiterite, tantalite (tapiolite), columbite, stibiotantalite, tourmaline, ilmenite, with a little zircon, apatite and sphene. The tailings consisted of tourmaline, limonitic grains, quartz, mica, etc.

BERYL.

A considerable number of assays (21) were made of commercial parcels of beryl prior to shipment to the United States and the crushing, sampling and rebagging facilities at the Laboratory were kept busy during the year handling these in addition to tantalum and tin-tantalum concentrates.

The principal producing areas were Wodgina (including Mt. Francisco), Yinnietharra, Londonderry, Poona and Strelley. The grades of ore produced were:—

	BeO %.
Wodgina	10·37—11·95
Mt. Francisco	13·05—13·49
Yinnietharra	13·13—13·44
Strelley	11·36
Poona	12·78—13·10
Londonderry	12·32

Valuable experience was gained in analytical methods for the determination of beryllium. Investigation by Mr. C. R. Le Mesurier led to improvements in the methods for the separation and recovery of beryllium oxide. The separation of beryllium from aluminium was checked spectroscopically and the possible error in the method adopted by us for the BeO determination was found to be less than 0.05 per cent. of the amount present in the sample.

A beginning was made with some special research on beryl but this was abandoned because of the number of commercial assays required at that time. This laboratory is to be responsible for all the beryl research for Australia and samples of beryl from other States will be sent over for examination and analysis.

A new locality for beryl is Wardawarra in the Murchison, 70 miles N.W. of Mt. Magnet. This beryl is opaque white. The beryl produced at Poona was massive with large fluted crystals white to pale pink in colour. Several interesting specimens were added to the collections through the courtesy of the Government Geologist and Mr. A. S. Giles (who produced two commercial parcels).

The difficulty of recognising non-crystalline beryl in the field was responsible for the receipt of numerous specimens of supposed beryl. Many of these were found to be quartz, but others were actually beryl resembling quartz very closely in appearance. One export parcel of supposed beryl was found to consist mainly of iron-stained and weathered felspar with less than 10 per cent. beryl, but in many parcels there was very little extraneous mineral.

OCHRE.

Samples of red ochre from the Ophthalmia Range were examined for the Geological Survey Branch. These consisted of "best grade" and "poorest grade" produced from ML370H. The former was a soft red schistose haematite rock, containing 90.16 per cent. ferric oxide, Fe_2O_3, which when ground in both oil and water formed dense bright "Red Oxide" paint and distemper. The "poorest grade" was a moderately soft schistose haematite rock of a purplish red colour containing 85.66 per cent. ferric oxide; this required considerably more grinding to produce a smooth even brushing paint and distemper, both of which were of a more purplish brown colour than that produced by the "best grade."

Ochre from Howard's Show, six to eight miles S.S.E. of M.L. 370H contained 90.60 per cent. ferric oxide the prepared paint and distemper being a "Red Oxide" of excellent quality.

A sample from Nelly's show three miles from ML 370H contained 86.08 per cent. ferric oxide. This also gives a "Red Oxide" pigment of excellent quality when ground in both oil and water.

The Geological Survey Branch also forwarded two samples of imported Spanish Red Oxide, a sample of Red Oxide being sold as the Australian equivalent, and rejects from the treatment of lower grade Red Oxide. Analyses were made of three of these samples with the following results.—

	Lab. No. 3318. Imported Spanish Red.	*Lab. No.* 3319. Spanish Red, Australian Oxide.	*Lab. No.* 5013. Imported Spanish Red, McLeod & Co., Sydney.
	%	%	%
SiO_2	23·71	4·30	7·00
Al_2O_3	7·51	4·80	3·81
Total iron as Fe_2O_3	55·18	88·20	79·11
Total manganese as MnO_2	3·82	0·03	....
MnO	....	....	·01
MgO	present (small)	*nil*	present (small)
CaO	3·98	0·26	4·86
H_2O+	2·62	3·14	....
$H_2O\pm$	....	....	1·55
TiO_2	0·23	0·05	0·05
CO_2	2·62	N.D.	3·80
P_2O_5	0·36	N.D.	....
	100·03	100·78	100·19

The colour of the three oxides when ground in oil was almost identical, but the imported Spanish Red gave a more intense red in water, particularly Lab. No. 3318. Rejects from the processing of the local lower grade ochre contained 94 per cent. Ferric Oxide, mostly in hard granular form difficult to pulverise.

High grade natural ochre from Little Wilga deposit 45 miles N.W. of Cue, in the Weld Range contained 85.77 per cent. ferric oxide. The colour of the pigment, ground in oil is a lighter red than the Ophthalmia Range material, being nearer to the trade colour of Flemish Red.

Ochre samples received from the Native Reserve at Wilgie Mia are earthy with fragments of soft weathered rock and ironstone and contain up to 85 per cent. ferric oxide. The prepared pigment is an excellent Red Oxide.

A sample from Jimblebah Hills, 50 miles S.W. of Ethel Creek was a soft red schistose haematite rock containing 89.62 per cent. ferric oxide and producing an excellent Red Oxide pigment.

A yellow ochre from N.W. of Cue was of a natural "Raw Sienna" colour in oil but lacked density or "hiding power."

Ochre from near Kundip was associated with considerable jarosite. It contained:

Partial Analysis—	%.
Ferric oxide Fe_2O_3....	41·6
Silica, SiO_2	2·5
Potash, K_2O	3·3
Soda, Na_2O	1·9
Sulphates, SO_3	17·4

LIMESTONE.

Thirty-nine samples of limestone from the area around Cockburn Sound were analysed for lime, magnesia, and siliceous insoluble. Calcium carbonate, $CaCO_3$, ranged from 41.5 to 88.8 per cent.; magnesium carbonate, $MgCO_3$, 0.2 to 4.7 per cent. Eighteen of the samples contained over 70 per cent. $CaCO_3$.

Coastal limestones from Loc. 525 at Albany were found to contain 39 and 76 per cent. of calcium carbonate.

Soft white nodules in chalk from the Dandaragan district consisted of circular crystals of calcite.

Two samples of limestone and one sample of mortar from Moola Bulla Station, near Hall's Creek were examined. One which had previously been used for builder's lime contained 14 per cent. siliceous material. The other, a deposit nearer the proposed building site, contained only 1 per cent. siliceous matter and would produce, on burning, a rich and pure lime. The bonding material in the sample of mortar was very hard, the addition of cement being suspected. Analysis of the first limestone, which was said to have been used, however, indicated that when burnt under suitably controlled temperatures it would produce good hydraulic lime.

Samples of supposed dolomite from 17 miles south-west of Day Dawn proved to be limestones containing some 15 per cent. siliceous material.

CLAY.

Three samples of clay, and portions of bricks manufactured from them, were received from Lake Grace. The clays proved to be very gritty consisting of some highly plastic clay associated with much quartz grit. They were found to be too refractory to produce a commercial grade of house brick, being friable and lacking in strength when burnt at temperatures up to 1150° C. These clays would require mixing with a less refractory and more ferruginous clay.

Somewhat similar clays, also proposed for use in the manufacture of house bricks, were forwarded from the Geraldton district. These clays burnt to a good colour but were too refractory, being under steel hard at 1150° C. Addition of a less refractory and more ferruginous clay would greatly improve the burnt product.

A kaolin-type clay from Donnybrook containing much fine quartz might prove suitable for adding to a more plastic type of clay to reduce shrinkage on air drying and distortion during burning.

A fine soft sedimentary clay from 14 miles west of Brookton was found to burn to a good white colour up to 1050° C., but developed a light cream colour at higher temperatures.

Representative samples of clays from bore holes in the proposed site for the new Government buildings were received from the Geological Survey Branch. The whole area is made up of interbedded layers of sand and clay. The clay beds are fairly hard and compact, and are shaly and fossiliferous at a depth of 87 feet. The clay samples are about 2 lbs. in weight and were collected at 2 feet intervals in the bore and auger holes. The following tests are being made to give information about the suitability for foundations for the buildings: —Mineralogical examination, absolute specific gravity, moisture content, lower plastic limit, lower liquid limit, shrinkage limit.

BENTONITE.

Sadler's Tests were made on several local clays, some of which are being sold as bentonite, for comparison with American and Canadian bentonite. The tests showed the materials from one deposit to vary in reaction between a fair grade of bentonite and a clay having no bentonitic properties.

A supposed bentonite sent in from Coorow was found to be a "Fuller's Earth," having an Ashley's figure for plasticity of 258/300.

TALC.

Five samples of talc rock from Mt. Monger were examined for the Geological Survey Branch. The rocks consisted of talc with tremolite in varying amounts up to 70 per cent.

Turned cylinders were prepared and burnt with slow even heating up to 1350° C. The cylinder of the talc rock containing 70 per cent. tremolite showed advanced vitrification at 1250° C. with some sagging and fusion. The other cylinders showed incipient vitrification but no distortion or cracking and were practically non-porous.

Three samples of ground talc from Ravensthorpe, representing different gradings, were examined. The samples consisted of nearly pure talc, free from grittiness and of a reasonably good white colour. The Ravensthorpe district is one of the few in the State in which high grade foliated talc occurs.

Samples from the Coodawa talc deposit approximately six miles east-north-east of Three Springs were examined for the Geological Survey Branch. These are high grade

talcs suitable for the production of powdered talc, one (marked A) a compact waxy-looking yellowish green talc, giving a good white powder. The powder from other specimens was greyish-white or slightly tinted.

Complete chemical analyses were made of four samples and show:—

	4020/44.	4021/44.	4022/44.	4023/44.
	A.	B.	C.	D.
	%	%	%	%
Silica, SiO_2	62·08	62·47	62·07	60·52
Alumina, Al_2O_3	0·46	0·58	0·72	1·23
Ferric oxide, Fe_2O_3	0·08	0·20	0·15	0·25
Ferrous oxide, FeO	0·77	0·76	0·71	0·85
Manganese oxide, MnO	Trace	Trace	Trace	0·01
Magnesia, MgO	31·33	30·55	31·13	30·81
Lime, CaO	0·04	0·07	0·01	0·16
Soda, Na_2O	0·31	0·08	0·08	0·02
Potash, K_2O	0·01	*nil*	*nil*	0·02
Water, H_2O—	0·33	0·44	0·25	0·55
Water, H_2O+	4·68	4·80	4·92	5·19
Titanium dioxide, TiO_2	0·01	0·02	0·01	0·03
Carbondioxide, CO_2	0·06	0·06	0·02	0·02
Phosphoric oxide, P_2O_5	*nil*	0·03	0·15	0·04
Chromic oxide, Cr_2O_3	*nil*	Trace	*nil*	Trace
Chloride, Cl	*nil*	*nil*	*nil*	Trace
Sulphur trioxide, SO_3	*nil*	*nil*	*nil*	0·01
	100·16	100·06	100·22	99·71

Analysts—C. E. S. Davis, A, D. C. R. Le Mesurier. B, C.

A.—Dense compact, yellowish-green, waxy-looking micro-crystalline talc.

B.—Tough fine-grained, compact, greyish to creamy white talc.

C.—Fine-grained, light grey talc.

D.—Mottled grey to dense, compact, yellowish grey talc.

SAWDUST AND CHARCOAL.

Charcoal briquettes made at Banksiadale had a calorific value of 14,780 B.T.U.; proximate analysis figures being (moisture free basis):—Volatile Hydrocarbons, 10.40 per cent.; Fixed Carbon, 88.44 per cent.; Ash, 1.56 per cent.

Briquettes manufactured from sawdust with an added ingredient to promote burning instead of smouldering were examined. These briquettes were spherical and about 3in. in diameter and could be dropped from a height of 10 feet without breaking. Calorific value was 7,706 B.T.U., about that of dry saw dust.

SILICA ROCKS.

Two samples of sedimentary silica rocks, supposed natural "Firestones" from the Ravensthorpe district, were examined for the Geological Survey Branch. Small cylinders of these rocks were turned on the lathe and then submitted to a slow and steady rise of temperature up to 1,350°C. The fired pieces showed no signs of vitrification or distortion, but one sample developed several large cracks. There was some hardening, but the burnt cylinders could still be scratched with the finger nail.

QUARTZ CRYSTAL.

Owing to an increased demand for quartz crystal suitable for piezo-electric work, numerous quartz crystals, mostly rather small and flawed, were examined during the year. The requirements are likely to increase during the post-war period and any large, clear crystals are readily saleable. From two localities, Kangan Station and Payne's Find usable crystals were obtained. Crystals selected from a deposit on Kangan Station by an officer of the Geological Survey were examined and a number were sent to the Amalgamated Wireless (Australasia) Limited, Sydney. Crystals were also sent direct by the station owners. From all the parcels, representing over 210 lbs. of crystal, 9¼ lbs. were usable, valued at £3 per pound. Of the 7½ lbs. selected in this laboratory, 3 lbs. were usable, thus indicating the value and saving of freight if selection could be made at the deposit. The largest crystal in the original shipment weighed 60 lbs., and the largest usable crystal 8 lbs. which yielded 3 lbs. of usable crystal. With the exception of one or two fragments all the crystals were colourless, water-clear, and generally free from flaws although external evidence of twinning was present in some. The crystals were well developed, but in some there was a tendency for the development of four prism faces to the inclusion of the remaining two, giving an almost tetragonal appearance. Crystals from a nearby deposit were milky in appearance, much distorted and quite valueless for piezo-electric purposes.

Crystals selected from parcels from three localities in the Payne's Find district were well developed and on examination by the Amalgamated Wireless yielded over 3 lbs. of usable crystal, the largest single crystal weighed 2 lbs. 2 ozs. Other crystals which were clear and smoky were found to be heavily electrically twinned and to be of no value for piezo-electric purposes.

COAL.

Five samples of coal from the newly opened 12ft. seam on the Griffin Mine at Collie. These were collected at the freshly broken face and immediately sealed in airtight tins. Details of the examination are as follows:—

Marks.

No. 1.—Top 3 feet, 12 feet to 9 feet.
No. 2.— 9 feet to 6 feet.
No. 3.— 6 feet to 3 feet.
No. 4.—Bottom 3 feet, 3 feet to floor.
No. 5.—General sample of whole seam.

Proximate Analysis of freshly broken Coal.

Lab. No.	7719	7720	7721	7722	7723
Mark	No. 1	No. 2	No. 3	No. 4	No. 5
	%	%	%	%	%
Moisture	33·09	24·55	24·30	24·08	25·95
Volatile hydrocarbons	24·79	28·50	28·84	31·58	28·98
Fixed Carbon	39·35	44·47	44·50	41·89	42·66
Ash	2·77	2·48	2·36	2·45	2·41
	100·00	100·00	100·00	100·00	100·00
Moisture lost on air drying for 24 hours (in lump form)	11·77	5·74	4·96	4·87	6·27
Additional moisture lost on drying at 105° C. for ½ hour (in coarse powder)	21·32	18·81	19·34	19·21	19·68
Total Moisture	33·09	24·55	24·30	24·08	25·95

Calorific Value (by bomb calorimeter).

Freshly broken coal, B.T.U.	8,291	9,493	9,589	9,670	9,337
Air dried coal, B.T.U.	9,749	10,215	10,217	10,290	10,128
Ash and moisture free coal B.T.U.	12,926	13,010	13,073	13,162	13,035
Ratio of Fixed carbon to volatile hydrocarbons	1·59 : 1	1·56 : 1	1·54 : 1	1·33 : 1	1·47 : 1
Ash.—					
Colour of ash	brown	light brown	light brown	light brown	teak
Phosphorus in ash %	2·81	·51	·21	·24	·96

Ultimate Analysis.

Lab. No.	7719	7720	7721	7722	7723
Mark	No. 1	No. 2	No. 3	No. 4	No. 5
Freshly Broken Coal—	%	%	%	%	%
Sulphur S	·63	·35	·42	·54	·47
Nitrogen N	·97	1·02	1·01	1·02	1·02
Phosphorus P	·078	·013	·005	·006	·023
Ash and Moisture Free Coal—					
Carbon C	76·97	77·14	76·24	75·94	77·28
Hydrogen H	4·51	4·98	4·84	5·17	5·14
Oxygen O	16·03	16·00	16·96	16·76	15·50
Sulphur S	·98	·48	·58	·74	·66
Nitrogen N	1·51	1·40	1·38	1·39	1·42

Analyst: H. Manns.

A bore hole in No. 2 shaft at Eradu passed through carbonaceous shale bands between the depths of 145ft. and 170ft. These carbonaceous bands contain too much incombustible matter, usually over 50 per cent., to be of value as a fuel.

SAPPHIRINE.

An analysis was made of supposed sapphirine separated from a biotite schist obtained at Dangin by Dr. R. T. Prider, Geology Department, University of Western Australia.

Sapphirine, Dangin.

	%
SiO_2	14·89
Al_2O_3	60·44
Fe_2O_3	1·70
FeO	6·45
MnO	0·20
MgO	15·23
CaO	*Nil*
Na_2O	0·21
K_2O	0·02
H_2O—	0·41
H_2O+	0·57
TiO_2	0·04
CO_2	*Nil*
P_2O_5	0·10
Cr_2O_3	*Nil*
ZrO_2	*Nil*
BeO	*Nil*
	100·26

Analyst: J. D. Hayton.

ANALYSES OF ROCKS.

Four complete analyses of ultra-basic rocks from the Mt. Margaret Goldfield and one analysis of garnet separated from one of these rocks were made for the Geological Survey Branch.

	Uralitised Dolerite-Gabbro	Garnetised Gabbro	Garnetised Gabbro	Serpentine
	L. 753 1657/44 %	L. 676 1654/44 %	L. 831 1655/44 %	L. 691 1656/44 %
SiO_2	51·83	45·31	40·98	38·68
Al_2O_3	13·97	7·49	12·77	2·80
Fe_2O_3	1·16	1·02	1·10	6·59
FeO	6·53	5·12	4·06	2·33
MnO	1·16	·31	·16	·18
MgO	9·51	14·66	7·31	36·02
CaO	9·74	22·70	29·40	*Nil*
Na_2O	1·89	·04	*Nil*	*Nil*
K_2O	1·37	·04	·03	·06
H_2O—	0·20	·24	·31	....
H_2O+	2·40	2·65	2·68	12·14
TiO_2	0·51	·46	1·01	·15
CO_2	0·24	·06	·07	*Nil*
P_2O_5	0·16	·08	·12	·09
FeS_2	0·10	....	·09	·06
S	....	*Nil*	....	....
SO_3"	0·02	....	....	·07
Cr_2O_3	0·03	·26	*Nil*	·59
V_2O_5	Trace	*Nil*	·04	Trace
BaO	*Nil*	*Nil*	*Nil*	....
NiO	*Nil*	·03	....	·30
Cl	Trace	....	....	....
	99·82	100·47	100·13	100·06
Analyst:	C. E. S. Davis	J. D. Hayton	J. D. Hayton	J. D. Hayton

The refractive indices of the garnets in these rocks were determined by the immersion method. Since the indices lay beyond the range of the Abbé refractometer the instrument we usually employ in this work, the refractive indices of the media were determined with a hollow glass prism on our Goldschmidt two-circle goniometer. The prism was made by Mr. S. E. Terrill who used K. Kohlrausch's method of critical incidence, obtaining refractive indices for the garnets accurate to ± ·001. The refractive index of these garnets varied from 1·710 to 1·730.

The analysis of garnet separated from L. 695 *is.*—

	1658/44 %
SiO_2	40·20
Al_2O_3	18·25
Fe_2O_3	1·30
FeO	1·72
MnO	0·21
MgO	2·54
CaO	34·37
Na_2O	0·07
K_2O	0·03
H_2O+	1·03
TiO_2	0·44
P_2O_5	*Nil*
Cr_2O_3	*Nil*
	100·16
Ref. Index	1·732–1·750
Analyst:	J. D. Hayton

Note.—The separated product was hand-picked to remove obvious impurities, but small amounts of felspar, ilmenite, and rutile, mainly as composite grains still remained in the final sample.

MISCELLANEOUS MINERAL NOTES.

Monazite.—A stream concentrate from Cooglegong contained about 33 per cent. monazite, 10 per cent. cassiterite, with tanteuxenite, garnet, limonite, magnetite and ilmenite.

Spodumene.—Picked crystals of spodumene from Cattlin Creek, about 1½ miles N.W. of Ravensthorpe contained 6·20 per cent. Li_2O. The pegmatite in which the spodumene occurs is fresh and unweathered.

Corundum.—Corundum from Nevoria was associated with some 25 per cent. of mica. Mica reduces its value as an abrasive and has to be removed before use.

Kyanite.—Massive rock-like kyanite from a new locality (Yanmah) 11 miles N.W. of Manjimup was examined. It consisted of boulders containing kyanite 90 per cent.; limonite, 4 per cent.; rutile, 3 per cent.; kaolin, hornblende and zircon 3 per cent.

Spinel.—Chrome Spinel from N. of Wodgina contained 20 per cent. Cr_2O_3.

Jarosite.—Samples of jarosite from Ravensthorpe gave by analysis K_2O, 4.5 per cent.; Na_2O, 1.28 per cent.; acid soluble, SO_3, 25.55 per cent.

Fluorite.—White fluorite of good quality was sent in from 10 miles S. of Yinnietharra.

Dolomite.—Dolomite from Mt. Magnet, similar to that used in local foundries contained $MgCO_3$, 43.6 per cent.; $CaCO_3$, 54.9 per cent.; insoluble in acid, 0.9 per cent. It is a dense clean mineral.

Bismuth.—Two parcels of bismuth concentrates (carbonate ore) representing 1st and 2nd grade material were obtained from M.L. 173H at Yinnietharra. The combined weight was over 1,400 lbs., and they assayed respectively 73 per cent. and 54 per cent. bismuth. Crushing, sampling, rebagging, and assay were performed at the laboratory.

Yttrotantalite.—The Government Geologist while at Marble Bar received from H. Hanson of that town, two samples of heavy concentrates. One from the Top Camp at Old Shaw near Hillside Station, consisted mainly of yttrotantalite with some cassiterite and a little microlite. The second sample was a monazite gravel from Cooglegong.

Carborundum.—During the last year or so several specimens of carborundum, a well crystallised artificial furnace product have been received from the Kimberley and North-West. A possible explanation is that they have been carried by aborigines as curios.

Suites of Mineral Specimens were examined for the Geological Survey Branch from Yinnietharra, Wodgina, Strelley, Tabba Tabba, and Pilgangoora.

Of interest among these samples were:—

Yinnietharra.—Almandine garnet, and two samples of columbite from different localities.

Wodgina.—Lithiophillite and purpurite from M.C. 107; Lepidolite, M.C. 107—N. end of dyke, Li_2O ranging from 0.51 to 1.77 per cent.; Almandine—Pyrope garnet intergrown with chlorite, M.C. 107; Columbite from Kangan Station.

Strelley.—Beryl, three samples. From M.L. 346,-BeO, 12.65 per cent.; from M.C. 106, BeO, 11.36 per cent.—Purpurite with small inclusion of dufrenite from M.C. 106. Lepidolite, M.C. 106, containing 0.6 per cent., Li_2O. Lithiophillite with purpurite from M.C. 106.

Tabba Tabba.—From M.L. 312: Massive lepidolite Li_2O, 2.47 per cent., from N. end of W. loop of dyke. Beryl, BeO, 11.67 per cent. from N.E. side S.E. end of main tantalite dyke.

Pilgangoora.—From M.C. 132: Spodumene (a) from N. and S. ends of No. 3 workings. (b) from S. end of lease in two places. Beryl, BeO 12.29 per cent. from S. end of No. 4 workings. *From M.C.* 131: Spodumene lilac coloured, from centre of No. 1 workings. Tantalite from N. end of No. 1 workings.

NEW MINERAL RECORDS.

The following is a list of new localities for various minerals recorded at the laboratory during the year.

Actinolite, Wynyango Station.
Alunite, 7 miles east of Kundip.
Beryl, Wardawarra.
Bismuth (native), Strelley.
Bismutosphaerite, Londonderry.
Bismuthenite, Londonderry.
Euxenite, Yinnietharra.
Fluorite, 10 miles south of Yinnietharra.
Fuller's Earth, 14 miles S.W. of Coorow.
Graphite, York.
Iron-ores, Goomalling; 38 miles from Meekatharra.
Kyanite, Yanmah, 11 miles N.W. of Manjimup.
Lepidolite, Kathleen Valley.
Ochres, Little Wilga, 45 miles N.W. of Cue; Jimblebah Hills.
Pucherite, Londonderry.
Quartz crystals, Kangan Station.
Spinel (chromiferous), Nth. of Wodgina.
Tourmaline, Payne's Find district; 10 miles N.E. of Derby.

SOIL MINERALOGY AND SEDIMENTARY PETROLOGY.

Following the establishment in 1943 of the Section to deal with Mineral Investigations of Soils, sedimentary materials, and problems connected with sedimentary petrology Table IV shows the source and type of material examined during 1944.

Ord River Soil Survey.—29 samples collected by the Department of Agriculture during the course of the soil survey in the proposed irrigation areas on the Ord River were examined mineralogically. These soils were generally of alluvial origin and yielded an interesting variety of minerals in both the heavy and light fractions. The heavy minerals are: Magnetite, ilmenite, limonite, amphiboles, epidote, zoisite, altered pyroxenes, hypersthene, serpentine, altered olivine, tourmaline, zircon, andalusite, rutile, corundum, garnet, apatite, anatase, biotite, and staurolite. The minerals present in the light fractions are: Quartz, clay minerals, plagioclase, orthoclase, microcline, and other altered felspars. The residues from the soils vary greatly in the proportions of these minerals and the minerals themselves vary in shape and colour. The minerals in the alluvial soils have been derived from the following sources: Basalts, limestones, mudstones and other sedimentary rocks, possibly Cambrian, Pre-Cambrian rocks of various kinds. There is considerable variation in mineral composition between the surface soils and the sedimentary material at depth, which indicates the alluvial processes by which the sediments have been accumulated. Additional samples of soils and rocks from the area were collected for future examination.

Kendenup Soils.—16 samples representing five soil profiles at Kendenup and three at Mt. Barker in orchards suffering from manganese deficiency were examined mineralogically with a view to obtaining some knowledge of the parent rocks of these soils. Beyond indicating gneisses (Pre-Cambrian) of two different types this examination did not give any suggestions as to the cause of the manganese deficiency, although at present it appears to be associated with the graphite-bearing gneisses of the area. Both types of gneiss appear to be lacking in ferromagnesian minerals.

Sheep-breeding Problems.—During October field-work was done in collaboration with officers of the Department of Agriculture in the Kojonup, Williams, Narrogin and Beverley districts where sheep-breeding problems have been reported. 126 samples of soils and rocks were collected from nine properties with a view to giving the origin and mineralogical composition of these soils, thereby assisting in interpreting the soil conditions and possibly also with experiments being carried out by the Department of Agriculture.

FOODS.

There was a considerable diminution in the number of foodstuffs examined throughout the year, largely due to the cessation of work done for the Commonwealth Food Control.

The number of samples received through the channel of food inspection amounted to 81, of which 76 consisted of milk samples.

Milk (76).—For the purpose of checking up on the quality of milk being supplied to the metropolitan area, 59 samples of milk were received from the Department of Public Health.

Ten (10) did not comply with the regulations, the majority of these being deficient in total solids or solids not fat. Only two did not comply with the regulations with regard to the fat content.

Owing to the sudden death of the City Analyst, temporary arrangements were made to take over the analysis of some samples of milk then in prospect. Of the 13 samples submitted nine did not comply, nearly all showing serious deficiencies in the fat content.

Human Milks.—To assist Infant Health centres and clinics in the diagnosis of any abnormal conditions thought to be due to the composition of mother's milk partial analyses of 16 samples were made with the least possible delay to permit of early rectification.

Liquors, Beverages, etc.—Only four samples of liquors were received during the year, three of which represented samples of wines examined for alcoholic content, preservatives and saccharin.

The vendors of a preparation labelled "Gin Squash" were successfully prosecuted as the sample contained the preservative substance sulphur dioxide without declaration.

Although no standards have been laid down for such a mixture, the proportion of gin to fruit squash composition was considered to be too low. Calculated on the minimum spirit strength allowed for gin under the Food and Drug Regulations the mixture would be Gin 33.1, Squash composition 66.9.

A number of coffee essences were examined because of claims by manufacturers that Kenya coffee was deficient in caffeine when compared with other sources. Analysis showed that the essences did not come up to the requirements of the Food and Drug Regulations with regard to the caffeine content.

LEMON SURVEY.

The investigation initiated in 1943 for a period of 12 months with the co-operation of the Department of Agriculture and growers with the object of correlating acidity, vitamin C, ratio of juice to total weight of lemon with seasonal and soil conditions, rainfall, cultivation, etc., was completed in March.

During the latter part of the investigation the lemons were showing the effect of the abnormal dry conditions then prevailing.

No definite conclusions could be arrived at as the result of the investigation, but with regard to acidity and vitamin C, there appeared to be little difference between the two species, Lisbon and Eureka.

The lowest values for both acidity and vitamin C appeared to be about June for the orchards in the foothills. Orchards situated farther in the adjacent hills gave the lowest values in July to September.

Some inexplicable differences appeared, thus maximum figures for acidity were reached in June in lemons from V. Wilkinson of Gosnells and A. J. Lee of Maddington with a steady decline until the end of March whilst from the latter orchard Lisbon lemons showed an increase in vitamin C from 37 Mgm. per 100 ml. of juice in July to 72 Mgm. per 100 ml. in December. The analysis for the 12 months terminating in March are given in Appendix 3, p. 141.

INTER-DEPARTMENTAL COMMITTEE ON FRUIT PRODUCTS.

Information regarding the sugar content, acidity and astringency of juice expressed from apples was obtained in a few samples.

It was suggested that a programme be initiated during 1945 season to determine the spread of the periods for processing for juice and dehydration from localities in the south-west and hills areas.

VEGETABLE RESEARCH COMMITTEE.

The work of this Committee continued the periodic analysis of tomatoes from Geraldton and Wanneroo districts for moisture, reaction, carotene and vitamin C.

The tomatoes from the Wanneroo district which continued until the end of May showed decreasing vitamin C content towards the end of the growing period.

A further continuation of the programme aiming at the increase in productivity, plant economy and carotene content of carrots by fertiliser and minor element experiments was carried on during the year. Decided progress has been made but in common with most biological experiments conclusions can only be arrived at by the examination of a sufficiently large number of both samples and controls covering the variables in conditions of growth.

MISCELLANEOUS WORK ON AGRICULTURAL PRODUCTS.

Linseed Oil.—Other work for the Department of Agriculture included the analysis of 128 samples of linseed grown at Merredin and Avondale Experimental Stations for the purpose of determining moisture and oil content.

The oil content on the moisture-free basis ranged from 35.2 per cent. to 45.4 per cent.

The establishment of a plant to express linseed oil from West Australian grown seed has followed as the result of the successful cultivation of linseed within the State.

Samples of the raw linseed oil, refined and unrefined, produced, were submitted by the Department of War Organisation of Industry for analysis to ascertain if they complied with the Australian Standard Specifications for raw linseed oil.

The refined oil complied in all respects but the unrefined did not quite comply with the drying time test.

Linseed Waste.—In connection with the possible use of waste from linseed processing being used for pig-feeding and to test the effect of other rations, 32 neck fats from carcasses from pig-feeding experiments conducted at Muresk Agricultural College were examined for iodine value as an index of the hardness of the fat.

Diets rich in linseed are said to produce soft fats but investigations have shown that variations in the iodine value of fats occur from various causes in addition to the influence of certain feeds, particularly with the part of the animal from which the fat is obtained.

Sheep-breeding Problems.—A number of specimens of ewe's livers were received from the Animal Nutrition Officer for the determination of arsenic as a trace element in connection with an investigation of infertility, dystokia and prolapse in certain areas.

As the result of investigations being carried out in respect to breeding problems in sheep, milk from maiden ewes was analysed. These milks varied considerably from average figures for ewes milk, the composition more closely resembling that of colostrum.

DRUGS AND MEDICINES.

A number of narcotic drugs used for horse "doping" found in the possession of a person charged under the Police Offences (Drugs) Act were submitted for identification.

The drugs were confiscated and when resubmitted by the Government Stores Department were carefully assayed to determine their purity and suitability for medicinal purposes.

A sample of mouth-wash (phenol sodique) reported to have caused undue burning was found to contain caustic alkalinity greatly in excess of that required to combine with the phenol.

Miscellaneous samples of drugs included identifications for Army Intelligence, a preparation surreptitiously taken to a hospital patient and drugs thought to have been narcotics which proved to be quinine.

Seventeen samples of anaesthetic ether were received which were mainly routine test samples for compliance with the British Pharmacopoeia tests for purity for Perth Hospital. All the samples from this source complied with the tests.

Impounded anaesthetics sent by direction of District Coroners consisted of ether and ethyl chloride used in suspected cases of death under anaesthetic.

To assist in an emergency condition created by shortage of staff at Perth Hospital some biochemical work was undertaken until other arrangements could be made. The work included the preparation of collodial gold, gold curves, biochemical analyses and preparation of allergic extracts.

CHEMICAL SEWAGE CONTROL.

Weekly.—Routine control consisted of weekly inspections with samples taken for reaction (pH) and solids in suspension at the treatment plants at Subiaco and Swanbourne.

During the year additional information was sought by the determination of the sludge of the percentage ratio of combustible to total. The results indicated that somewhat better results are obtained at Subiaco than at Swanbourne.

Following deterioration of the digesters at Swanbourne late in 1943, a modified method of liming achieved marked improvement so that during the hottest months the smell of the digester contents were negligible and flies less abundant than formerly.

In spite of the otherwise satisfactory functioning of the digesters at Swanbourne much suspended matter is still carried over, stressing the need for further treatment and for additional digester capacity.

Quarterly Complete Analysis.—An overall picture is obtained by periodic complete analysis of influent and effluent at the two treatment plants.

Amongst other data these analyses afford a means of determining the reduction achieved by treatment of oxygen absorbed in four hours, the biological oxygen demand and suspended solids with other putrescibility tests and factors.

Outfall Survey.—Samples during the annual survey of the ocean outfall area were taken in March under somewhat rough conditions. These analyses indicated the usual degree of contamination over a small ocean radius and length of beach near the outfall.

Trade Wastes.—Owing to a shortage of cylinders it has become the practice amongst aerated water manufacturers to generate their own carbon dioxide gas by means of sodium bicarbonate and sulphuric acid. The wastes from these operations is normally a concentrated solution of sodium sulphate but more often contains quite a high concentration of uncombined sulphuric acid, both of which, directly or indirectly, would have strong corrosive action on cement sewerage pipes.

A survey of plants in the metropolitan area was made and samples taken to determine the composition of the wastes and appropriate action.

The effluent from a potato dehydrating plant was examined to determine suspended matter and reaction. The sample was putrescent but gave no indication of objectionable sulphur compounds.

Investigational.—Following the reported success which had been achieved in other places with the use of ferric chloride to suppress hydrogen sulphide both as an oxidant and as an agent in immobilising as iron sulphide, considerable investigational work was done both in the laboratory and in the field.

Preliminary work was directed towards ascertaining dosages which would be practicable, methods of applications and tests.

The field work was done on South Perth sewage, hydrogen sulphide being determined at half-hourly periods, upstream before addition of ferric chloride and downstream after treatment. The dosages were 15, 30 and 60 parts per million.

The conclusion which could be drawn from the results obtained was that, whilst the addition of ferric chloride reduced the hydrogen sulphide it did not do so completely even at the greatest dosage. Further laboratory work, aimed at simulating conditions of long standing and contact, showed that no hydrogen sulphide could be detected with 30 p.p.m. after the fourth day.

WEEDICIDES.

A chlorinated benzene compound which had been imported by the City Gardener for the eradication of water hyacinth in lakes, etc., was reported upon as to composition and toxicity. Advice was also tendered on the hazards of handling the compound and its effect on fish life, etc.

AERATED WATERS.

A flocculent type of precipitate which had appeared in aerated water in previous years reached considerable proportions during this summer.

As no precipitate appears when rain water is used but appears when scheme water is used it was assumed that water from this source was the trouble. Some calcium and magnesium was found in the precipitate and suggestions made for its removal. These have not been completely successful and more work requires to be done on the problem.

TOXICOLOGY.

Human Poisoning Cases.—The human poisoning cases numbered 22. The poisons found were phenol disinfectants 1, strychnine 4, cyanides 2, barbiturates 1, phosphorus 1, and kerosene 1.

In nine cases no poisons were detected or contained substances not necessarily poisons but supporting medical diagnosis.

Most of these analyses were made in connection with coroners' inquests and evidence in these and other courts was given by Mr. J. C. Hood.

Animal Poisoning.—23 specimens of stomach contents, viscera, poisons and baits were received in connection with cases of real or supposed animal poisoning, six of which were the subject of investigation by the Criminal Investigation Branch as being of malicious intent.

Fatalities in stock with the use of a new batch of phosphorus rabbit poison caused this to be examined in comparison with the previous year's batch used without loss on the same property.

Analysis did not disclose any appreciable difference in phosphorus content or texture nor the presence of other poisons or anti-oxidants. The physical nature of the carrier used in the preparation of the baits may have had a material bearing on the subject.

Evidence on the relative toxicities and availability of animal poisons was given before a Select Parliamentary Committee on Vermin Destruction.

CRIMINAL INVESTIGATIONS.

A number of exhibits were received from the Criminal Investigation Branch in connection with the suspected poisoning by arsenic of a number of natives at Derby. Arsenic was found in flour and the damper made from it by the natives.

Subsequent investigation showed the poisoning to be accidental due to the mistaken admixture of arsenic for baking powder.

Assistance was also given to the Criminal Investigation Branch in the detection of nitrate spots on paraffin casts made of hands of a deceased person as a means of determining whether death had been by suicide or whether the revolver found in deceased's hand had been fired by somebody else.

Expert evidence was given at the Criminal Court in a case against two accused persons charged with conspiracy against the Taxation Department.

The evidence tendered concerned the nature of inks used and the effect on certain bleaching agents alleged to have been used in an endeavour to remove the cancellation marks on taxation stamps.

Evidence was also given at local and Criminal Courts in a case involving the examination of certain articles and also preparations for the presence of drugs which would assist in producing abortion.

Miscellaneous examinations made for the Criminal Investigation Branch included the identification of ampoules used for test purposes in gas warfare and also certain preparations thought to be of a deleterious nature but which proved to be of innocuous character.

INDUSTRIAL HYGIENE.

During the year a number of samples of lacquer used for coating food containers have been submitted for report by the Factories Department.

These have all been found to consist of a resinous substance dissolved in a volatile petroleum solvent with a low flash point. Extreme precautions have been urged with the use of these lacquers as the method of use involves the spreading of the solvent over surfaces thus exposing a large area for rapid evaporation.

Thoroughly efficient ventilation has been advised so as to prevent accumulation of inflammable vapours at the ground level not only for reasons of safety but also to safeguard the health of workers.

A health hazard was investigated as the result of complaints from machinists handling canvas rot-proofed with cupra-ammonia for the manufacture of army tents. A report was submitted as the result of the analysis of the canvas, which indicated that much of the irritation observed would be from the dusted copper compound.

Similar conditions experienced in other States of the Commonwealth has resulted in modified formulas for the rot-proofing agents which are said to minimise the hazards of the occupation.

A number of respirator pads used by operatives working lead dross as part of their daily occupation were examined for lead. Analysis disclosed a condition which called for immediate rectification as the quantity of lead greatly exceeded the lowest daily dose which if inhaled as fume or dust, may, in the course of years, set up chronic plumbism.

For the purpose of supporting diagnosis of "leaded" subjects, 14 samples of urine from private practitioners and the Department of Public Health were examined for lead.

Thirty samples of urine were also examined periodically for lead to check the incidence of exposure of battery plate workers at the W.A.G.R., whilst other urines were also analysed for suggested arsenic and antimony poisoning.

Two samples of air collected by the Inspector of Mines at Collie in the Co-operative Mine, Collie, gave figures for carbon dioxide and oxygen which did not indicate any serious vitiation of the air.

Following trouble experienced in fumigating a wheat silo at Bunbury with a brand of calcium cyanide, a number of samples of the wheat at various stages of discharging were analysed for moisture content and hydrocyanic acid content determined by aspiration with dry air, moist air and by steam distillation. In only one instance was a very faint trace recorded during aspiration with moist air and only just measurable amounts obtained in all cases by steam distillation.

During the loading of a vessel at Fremantle with bulk wheat which had been treated with "Cyano" the conditions were stated to be obnoxious and resulted in a stoppage of work by waterside workers.

In company with Dr. Samuel of the Department of Agriculture, Mr. Hood investigated the conditions and as the result it was reported that much of the disabilities experienced was due to dust which was preventable and recommendations were made to overcome the nuisance at the points of origin.

WORK FOR AUSTRALIAN AND ALLIED SERVICES.

Department of the Army.—Thirty-seven samples were received covering a variety of materials such as lubricating oils, gun recoil buffer oils, instrument oils, petrols for the detection of indicator fluid and sophistication with power kerosene, tablets for identification and hydraulic brake fluid for effect on rubber brake cups.

Royal Australian Air Force.—The services of the Laboratory were sought to investigate the carbon monoxide content of air in the cabin of a certain type of aircraft at various heights, with and without the use of the cabin heater.

Although the amounts of carbon monoxide found were small, the opinion was expressed that some saturation of the blood by the exhaust fumes must occur before the aircraft left the ground.

A continuous recording instrument for small amounts of carbon monoxide was checked against concentrations determined by accurate chemical means.

Aeronautical Inspection Directorate.—Forty-seven samples were received consisting of paint primers, ethylene glycol, corrosion inhibitors, cotton duck, soldering flux, oil sludge and check weighings on a number of bolts for aircraft.

A sample of imported khaki shirting which was not fast dyed was submitted for report on the bleaching effect of various washing agents.

United States Navy.—The work from this source, which carried a high priority, increased considerably during the year amounting to a total of 452 samples, mainly analysis of oils from submarines to determine replacement limits of used oils from engines and reduction gears.

Other work included identification of oil sludges, residues and deposits, greases, cleaning fluids and torpedo fuel.

A number of specimens and gas were analysed in an endeavour to elucidate the cause of sickness amongst a submarine crew.

NATURAL PRODUCTS.

Two plant materials were examined as potential rubber bearing plants. The quantity of rubber substance obtained from one plant (wild lettuce) was small and showed little possibility of commercial exploitation as it was of a non-adhesive nature with poor flexibility and elasticity.

The other material had been obtained by cooking an exudation from Poinsettia plant, which has been frequently noted as giving an appreciable flow of latex.

No recorded attempts at commercial exploitation could be traced, the success of which would depend on factors of growth, distribution and cost of collection, etc.

Three specimens of marine flotsam were submitted for identification as ambergris. One of these proved to be true "nugget" ambergis of somewhat variable composition whilst the others bore no resemblance to any of the forms of ambergris.

Various materials were submitted as possible sources of mineral oil. None of them gave any indication of petroleum or its residuums.

WOOD PRODUCTS.

Sections of powellised karri sleepers from the Nullabor section of the Transcontinental line after 27 years service were found to be immune from white ant attack.

It was thought that such immunity was due to locality but the analysis of selected sections of the sleepers showed quantities of arsenic closely approximating to that in the original sleepers.

Some powellising solutions used for treatment of karri sleepers were analysed for the State Saw Mills.

Some wood raspings were examined for the Forests Department by the C.S.I.R. methods for chemical identification of woods.

Mortality of pine seedlings at a plantation were shown to be due to arsenic inadvertently spilled some appreciable distance from the seedlings.

MISCELLANEOUS SAMPLES.

Amongst the miscellaneous samples were a loquat meal as a possible substitute for ground almonds, tallows for export, arsenical cattle dips, salts for various purposes, leather, exudation from bombs, gas neutralising "bullets," disinfectants, fruit preserver, weedicide, weevil spray, worm drench, locally manufactured metal polish, etched blood serum bottles, locally manufactured plastic drinking beakers and carbon tetrachloride for making smoke flares.

WATERS.

Natural.—Samples examined during the year from Mundaring Reservoir, Mt. Charlotte Reservoir, and the Kalgoorlie Reticulation showed practically no variation in composition from those taken in previous years, their good potable quality being maintained.

Further samples of waters taken in connection with the survey being carried out on the composition of the streams and rivers in the South-West of this State were examined for the Public Works Department. The results obtained to date are shown in Appendix 4. Analyses of the surface waters in the Canning Dam and the seepage waters from the walls of the tunnel under the dam were continued during the year under review.

Drought conditions during 1944 were responsible for the receipt of a large number of samples of water from dams, soaks, wells, bores and rivers. The samples covered the area south of Carnarvon and extended east to the Eastern Goldfields. The number of usable waters to unusable waters for stock purposes from the area covered were in the ratio of 5 to 1. The unusable waters were not confined to any particular portion of the State examined. The majority of the waters which were forwarded by farmers and graziers in this area were unsuitable for either irrigation or domestic uses.

Hygienic analyses were made of waters from the three Hills Reservoirs supplying the Metropolitan Area, viz., Wungong, Churchman's Brook and Canning. A complete analysis was made of the Canning Dam water taken during midsummer.

In addition to the above waters for various purposes were received for examination from the Royal Australian Navy, Australian Military Forces, Royal Australian Air Force and Allied Works Council.

Miscellaneous Water Supply Problems.—A galvanised cooling system to provide drinking water for school children at Kalgoorlie appeared to be showing excessive corrosion. The weight of zinc coating per square foot was determined together with an analysis for impurities in the coating. Test pieces were also exposed in Kalgoorlie water and the amount of zinc removed was determined.

Samples of water taken from the tank after one week's contact showed concentrations of zinc which were considerably below concentrations of zinc allowable in potable water. It was not considered that any danger attended drinking water from this source.

The nature of blue coloured deposits in pipe-lines in the hot water system at the King Edward Memorial Hospital was investigated by Mr. F. F. Allsop who found them to consist almost entirely of copper soaps.

Water was collected at various points of the system and the copper and other relevant determinations made. A comprehensive report was issued covering means of decreasing the solution of copper in the system by chemical and other means, also ways of removing the soaps already formed.

Sections of water pipes coated with a proprietary composition were submitted to various temperatures comparable to sun temperatures according to grade to determine the softening point, etc. A section of a pipe similarly treated and removed after 10 years service showed no deterioration or penetration of the lining, the internal metal surface of the pipe being in the same condition as when installed.

Battery.—Four hundred and forty samples of water for use in the United States Submarine Service were submitted for examination for compliance with the rigid specifications laid down by the Bureau of Ships, Washington, U.S.A.

SOILS.

A considerable number of soils (260) were received from the Department of Agriculture for mechanical and chemical analyses.

Of these 32 were from crop rotation experiments carried out at the Wongan Hills Research Station. These soils were examined for pH (reaction), nitrogen, organic carbon, potash and phosphates. The ammonia nitrogen and nitrate nitrogen were determined on incubated samples from this source.

In connection with the soil survey of the Ord River Valley in the Kimberley Area a number of samples of soils were submitted for the purpose of obtaining preliminary information regarding their mechanical analyses. A large number of type samples were subsequently submitted for general analyses.

A number of soils in connection with phosphorus status (phosphorus adsorption) from various parts of the State were received during this year.

Soils from apple orchards in the Kendenup and Mt. Barker districts showing symptoms of manganese deficiency were analysed for manganese and exchangeable manganese. Acid soils from the bottle brush and kangaroo grass country in the Albany district were examined to determine a treatment suitable for correcting the acidity.

The Forests Department submitted a number of soils from Pinjar in connection with the extension of the pine plantation in that area.

FERTILISERS.

No official samples for compliance with the Fertiliser Act were received during the year. Samples of the superphosphate supplied to the State Agricultural Research Stations were received for check analyses.

A large number of samples dealing with experiments carried out by the Department of Agriculture designed to determine the value of local phosphate rock and guano for fertilising purposes were received. These consisted of:—Superphosphate made from local natural phosphates; superphosphate mixed with an amount of the local raw phosphate and superphosphate with added lime. Arrangements were made to analyse these samples when the plot experiments were started, to be followed by a further examination later during the experiment to determine if any reversion had taken place.

A spectrographic examination of a sample of horse manure used for fertilising P. pinaster seedlings at the Forests Department Nursery at Applecross showed, in addition to the usual plant nutrients, iron, copper, aluminium and titanium, the elements that were deficient in the seedlings propagated at that nursery. Strong lines for barium, strontium and manganese were obtained also.

Pine Needles.—A series of pine needles from normal and disordered trees from the Mundaring, Hamel, Gnangara and Applecross Nurseries were submitted to a spectrographic examination.

WHEAT AND FLOUR.

The 1942-3 and 1943-4 F.A.Q. wheats and the flours milled from them were analysed during this year.

Five wheats from different State Research Stations to be tested for yield at the Merredin Research Station under uniform conditions were submitted for determination of their protein content.

Samples of export flour and flours from an experimental mill were also examined for their protein content.

Glutins washed from a flour by different operators were analysed for proteins.

A sample of flour forwarded by the Victorian Department of Agriculture for comparative tests in this State was submitted to a moisture and protein analysis.

PASTURES.

Further samples of pasture obtained from the experiments carried out at the Harvey and Waroona irrigation area, were received for analysis.

Pasture samples from the local phosphate, sub-acid phosphate and serpentine superphosphate experiments were collected from the rate of super treatment experiment and forwarded for analysis. These came from different parts of the State.

Hay samples from Merredin and other places were also received. These had been submitted to different treatments, e.g., cured and uncured.

Oat grain samples of different varieties grown at different research stations in the State, were submitted for analysis.

Subterranean clover grown in the sandhill region near Coolup was suspected of being deficient in some particular mineral constituent.

Subterranean clover samples were received in connection with the study of the copper status of soils and pastures in Western Australia. This is a continuation of work initiated several years ago in connection with pasture improvement. Samples were examined for copper, manganese, zinc, iron and the common fertilising constituents.

The use of molybdenum as a soil amendment in the growth of sub clover was studied.

Five samples of natural fodder plants from the Merredin Research Station, viz., *Enchylaena tomentosa, Atriplex canescens, Atriplex nummilarium, Atriplex semilunarius* and *Atriplex leptocarpam* were analysed for ash, protein, ether extract, fibre and nitrogen free extract. The results obtained are shown in table:—

	Enchylaena tomentosa.	Atriplex canescens.	Atriplex nummilarium.	Atriplex semilunarius.	Atriplex leptocarpam.
	%	%	%	%	%
Moisture	7·67	9·49	7·40	8·58	5·58
Ash	15·34	13·22	25·32	19·23	10·13
Protein (Nx6·25)	17·91	17·84	24·54	22·75	15·81
E. Extract	1·95	1·69	1·85	1·78	2·68
Fibre	17·80	13·90	6·90	10·20	13·50
Nitrogen Free Extract	39·33	43·86	33·99	37·46	52·30
	100·00	100·00	100·00	100·00	100·00

Main Constituents of Ash:

(1) Calculated as per cent. of Plant—on dry basis.

(2) Calculated as per cent. of Ash.

	Enchylaena tomentosa.	Atriplex canescens.	Atriplex nummilarium.	Atriplex semilunarius.	Atriplex leptocarpam.
	%	%	%	%	%
Calcium (1)	·30	1·06	·80	·92	1·56
(2)	1·85	7·24	2·94	4·38	13·57
Magnesium (1)	·19	1·34	·81	·78	1·14
(2)	1·20	9·15	2·95	3·70	10·65
Phosphorus (1)	·11	·16	·11	·11	·20
(2)	·65	1·06	·42	·50	1·90
Potassium (1)	1·55	4·76	2·84	1·31	2·26
(2)	9·50	32·64	10·38	6·54	21·05

VEGETABLES.

Samples of mature healthy cauliflower leaves submitted in connection with a potash and minor elements experiment with cauliflowers at Kenwick were examined for the usual plant nutrients and iron, copper and manganese contents.

Potato leaves from experiments laid down to determine the causes of a disorder of potatoes in the Marybrook district known as rust or bronzing that affects the foliage as well as the yield were submitted for examination. The potassium content of the affected leaves ranged from 0.46 to 0.66 per cent. whilst the unaffected leaves contained from 3.74 to 4.66 per cent. of potassium. Leaves from one experiment gave the following figures for total nitrogen:—Affected, 2.88 per cent., unaffected, 4.30 per cent.

In furtherance of the study of the fertiliser requirements of vegetables samples of leaves of runner-beans under experiment at Balcatta were analysed for the usual plant nutrients and certain minor elements.

Roots and tops from carrots grown at Osborne Park fertiliser and minor elements experimental plots were also submitted for the usual plant nutrients and minor elements analyses. The carotene content of the roots were also determined.

MEATMEAL.

Although there are no official standards laid down for meatmeals several samples of meatmeals now on the local market were examined. Some of them were of poor quality as regards their protein content that should be a guide as to their value as a "feeding stuff." Analyses showed a protein content of approximately 60 per cent. in the better quality samples whilst the poorer types showed a protein content of 34 per cent. only.

From the results obtained it would appear desirable to fix by regulation a minimum protein content for this type of "feeding stuff."

ELECTROLYTE.

More than 400 samples of battery electrolyte solutions taken from submarines were examined for the United States Navy. These were analysed for traces of ammonia, chloride, iron, copper, nickel, arsenic, antimony, manganese, nitrates and suspended matter

Owing to their urgency a high priority was given to this work at the expense of the normal activities of this laboratory.

SODIUM SULPHATE.

An interesting natural salt from the river bank on the Murchison River, 12 miles east of Three Rivers Homestead consisted of a crude sodium sulphate technically known as "salt cake." It is reported that large quantities are available.

A chemical analysis showed:—

	%
Calcium Ca	Trace
Magnesium, Mg	·02
Sodium, Na	27·95
Carbonate, CO_3	·12
Sulphate, SO_4	57·67
Chloride, Cl	·92
Insoluble (in water)	·13
Iron and aluminium oxides, + Silica, Fe_2O_3, Al_2O_3 + SiO_2	·05
Nitrate, NO_3	Trace
Potassium, K	·04
Assumed Combination:	
Magnesium carbonate, $MgCO_3$	·07
Sodium carbonate, Na_2CO_3	·12
Sodium sulphate, Na_2SO_4	85·29
Sodium chloride, NaCl	1·52
Iron and aluminium oxides + Silica, Fe_2O_3 and Al_2O_3 + SiO_2	·05
Insoluble	·13

MISCELLANEOUS.

Samples examined in the Agricultural Section included:—Malting barley for nitrogen content. Tannin extracts ("Myrtan") for copper determination. Wholemeal bread for protein analysis. Glauconite used as water filters in submarines for copper, nickel, arsenic. Pyrites for a spectrographic examination for the presence of thallium. Dried effluent from a power alcohol plant to determine its value as a "feeding stuff."

The assistance given by Messsrs. A. J. Hoare, J. N. A. Grace, J. C. Hood and Dr. Dorothy Carroll in the preparation of this report is duly acknowledged.

(Sgd.) H. BOWLEY, F.A.C.I.,
Government Mineralogist, Analyst and Chemist.
28th June, 1945.

APPENDIX I.

MINERALOGICAL EXAMINATION OF TANTALITE CONCENTRATES FROM STRELLEY, TABBA TABBA AND PILGANGOORA.

By H. P. Rowledge, A.W.A.S.M., A.A.C.I.

A mineralogical examination was carried out on a number of concentrates and specimens collected by H. A. Ellis during a geological survey of the tantalite deposits in the West Pilbara goldfield as follows:—

Strelley	131 samples.
Tabba Tabba	48 samples.
Pilgangoora	28 samples.

Composite samples were prepared from selected groups and grading tests and assays for Ta_2O_5, Nb_2O_5, SnO_2 and TiO_2 carried out.

This systematic sampling afforded an excellent opportunity of increasing our knowledge of the occurrence of the tantalum minerals and their associates in this important and interesting area. These deposits have been worked over for many years and much of the coarser tantalite removed. The average grade available at present is shown in the tables. These notes should be read in conjunction with sample plans prepared by H. A. Ellis.

Strelley M.C. 106.

The tantalite in this locality occurs generally in the following forms:—

Coarse ragged rusty brown fragments with very little crystalline form and often altered in varying stages to grey microlite.

Small flat rectangular and lath shaped crystals and crystal fragments showing parallel prismatic development, often intergrown with gangue and sometimes showing twinned aggregates.

Small stout nuggety crystals with double ended pyramidal faces sometimes black and lustrous but often unevenly altered to microlite. This form is often in twins and twinned aggregates showing many terminal faces.

Where clean specimens free from intergrowths and microlite were obtainable, the specific gravities were shown to be in the vicinity of 7.4 showing the Ta_2O_5 content to be high (Ta_2O_5, 74.8%, Nb_2O_5 10.2%).

No other tantalum or associated minerals than those previously recorded were recognised. Of interest is the presence of appreciable quantities of beryl in the eluvial recognised and collected by H. A. Ellis whilst sampling.

Grading tests and chemical assays for Ta_2O_5, Nb_2O_5, SnO_2 were carried out on composite samples prepared from selected groups with the following results:—

Lab. No.	Mark.	Ta_2O_5.	Nb_2O_5.	SnO_2.
		%	%	%
4234/44	Group 1	59·2	7·9	5·1
4235/44	Group 2A (high cassiterite)	48·4	4·3	31·2
4686/44	Group 2B (low cassiterite)	64·5	6·7	10·0

Grading Test.

Lab. No.	Mark.	+ ½ in. mesh.	+ ¼ in. mesh.	+ ⅛ in. mesh.	+ 1/16 in. mesh.	—1/16 in. mesh.
		%	%	%	%	%
4234/44	Group 1	*Nil*	5·3	10·6	40·6	43·5
4235/44	Group 2A (high cassiterite)	*Nil*	2·8	25·3	40·9	31·0
4686/44	Group 2B (low cassiterite)	*Nil*	8·5	13·6	41·3	36·6

In these samples it was noticed that the amount of cassiterite observed by visual examination in the Zn dish test was lower than the amount of SnO_2 obtained by chemical assay. A chemical examination of a shipment parcel of concentrates from this locality showed that of a total SnO_2 6.7% only .33% was present as cassiterite.

Tabba Tabba. M.L. 312, *M.C.* 6, *M.C.* 116.

Tantalite occurs in this locality in forms similar in many respects to those at Strelley except that in one position it occurs as fine granular and crystalline compact skins attached to the facings of quartz and beryl previously described. Generally speaking at the main workings M.L. 312, M.C. 6 and S.W. side of M.C. 116, less microlite is evident whilst simpsonite is present, a mineral which does not occur at Strelley. Microlite however is predominant about ¼ mile away at Crawford's small workings on the N.E. side of M.C. 116.

This examination shows that the occurrence of simpsonite is more extensive than was thought, for it is present in samples T 36-41 from the S.E. workings as well as the original central workings. Associated with it in this new position are appreciable quantities of very fine well crystallised amber to ruby coloured rutile, one sample assaying 17% TiO_2.

Associated with the simpsonite is a reddish brown mineral which as yet has been unidentified. It occurs closely associated and intergrown with the simpsonite in the form of tiny acicular prisms and pyramids irregularly distributed and in skins and small veins. It is vitreous, somewhat like rutile in appearance with Str. Ext. and R.I. $>$ 1.74. No TiO_2 is present and the S.G. is approximately 6.45. This mineral is being hand picked until sufficient quantity is obtained for determination.

Grading tests and chemical assays for Ta_2O_5, Nb_2O_5, SnO_2 and TiO_2 were carried out on composite samples prepared from selected groups with the following results:—

Lab. No.	Mark.	Ta_2O_5.	Nb_2O_5.	SnO_2.	TiO_2.
		%	%	%	%
4196	.... 1a	57·7	2·8	21·2	under 3
4197	.... 1b	64·9	2·1	11·4	under 3
4198	.... 1c	68·8	4·1	10·3	under 3
4199	.... 2a	54·9	3·3	17·8	4·1
4200	.... 2b	47·2	4·1	12·1	9·7

Grading Test.

Lab No.	Mark.	+ ½ in. mesh.	+ ¼ in. mesh.	+ ⅛ in. mesh.	+ 1/16 in. mesh.	— 1/16 in. mesh.
	..	%	%	%	%	%
4196	.... 1a	4	22	26	36	12
4197	.... 1b	*Nil*	1	22	32	45
4198	.... 1c	*Nil*	1	22	50	27
4199	.... 2a	*Nil*	8	6	37	49
4200	.... 2b	*Nil*	*Nil*	12	22	66

The amount of cassiterite recognised by visual examination in the Zn dish test did not compare with the amount of SnO_2 obtained by chemical assay in any of these samples, the visual examination giving much lower results. The maximum difference occurred in samples from the simpsonite quarry when under 2% cassiterite was seen by visual examination, against 11.4% SnO_2 obtained by chemical assay. Cassiterite was observed in a few fragments adhering to and intergrown with the tantalite.

Pilgangoora.

This field extends over several miles of country in a general north and south direction and embraces M.C. 131-134. Information regarding the occurrence has been far from complete in the past and this examination will serve to furnish reliable information regarding the distribution of tantalum minerals and their associates in this area. No tantalum mineral other than tantalite and columbite was recognised.

M.C. 131.—P29-30 Eluvial. Vicinity of No. 1 workings. The tantalite occurs here as small lath shaped crystal fragments showing prismatic development much intergrown with quartz and sometimes twinned in rosette fashion. Flat plates interleaved with quartz and small short stout pyramidal crystals were also seen. It was too much intergrown with gangue to determine the grade by S.G. method. The associated minerals were quartz, muscovite and spodumene. No cassiterite was observed in these samples.

M.C. 131.—P17-23 Alluvial, along E.W. Creek between Nos. 1 and 2 workings. The forms in these samples were small flat rectangular and lath shaped crystal fragments with square ends and small bevelled faces. It was rather freely intergrown with gangue. The S.G. of the cleanest pieces was 6.9 (Ta_2O_5 62%).

Moderate amounts of fines—30 mesh were present consisting of garnet and tantalite. One of the samples showed a few specks of gold. The associated minerals were cassiterite varying from 5-11%, garnet, limonite, magnetite and ilmenite.

M.C. 131.—P13-16, 24. Alluvial, Wagon Wheel Patch. The tantalite here showed the usual forms of flat rectangular and lath shaped and small stout crystals with prism and terminal faces. Some were in the form of geniculated twins up to ¼in. size. Another form was present as ragged fragments up to ½in. size, showing very little crystalline form.

S.G. crystalline type, 6.8, 6.7, 6.75 (Ta_2O_5, 57.8%).
S.G. non-crystalline type, 7.1 (Ta_2O_5, 67.3%).

The associated minerals were cassiterite, varying from 4-14%, limonite, magnetite, garnet and ilmenite.

M.C. 131 *No.* 2 *Workings.*

P. 31 *Dump and Eluvial.*—This concentrate consisted of coarser fragments up to ¾in. in size of rectangular flat prismatic crystals and with small terminal faces and some intergrowth of quartz and albite. The S.G. of the clean mineral was 6.6 (Ta_2O_5 53.4%).

Lode.—Smaller rectangular flat crystals with small terminal faces intergrown with albite and quartz.

The associated minerals were garnet, spodumene, quartz and albite. No cassiterite was observed.

P. 32.—This consisted mainly of cassiterite 62% with tantalite of similar forms to P. 31. The associated minerals were garnet and spodumene.

M.C. 132. South of Pilgangoora Creek.

P. 1-4 Alluvial.—The tantalite was in the usual form of flat rectangular and lath shaped crystals. The larger ones up to ½in. in size had a S.G. of 6.65-6.74 (Ta_2O_5 55.0-57.5). The S.G. of the smaller ones was 6.1-6.2 (Ta_2O_5 37.1-40.6%).

A considerable amount of fines —30 mesh was present in these concentrates varying from 19-58%. The associated minerals were cassiterite varying from 5-18%, garnet and a little ferromagnesian mineral.

P. 25-26. Eluvial.—The tantalite forms were similar to those in P. 1-4 and were mostly intergrown with gangue. The S.G. of the clean mineral was 6.3 (Ta_2O_5, 43.9%). The associated minerals were cassiterite 6% and garnet.

M.C. 132 *and M.C.* 133 *S. end.*—Alluvial along Pilgangoora Creek. The tantalite was in the typical forms and grade usual in this locality. A considerable amount of fines –30 mesh varying from 23-82% was present in the concentrates. The associated minerals were cassiterite varying from 0.5-7% with 23% in P7 magnetite ilmenite and garnet. The maximum amount of TiO_2 present was 14%.

M.C. 133 *P.* 27-28. No. 3 workings.—This concentrate as received, consisted of two samples, coarse and fine.

In the coarse there were ragged fragments of tantalite up to ½in. in size with corroded surfaces and showing very little crystal form. S.G. 7.21 (Ta_2O_5 70.1%) and fragments of larger flat crystalline types 6.58 (Ta_2O_5 52.8%). There were also present the usual smaller flat rectangular types S.G. 6.8 (Ta_2O_5 59.2%) and small short stout crystals. The cassiterite amounted to 43% approximately.

In the fine the tantalite was the smaller crystalline type with cassiterite amounting to 44% approximately. The associated minerals garnet and spodumene were present.

Conclusions.

The predominant types of tantalite observed in this field are in general the flat rectangular and lath shaped forms with a S.G. in the vicinity of 6.7 which is near the halfway mark between tantalite and columbite and lower S.G.'s down to 6.1 with the mineral merging into columbite. In two positions higher grade tantalite with practically no crystal form was found associated with the above forms at—

M.C. 131 Wagon Wheel Patch S.G. 7.1 (Ta_2O_5 67.3%).

M.C. 133 No. 3 Workings S.G. 7.21 (Ta_2O_5 70.1%).

No tantalum mineral other than tantalite-columbite was recognised.

Cassiterite is nearly always present and is found associated with the tantalite in varying amounts.

APPENDIX II.

REPORT ON A VISIT TO WODGINA DISTRICT.

By H. P. Rowledge, A.W.A.S.M., A.A.C.I.

During the period from May 5th to May 19th, 1944, I visited the West Pilbara Goldfield and interviewed the smaller tantalite producers. There were not a great number working in the field and those who could be contacted were interviewed and informed as to the general position with regard to tantalite. Their workings were inspected and their products examined. They were informed of the value of different grades of tantalite, penalties incurred and the advisability of producing larger parcels in the vicinity of 1,000 lbs. They were shown how the mixing of different grade parcels would cause a loss in value than when sold separately. It was explained to them that large parcels could be kept separate from those of other producers and a chemical assay obtained which would give them the true value of the parcel whereas in smaller parcels only approximate values could be given by the visual examination only.

It does not appear as though there will be a great amount of hand prepared clean tantalite produced capable of being purchased direct. Most of this has come from Pilgangoora and from Crawford's at Tabba Tabba with smaller quantities from Kangan and M.L. 346, 2½ miles north of Strelley Mine. It seems probable that Pilgangoora will be the greatest producer of this class of material. Occurrences were seen however, which may be capable of producing larger quantities but the products obtained would require cleaning by crushing and concentration in a treatment plant. Deposits of this nature were seen at Kangan and M.L. 346 Strelley.

I collaborated with H. A. Ellis in an examination of a number of deposits in the principal areas of this district.

Details of the tantalite occurrences worked by the smaller producers are as follows:—

Pilgangoora.—No one was actually working in this field at the time of my visit. One small producer named Webster was, however, contacted at his camp near Wodgina. He had previously produced a small parcel which assayed approximately 43 per cent. Ta_2O_5 and 12 per cent. cassiterite. I interested him in the production of larger parcels and explained the value of the different grades of tantalite and the penalties incurred by the presence of over 3 per cent. cassiterite. Ellis and I took him to the field where I examined concentrates from alluvial at various places on the southern leases selected by him along a N.N.W. trending tributary of Pilgangoora Creek at a point approximately ¾ mile W.17°N. of an unchartered cairn. One position was selected as the best place to work. This was where the cassiterite content was found to be lowest, approximately 3 per cent., and the Ta_2O_5 content of the clean mineral approximately 47 per cent. The tantalite was in the form of flat rectangular crystals typical of this locality.

A position on the north leases was also examined. This was a large alluvial patch between the Lalla Rookh road and a bend in an east-west running creek. An examination of the concentrate from a large mixed sample of alluvial obtained from several dumps and potholes showed the tantalite to be more ragged and fragmental than crystalline and the cassiterite present to be approximately 4 per cent. The Ta_2O_5 content of the clean tantalite was higher than that from the first locality examined being approximately 58 per cent. The concentrate was however contaminated with a large amount of limonite pebbles and magnetite as well as some garnet. Webster was told that whilst working the position selected on the south leases he could prospect at this locality and send a sample of the concentrates to see if they can be reasonably cleaned to produce a higher grade product. He appears to be a reliable worker and was at the time of the interview designing a hand made sluicing plant.

Appreciable amounts of cassiterite up to 14 per cent were found to be present with the tantalite in the concentrates from the alluvial examined on the southern leases. If these concentrates were magnetically separated a more valuable product would be obtained.

Kangan Station.

Roger Bros. have prospected their property along the southerly slopes of the Kangan Hills near their homestead. A number of specimens collected by them were examined and in most cases proved to be columbite. Figures obtained by specific gravity determination showed some of them to have a Ta_2O_5 content of as low as 29 per cent. At two places, however, a workable grade of tantalite has been obtained.

1. Tantalite-microlite in eluvial about half mile N.32°E. of the homestead. This deposit was seen on my previous visit in 1943. Small parcels of hand picked clean mineral have been collected and sold at Wodgina.

2. Albite pegmatite near the beryl deposit about one mile N. 60° W. of the homestead. Here Rogers has opened up the pegmatite from which promising ore has been obtained. This formation consists of tantalite up to ¼in. square embedded in albite and quartz. Specific gravity determinations showed the Ta_2O_5 content of the clean tantalite to be approximately 58 per cent. No cassiterite was observed. A parcel of hand picked tantalite sent to Wodgina was too contaminated with albite for its value to be assessed by specific gravity determination. Rogers was advised that ore from this deposit would have to be mined in large parcels and arrangements made with the Wodgina Mine to have it crushed, tabled and cleaned in their treatment mill. Payment could then be made on the value of the clean concentrates. In the meantime it was suggested that work be continued on the smaller high grade tantalite-microlite deposits.

M.L. 346, 2½ miles North of Strelley mines.

This occurrence was seen by me in September, 1943, when small specimens of lustrous black high grade tantalite or tapiolite were picked from the dump of old workings, the Ta_2O_5 content of which was 79% approximately.

Sherlock, the manager of Strelley Station has recently produced a parcel which was rejected as containing too much cassiterite (about 40 per cent.). A number of fragments up to ¾in. in size collected by him were examined and specific gravity determinations done to educate him in the appearance of the high grade mineral present in this deposit.

In collaboration with H. A. Ellis an examination of the dump and costeans of the old workings was carried out and Sherlock shown where high grade tantalum minerals could be obtained reasonably free from cassiterite. The sites for working would have to be carefully chosen so as to avoid contamination with cassiterite which is abundant in adjacent positions. These positions have been marked by Ellis.

A number of samples was taken and hand concentrated when well crystallised black lustrous tantalite or tapiolite was seen as well as grey microlite. Generally speaking, the tantalum minerals are in the form of small rectangular intergrowths of tapiolite or tantalite and microlite with quartz and muscovite in fragments up to ½in. in size. They appear to be much intergrown with gangue. A mixed sample of these concentrates was brought to the laboratory to ascertain the amount of gangue present and for determination of the $(TaNb)_2O_5$ content before and after crushing and further concentration to ascertain whether a more valuable product can be obtained by this means. It was shown to contain 66% $(Ta,Nb)_2O_5$ approximately and 4 per cent. cassiterite which is a saleable product. Crushing and further concentrates in a heavy solution S.G. 3.3 yielded 2.5 per cent. gangue increasing the $(Ta,Nb)_2O_5$ content to 67.5 per cent. Specific gravity determination of the clean mineral showed the Ta_2O_5 content to be approximately 79 per cent.

Tabba Tabba.

Crawford of Tabba Tabba Station has recently produced and sold a parcel of clean microlite from eluvial on his property. He could not be located at the time of my visit as he was out mustering and shearing.

A brief inspection of the old tantalite workings was made with Ellis and he was shown where the mineral simpsonite occurred. This lode is not being worked for tantalite at the present time.

Wallareenya Station.

Two samples were examined for Mrs. Kerr the owner of the station. They both proved to be columbite with a Ta_2O_5 content of approximately 15 per cent.

She was given all the information supplied to the small producers and advised to forward any further samples found on her property to the laboratory for identification.

Beryl.

The position with regard to the occurrence of beryl is as follows:—

Beryl is being produced at the present time from the south workings at Wodgina and from Lamont's workings in the Mt. Francisco area.

The latter occurrence was seen and described on an earlier visit when large and small beryl crystals were seen lying as they had fallen in the detritus alongside a quartz ridge in the pegmatite. These have been collected and sold. The detritus has since been opened up and large tapered corroded crystals similar to that seen lying on the surface were seen standing vertical on their base in the eluvial. They are irregularly distributed and consequently no idea can be formed of the quantity available. I was informed that up to date about 23 tons have been obtained from this deposit.

Beryl has been observed in a number of other places in the West Pilbara, namely Kangan Station, Strelley, Tabba Tabba and Pilgangoora.

The occurrence at Kangan was described on an earlier visit in September, 1943, when boulders and fragments showing strong parallel prismatic development were seen scattered over an area of about 50 yards square on the surface outcrop of the pegmatite. A specimen when assayed showed the BeO content to be 13.5 per cent. Rogers has opened up this pegmatite and the beryl is seen to be irregularly distributed associated with felspar and quartz. Again it is impossible to form any idea of the quantity available. He has been advised to collect the beryl until sufficient quantity has been gathered to warrant transport.

Ellis has recognised beryl fragments and boulders in the eluvial at Strelley Mine which he has been sampling for tantalite. Several tons have already been collected. It shows some crystal faces and striae. Some boulders show it to be intergrown with quartz and felspar. It has not yet been located in the pegmatite itself. Appreciable quantities should be obtained by collecting the fragments when mining the eluvial for tantalite.

It is quite possible that similar conditions exist at the old tantalite workings at Tabba Tabba where beryl was seen in well crystallised form and in masses "frozen" in the pegmatite as well as fragments in the detrital on the slopes.

At Pilgangoora a small amount of beryl associated with quartz and felspar was seen on an earlier visit lying alongside a costeen in pegmatite west of Lalla Rookh road on the northern leases.

There are many pegmatites yet to be explored and it seems reasonable to expect that at least some of them when prospected will show the presence of beryl.

APPENDIX III.—LEMON SURVEY.

Analytical figures for lemons from Walliston, Armadale, Gosnells, Maddington, and Sawyers' Valley.

A. H. HUNTER, WALLISTON.

	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar., 1944.	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar. 1944.
Variety	Lisbon.												Eureka.											
Soil	Gravelly sand, yellow clay subsoil.												Gravelly sand, yellow clay subsoil.											
Cultivation, etc.	Per Tree. 1940—B. & B. 3 lb., Potash 1 lb. 1941—Bonedust 3 lb., Ammonia 1 lb. 1942—B. & B. 2 lb.						Cultivated both ways. Manure per tree—Nitrate of soda 6 lb., Rape manure 3 lb., Superphosphate 2½ lb.						Per Tree. 1940—B. & B. 3 lb., Potash 1 lb. 1941—Bonedust 3 lb., Ammonia 1 lb. 1942—B. & B. 2 lb.						Cultivated both ways. Manure per tree—Nitrate of soda 6 lb., Rape manure 3 lb., Superphosphate 2½ lb.					
Rainfall (Points)	192	302	719	839	664	519	62	19	....	12	....	12	192	302	719	839	664	519	62	19	....	12	....	12
Weight of sample (grams)—																								
5 fruits	1,092	....	....	....	....	....	....	....	....	....	....	....	910	....	....	....	....	....	....	....	....	....	....	....
15 fruits	....	1,605	1,799	1,878	1,590	1,686	1,648	1,282	1,236	1,543	1,726	1,393	....	1,860	1,779	1,940	1,520	1,491	1,689	1,446	1,590	1,589	1,380	1,225
Volume of juice (millilitres)—																								
5 fruits	285	....	....	....	....	....	....	....	....	....	....	....	250	....	....	....	....	....	....	....	....	....	....	....
15 fruits	....	420	545	575	550	550	670	500	460	560	610	450	....	555	515	545	580	520	620	540	565	550	530	500
Juice/weight per cent.	26	26	30	31	35	33	41	39	37	36	35	32	27	30	29	28	38	35	37	37	36	35	38	41
Analysis of juice (strained through linen 45 threads to one inch)—																								
Specific gravity (by hydrometer)	1·038	1·038	1·034	1·030	1·036	1·028	1·028	1·030	1·032	1·038	1·035	1·041	1·038	1·035	1·035	1·031	1·035	1·030	1·028	1·030	1·026	1·038	1·042	1·042
Equivalent to °Brix	9·5	9·5	8·5	7·5	9·0	7·1	7·1	7·5	8·0	9·5	8·8	10·2	9·5	8·8	8·8	7·8	8·8	7·5	7·1	7·5	6·6	9·5	10·4	10·4
Vitamin C. Mgm per 100 ml.	49	50	45	44	63	56	61	52	53	57	52	60	55	47	53	48	60	56	52	56	61	59	54	55
Acidity (as anhydrous citric acid) per cent. w/v.	5·9	4·2	4·4	3·5	5·8	4·8	4·9	4·8	4·7	5·7	5·4	6·8	5·1	4·5	4·2	3·1	5·3	4·4	4·9	5·2	5·3	5·9	6·0	6·7

W. F. FEARS, WALLISTON.

	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar., 1944.	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar., 1944.
Variety	Lisbon.												Eureka.											
Soil	Deep gravelly soil on hillside.												Deep gravelly soil on hillside.											
Cultivation, etc.	Per acre. 1940—Fowl manure ½ ton, Bonedust ½ ton. 1941—Bonedust ½ ton. 1942—Bonedust ½ ton, B. & B. 2 cwt.						Cultivated both ways. Heavy crops N.Z. lupins ploughed in. No manure to date.						Per acre. 1940—Fowl manure ½ ton, Bonedust ½ ton. 1941—Bonedust ½ ton. 1942—Bonedust ½ ton, B. & B. 2 cwt.						Cultivated both ways. Heavy crops N.Z. lupins ploughed in. No manure to date.					
Rainfall (Points)	192	302	719	839	664	519	62	19	....	12	....	12	192	302	719	839	664	519	62	19	....	12	....	12
Weight of sample (grams)—																								
5 fruits	908	....	....	....	....	....	....	....	....	....	....	....	744	....	....	....	....	....	....	....	....	....	....	....
15 fruits	....	1,916	1,732	2,124	1,640	1,729	1,914	1,696	1,548	1,787	1,909	1,794	....	1,841	1,684	2,121	1,840	1,957	2,138	1,945	1,720	1,724	1,833	1,728
Volume of juice (millilitres)—																								
5 fruits	270	....	....	....	....	....	....	....	....	....	....	....	245	....	....	....	....	....	....	....	....	....	....	....
15 fruits	....	645	585	580	615	670	740	650	695	730	650	630	....	650	525	720	675	700	810	700	685	680	635	640
Juice/weight per cent.	30	34	34	27	38	38	39	38	45	41	34	35	33	35	31	34	37	36	38	36	40	39	35	37
Analysis of juice (strained through linen 45 threads to one inch)—																								
Specific gravity (by hydrometer)	1·035	1·034	1·033	1·032	1·035	1·031	1·031	1·030	1·035	1·033	1·038	1·032	1·038	1·038	1·035	1·035	1·037	1·028	1·029	1·028	1·035	1·040	1·042	1·029
Equivalent to °Brix	8·8	8·5	8·3	8·0	8·8	7·8	7·8	7·5	8·8	8·3	9·5	8·0	9·5	9·5	8·8	8·8	9·2	7·1	7·3	7·1	8·8	9·9	10·4	7·3
Vitamin C. Mgm per 100 ml.	43	41	44	46	54	53	49	55	58	47	45	48	44	42	42	44	53	49	51	50	55	55	46	38
Acidity (as anhydrous citric acid) per cent. w/v.	5·5	5·0	4·1	3·6	5·1	5·4	5·3	5·5	6·1	5·6	5·1	4·4	4·5	4·4	4·2	4·3	4·7	4·2	5·0	5·1	6·1	6·9	5·9	5·3

L. C. H. LORDING, WALLISTON.

	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar., 1944.	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar., 1944.
Variety	Lisbon.												Eureka.											
Soil	Dark red gravelly loam, similar subsoil.												Dark red gravelly loam, similar subsoil.											
Cultivation, etc.	Per acre. 1940—Nitrate of soda 4 cwt., Potash 1½ cwt. 1941—Sal ammoniac 4 cwt., Potash 1½ cwt. 1942—Bonedust 5 cwt.						Heavy crop N.Z. lupins ploughed in one way. Manure per tree—Nitrate of soda 3½ lbs.						Per acre. 1940—Nitrate of soda 4 cwt., Potash 1½ cwt. 1941—Sal ammoniac 4 cwt., Potash 1½ cwt. 1942—Bonedust 5 cwt.						Heavy crop N.Z. lupins ploughed in one way. Manure per tree—Nitrate of soda 3½ lbs.					
Rainfall (Points)	192	302	719	839	664	519	62	19	....	12	....	12	192	302	719	839	664	519	62	19	....	12	....	12
Weights of sample (grams)—																								
5 fruits	664	....	....	....	....	....	....	....	....	....	....	....	659	....	....	....	....	....	....	....	....	....	....	....
15 fruits	....	1,890	1,963	1,883	1,900	1,693	2,027	1,562	1,615	1,558	1,602	1,769	....	1,998	1,905	2,096	1,960	1,901	2,153	2,025	1,964	1,821	2,017	1,693
Volume of juice (millilitres)—																								
5 fruits	225	....	....	....	....	....	....	....	....	....	....	....	210	....	....	....	....	....	....	....	....	....	....	....
15 fruits	....	575	610	635	665	580	760	610	640	650	610	780	....	640	625	660	685	680	750	650	795	720	685	610
Juice/weight per cent.	34	30	31	34	35	34	37	39	40	42	38	44	32	32	33	31	35	36	35	32	40	40	34	36
Analysis of juice (strained through linen 45 threads to one inch)—																								
Specific gravity (by hydrometer)	1·030	1·033	1·032	1·035	1·035	1·030	1·026	1·028	1·030	1·035	1·035	1·029	1·033	1·033	1·033	1·036	1·034	1·030	1·028	1·026	1·030	1·035	1·035	1·028
Equivalent to °Brix	7·6	8·3	8·0	8·8	8·8	7·5	6·6	7·1	7·5	8·8	8·8	7·3	8·3	8·3	8·3	9·0	8·5	7·5	7·1	6·6	7·5	8·8	8·8	7·1
Vitamin C. Mgm per 100 ml.	39	39	38	39	44	42	51	38	41	38	46	32	44	40	43	46	49	60	53	55	43	46	40	40
Acidity (as anhydrous citric acid) per cent. w/v.	4·5	4·3	4·6	5·1	4·9	4·6	4·9	4·8	5·0	5·5	5·0	5·0	5·0	4·4	4·5	5·3	5·3	5·2	5·3	5·4	4·9	5·3	4·9	4·4

G. F. HALLEEN, WALLISTON.

	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar., 1944.	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar., 1944.
Variety	Lisbon.												Eureka.											
Soil	Sandy soil, yellow sand subsoil.												Sandy soil, yellow sand subsoil.											
Cultivation, etc.	Per acre. 1940—B. & B. and super 6 cwt. 1941—B. & B. and super 4 cwt. 1942—B. & B. 5 cwt.						Cultivated both ways. No manure at present.						Per acre. 1940—B. & B. and super 6 cwt. 1941—B. & B. and super 4 cwt. 1942—B. & B. 5 cwt.						Cultivated both ways. No manure at present.					
Rainfall (Points)	192	302	719	839	664	519	62	19	....	12	....	12	192	302	719	839	664	519	62	19	....	12	....	12
Weight of sample (grams)—																								
5 fruits	500	....	....	....	....	....	....	....	....	....	....	....	762	....	....	....	....	....	....	....	....	....	....	....
15 fruits	....	1,725	1,910	1,662	1,560	1,480	1,629	1,712	1,730	1,462	1,215	1,765	....	1,708	1,926	1,728	1,900	1,553	1,631	1,635	1,986	1,835	1,640	1,369
Volume of juice (millilitres)—																								
5 fruits	175	....	....	....	....	....	....	....	....	....	....	....	180	....	....	....	....	....	....	....	....	....	....	....
15 fruits	....	500	720	575	585	600	630	650	700	555	460	630	....	545	675	650	780	570	590	610	760	760	585	520
Juice/weight per cent.	35	29	38	35	38	41	39	38	40	38	38	36	24	32	35	38	41	37	36	37	38	41	35	38
Analysis of juice (strained through linen 45 threads to one inch)—																								
Specific gravity (by hydrometer)	1·037	1·035	1·033	1·035	1·037	1·030	1·029	1·028	1·031	1·035	1·049	1·040	1·033	1·038	1·035	1·033	1·035	1·032	1·026	1·028	1·031	1·038	1·043	1·043
Equivalent to °Brix	9·2	8·8	8·3	8·8	9·2	7·5	7·3	7·1	7·8	8·8	12·1	9·9	8·3	9·5	8·8	8·3	8·8	7·9	6·6	7·1	7·8	9·5	10·7	10·7
Vitamin C. Mgm per 100 ml.	38	39	35	41	44	52	48	46	46	50	55	45	39	38	41	43	48	46	47	45	50	38	52	46
Acidity (as anhydrous citric acid) per cent. w/v.	5·2	4·9	4·8	4·5	4·6	5·3	5·2	4·8	4·9	5·5	6·9	6·2	4·6	4·8	4·2	4·3	4·9	5·6	5·2	4·6	4·9	5·5	5·4	6·7

A. J. LEE, MADDINGTON.

	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar., 1944.	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar., 1944.
Variety	Lisbon.												Eureka.											
Soil	Red Chocolate Loam.												Red Chocolate Loam.											
Cultivation, etc.	Light dressing of potato manure "K." (1940, 1941, 1942)												Light dressing of potato manure "K." (1940, 1941, 1942)											
Rainfall (Points)	264	380	623	721	512	432	110	5	....	3	....	10	264	380	623	721	512	432	110	5	....	3	....	10
Weight of sample (grams)—																								
5 fruits	469	....	....	....	....	....	....	....	....	....	....	....	511	....	....	....	....	....	....	....	....	....	....	....
15 fruits	....	1,840	1,758	1,681	2,010	1,830	1,719	1,526	1,591	1,586	1,688	....	....	1,324	1,408	1,752	1,420	1,520	1,492	1,197	1,397	1,362	1,340	....
Volume of juice (millilitres)—																								
5 fruits	160	....	....	....	....	....	....	....	....	....	....	....	175	....	....	....	....	....	....	....	....	....	....	....
15 fruits	....	570	715	445	710	720	550	470	510	510	850	....	....	430	520	655	600	530	550	490	605	520	560	....
Juice/weight per cent.	34	31	41	27	35	39	32	31	32	32	34	....	34	32	37	37	42	35	37	41	43	38	42	....
Analysis of juice (strained through linen 45 threads to one inch)—																								
Specific gravity (by hydrometer)	1·035	1·038	1·039	1·037	1·039	1·033	1·030	1·039	1·035	1·030	1·038	....	1·038	1·043	1·044	1·043	1·040	1·034	1·033	1·033	1·031	1·029	1·038	....
Equivalent to °Brix	8·8	9·5	9·7	9·2	9·7	8·3	7·5	9·7	8·8	7·5	9·5	....	9·5	10·7	10·9	10·7	10·0	8·5	8·3	8·3	7·8	7·3	9·5	....
Vitamin C. Mgm per 100 ml.	46	47	52	37	55	54	63	71	72	65	61	....	44	47	53	53	57	58	51	52	49	48	47	....
Acidity (as anhydrous citric acid) per cent. w/v.	5·1	4·9	6·5	3·9	6·2	5·5	5·2	5·6	5·5	5·6	5·4	....	4·7	5·5	6·9	6·3	5·9	5·7	5·2	5·0	5·1	4·9	5·3	....

V. WILKINSON, GOSNELLS.

	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar., 1944.	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar., 1944.
Variety	Lisbon.												Eureka.											
Soil	Light sandy loam.												Sand.											
Cultivation, etc.	Per tree. 1940—Super 5 lb. 1941—B. & B. 5 lb. 1942—B. & B. 12 lb.												Per tree. 1940—Super 5 lb. 1941—B. & B. 5 lb. 1942—B. & B. 12 lb.											
Rainfall (Points)	264	380	623	721	512	432	110	5	....	3	....	10	264	380	623	721	512	432	110	5	....	3	....	10
Weight of sample (grams)—																								
5 fruits	645	....	....	....	....	....	....	....	....	....	....	....	551	....	....	....	....	....	....	....	....	....	....	....
15 fruits	....	1,730	1,487	1,890	2,280	1,875	1,985	1,936	1,831	1,887	1,758	1,444	....	1,715	1,697	1,896	1,810	1,770	2,114	1,741	1,765	1,893	1,510	1,471
Volume of juice (millilitres)—																								
5 fruits	190	....	....	....	....	....	....	....	....	....	....	....	185	....	....	....	....	....	....	....	....	....	....	....
15 fruits	....	540	535	620	870	700	700	690	720	740	755	610	....	600	608	589	670	600	710	630	690	730	615	620
Juice/weight per cent.	30	31	36	33	38	37	35	36	39	39	43	42	34	35	36	31	37	34	34	36	39	39	41	42
Analysis of juice (strained through linen 45 threads to one inch)—																								
Specific gravity (by hydrometer)	1·035	1·040	1·043	1·039	1·039	1·033	1·031	1·036	1·035	1·029	1·035	1·032	1·036	1·038	1·043	1·041	1·039	1·028	1·029	1·032	1·036	1·030	1·038	1·033
Equivalent to °Brix	8·8	10·0	10·7	9·7	9·7	8·3	7·8	9·0	8·8	7·3	8·8	8·0	9·0	9·5	10·7	10·2	9·7	7·0	7·3	8·0	9·0	7·5	9·5	8·3
Vitamin C. Mgm per 100 ml.	39	40	47	43	40	42	43	41	41	37	34	35	46	41	51	50	50	51	44	46	51	48	45	43
Acidity (as anhydrous citric acid) per cent. w/v.	4·5	5·1	7·0	5·8	5·4	5·3	5·1	4·9	5·3	4·8	5·1	4·8	4·5	5·1	6·8	6·1	5·9	5·4	5·1	4·8	5·3	5·2	5·5	5·4

A. McCORMACK, ARMADALE.

	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar., 1944.	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar., 1944.
Variety	Lisbon.												Eureka.											
Soil	Light grey sandy loam.												Light grey sandy loam.											
Cultivation, etc.	3 acres. 1940—Super ½ ton. 1941—Fowl and goat. 1942—Manure 2 ton.												3 acres. 1940—Super ½ ton. 1941—Fowl and goat. 1942—Manure 2 ton.											
Rainfall (Points)	264	380	623	721	512	432	110	5	....	3	....	10	264	380	623	721	512	432	110	5	....	3	....	10
Weight of sample (grams)—																								
5 fruits	729	....	....	....	....	....	....	....	....	....	....	....	685	....	....	....	....	....	....	....	....	....	....	....
15 fruits	....	2,090	2,105	2,213	2,347	2,540	2,354	1,822	1,709	1,995	1,920	1,734	....	2,250	2,169	2,764	2,298	1,960	2,113	1,996	1,712	1,685	1,501	1,395
Volume of juice (millilitres)—																								
5 fruits	220	....	....	....	....	....	....	....	....	....	....	....	230	....	....	....	....	....	....	....	....	....	....	....
15 fruits	....	670	785	790	1,040	975	900	785	680	740	750	630	....	785	730	950	920	850	900	800	690	580	610	520
Juice/weight per cent.	30	32	37	36	44	38	38	43	40	37	39	36	34	35	34	34	40	43	43	40	40	34	41	37
Analysis of juice (strained through linen 45 threads to one inch)—																								
Specific gravity (by hydrometer)	1·038	1·038	1·037	1·029	1·036	1·031	1·029	1·032	1·035	1·031	1·039	1·035	1·038	1·038	1·033	1·034	1·030	1·027	1·026	1·035	1·036	1·029	1·044	1·036
Equivalent to °Brix	9·5	9·5	9·2	7·3	9·0	7·8	7·3	8·0	8·8	7·8	9·7	8·8	9·5	9·5	8·3	8·5	7·5	6·8	6·6	8·8	9·0	7·3	10·9	9·0
Vitamin C. Mgm per 100 ml.	41	34	40	33	38	34	37	43	43	39	32	37	39	34	35	29	34	38	37	40	47	44	40	42
Acidity (as anhydrous citric acid) per cent. w/v.	5·4	5·2	5·8	3·7	5·5	5·5	5·7	5·5	5·6	5·7	6·2	6·0	5·3	4·5	4·6	5·1	4·1	4·5	4·9	5·7	5·5	6·0	6·6	5·9

A. J. RUMBOLD, SAWYERS' VALLEY.

	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar., 1944.	April, 1943.	May, 1943.	June, 1943.	July, 1943.	Aug., 1943.	Sept., 1943.	Oct., 1943.	Nov., 1943.	Dec., 1943.	Jan., 1944.	Feb., 1944.	Mar., 1944.
Variety	Lisbon. Composite Sample.												Eureka. Composite Sample.											
Soil	Light grey sandy loam.												Light grey sandy loam.											
Cultivation, etc.	1940—Very little fertiliser over the past two years. 1941— 1942—Only super and some stable manure.												1940—Very little fertiliser over the past two years. 1941— 1942—Only super and some stable manure.											
Rainfall (Points)	224	235	539	793	529	431	76	13	....	6	....	8	224	235	539	793	529	431	76	13	....	6	....	8
Weight of sample (grams)—																								
15 fruits	....	2,229	2,310	2,471	1,873	2,036	2,067	2,098	2,146	1,823	1,685	1,849	....	2,373	2,247	2,218	2,490	2,382	2,049	1,717	1,724	1,744	1,719	1,614
Volume of juice (millilitres)—																								
15 fruits	....	765	670	790	645	720	750	835	870	770	750	695	....	730	715	710	795	870	770	680	710	720	720	670
Juice/weight per cent.	....	34	29	32	34	35	36	40	41	42	44	38	....	31	32	32	32	37	38	40	41	41	42	42
Analysis of juice (strained through linen 45 threads to one inch)—																								
Specific gravity (by hydrometer)	....	1·039	1·038	1·037	1·037	1·037	1·032	1·035	1·032	1·034	1·036	1·034	....	1·039	1·038	1·035	1·031	1·029	1·034	1·035	1·034	1·033	1·033	1·036
Equivalent to °Brix	....	9·7	9·5	9·2	9·2	9·2	7·9	8·8	8·0	8·5	9·0	8·5	....	9·7	9·4	8·8	7·8	7·3	8·4	8·8	8·5	8·3	8·3	9·0
Vitamin C. Mgm per 100 ml.	....	39	39	38	48	50	48	41	49	55	48	49	....	44	45	38	36	33	48	53	54	55	52	49
Acidity (as anhydrous citric acid) per cent. w/v.	....	5·9	6·1	4·9	5·7	5·3	5·2	5·0	6·1	6·2	6·2	6·3	....	6·0	5·6	5·0	4·8	4·1	5·2	5·4	6·0	6·2	6·5	6·3

Note.—Rainfall figures are those obtained at the nearest recording station.

APPENDIX IV.

SALINITY OF THE SOUTH-WEST RIVER WATERS.

T.S.S., p.p.m. = Total soluble salts, parts per million.

River.										
Lefroy Brook	Date	19–2–41	18–11–41	25–2–42	23–6–42	15–9–42	18–1–43	11–4–43	15–6–43	11–7–44
	T.S.S., p.p.m.	188·6	208·6	200	118·6	117·7	200	212	228	178
Donnelly	Date	25–2–41	18–11–41	24–2–42	23–6–42	15–9–42	18–1–43	5–4–43	4–6–43	11–7–44
	T.S.S., p.p.m.	191·3	208·6	248·6	130	142·1	160	268	180	166
Wellington Dam, Collie	Date	27–2–41	1–12–41	17–3–42	9–10–42	2–2–43	6–4–43	18–6–43	5–7–44	....
	T.S.S., p.p.m.	408·6	204·3	268·6	159·3	262	272	284	374	....
Warren	Date	20–2–41	10–11–41	24–2–42	23–6–42	14–9–42	18–1–43	6–4–43	15–6–43	11–7–44
	T.S.S., p.p.m.	215·7	308·6	248·6	300	189	258	538	428	394
Capel	Date	26–2–41	19–11–41	23–2–42	22–6–42	16–9–42	12–1–43	14–4–43	22–6–43	12–7–44
	T.S.S., p.p.m.	528·6	288·5	544·3	188·5	142·3	520	572	468	328
Blackwood	Date	26–2–41	19–11–41	24–2–42	16–9–42	18–1–43	5–4–43	14–6–43	11–7–44	....
	T.S.S., p.p.m.	1,211·5	1,204	1,440	395·4	1,188	1,598	1,528	1,500	....
Frankland	Date	4–3–41	11–11–41	3–3–42	16–6–42	23–9–42	18–1–43	6–4–43	16–6–43	18–7–44
	T.S.S., p.p.m.	460	739·9	595·7	205·7	322·6	408	336	220	296
Preston	Date	25–2–41	12–11–41	23–2–42	24–6–42	9–10–42	18–1–43	5–4–43	24–6–43	....
	T.S.S., p.p.m.	424·3	355·7	471·4	245·7	233·3	396	356	476	....
Murray (Coolup)	Date	7–3–41	14–11–41	27–2–42	....	....	....	....	....	....
	T.S.S., p.p.m.	724·1	900	671·4	....	....	....	....	....	....
Murray (Hughes Bridge)	Date	7–3–41	14–11–41	27–2–42	19–6–42	1–10–42	9–4–43	19–6–43	7–7–44	15–1–43
	T.S.S., p.p.m.	1,016	1,080	715·7	2,840	558·7	2,708	2,152	2,076	456
Kent	Date	4–3–41	9–12–41	3–3–42	16–6–42	22–9–42	19–1–43	6–4–43	19–6–43	....
	T.S.S., p.p.m.	1,016	555·8	951·4	355·7	138	458	66	384	....
Bancell's Brook	Date	7–3–41	13–11–41	5–3–42	20–6–42	2–10–42	13–1–43	11–4–43	18–6–43	....
	T.S.S., p.p.m.	95·7	95·7	104·3	84·3	83·4	88	88	104	....
Margaret	Date	19–11–41	22–6–42	16–9–42	12–1–43	13–4–43	21–6–43	12–7–44	....	....
	T.S.S., p.p.m.	208·6	160	110·3	200	296	236	160	....	....
Denmark	Date	11–11–41	16–6–42	23–9–42	7–4–43	16–6–43	....	....	....	....
	T.S.S., p.p.m.	568·5	492	142·4	548	484	....	....	....	....
Logue's Brook	Date	13–11–41	5–3–42	18–6–42	2–10–42	13–1–43	11–4–43	18–6–43	18–7–44	....
	T.S.S., p.p.m.	108·6	100	91·4	78·6	92	134	104	92	....
Ferguson	Date	10–11–41	24–6–42	9–10–42	18–1–43	5–4–43	16–6–43	19–7–44	....	....
	T.S.S., p.p.m.	304·2	170	178·6	296	288	268	296	....	....
North Dandalup	Date	14–11–41	27–2–42	19–6–42	1–10–42	29–1–43	9–4–43	18–6–43	21–7–44	....
	T.S.S., p.p.m.	168·6	308·6	170	136·3	220	248	192	176	....
South Dandalup	Date	14–11–41	19–6–42	30–9–42	15–1–43	9–4–43	12–6–43	21–7–44	....	....
	T.S.S., p.p.m.	415·6	280	225	226	202	264	316	....	....
Harvey	Date	4–3–41	10–11–41	17–3–42	15–6–42	9–10–42	21–4–43	23–6–43	11–7–44	....
	T.S.S., p.p.m.	244·2	160	171·4	175·7	108·7	210	216	238	....
Wokalup	Date	12–11–41	15–6–42	9–10–42	21–4–43	23–6–43	18–7–44	....	....	....
	T.S.S., p.p.m.	268·6	195·7	177·6	360	320	142	....	....	....
Drake's Brook	Date	15–11–41	18–3–42	18–6–42	8–10–42	3–2–43	11–4–43	18–6–43	....	....
	T.S.S., p.p.m.	128·6	191·4	208·5	107·1	152	132	232	....	....
Samson Brook	Date	15–11–41	18–3–42	18–6–42	8–10–42	3–2–43	11–4–43	12–6–43	....	....
	T.S.S., p.p.m.	100	171·4	200	108·7	148	182	152	....	....
Brunswick	Date	3–12–41	17–3–42	24–6–42	9–10–42	14–4–43	14–6–43	13–7–44	....	....
	T.S.S., p.p.m.	180	180	135·7	124·4	196	216	182	....	....

TABLE 1.

AGRICULTURE, FORESTRY, AND WATER SUPPLIES SECTION.

Source and Description of Samples received during 1944.

—	Department of Agriculture.	Metropolitan Water Supply, Sewerage, and Drainage Dept.	Department of Works and Labour.	Public Health Department.	Departmental (Government Mineralogist and Analyst.)	Department of Industrial Development.	State Mining Engineer.	Treasury.	Government Geologist.	Free.	Public Pay.	Forests.	Alunite Industry Board of Management.	State Saw Mills.	United States Navy.	Royal Australian Navy.	Department of the Army.	Royal Australian Air Force.	Allied Works Council.	Minerals Production.	Main Roads Department.	Total.
Water	35	11	82	3	....	3	3	1	....	....	297	1	....	2	87	9	6	4	9	2	....	555
Distilled Water	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	1
Electrolyte	....	....	....	....	....	....	....	....	....	....	....	....	....	....	424	....	....	....	....	....	....	424
Battery Water	....	....	....	....	....	....	....	....	....	....	....	....	....	....	353	....	....	....	....	....	....	353
Sewage	....	146	....	....	64	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	210
Trade Waste	....	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
Ocean Pollution.																						
Effluent	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Ocean Water	....	47	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	47
Fodders.																						
Pastures	458	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	458
Sub-clover	112	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	112
Oat Grain	34	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	34
Sheepnuts	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Meatmeal	2	....	....	....	....	....	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	6
Linseed Meal	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Dried Effluent Residue	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Crushed Grain	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Soils	260	....	....	....	....	....	....	....	....	....	3	28	....	....	....	....	....	....	....	....	....	291
Grain and Cereals.																						
Wheat	7	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7
Flour	17	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	17
Glutens	18	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	18
Malting Barley	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Fertilisers	22	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	....	24
Flax	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Wood	1	....	....	....	....	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	13
Vegetables.																						
Carrot Tops	40	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	40
Carrot Roots	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Cauliflower Leaves	10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10
Potato Leaves and Stems	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12
Bean Leaves	10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10
Fruits.																						
Apple Leaves	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Pine Needles	....	....	....	....	....	....	....	....	....	....	....	17	....	....	....	....	....	....	....	....	....	17
Potash	....	....	....	....	....	2	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	3
Alunite	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	2
Pyrites	....	....	....	....	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
Sand	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Salt (Natural)	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1
Brine	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1
Phosphate Rock	....	....	....	....	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	4
Clay	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	3
Plastic Chippings	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Solution	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Glauconite	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	2
Coating from Tanks	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	2
Cloth	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1
No. of Samples	1,057	210	83	3	69	17	3	2	4	1	306	47	3	2	869	9	7	4	9	2	3	2,710

TABLE 2.

FOODS, DRUGS AND TOXICOLOGY SECTION.

Source and Description of Samples received during 1944.

	Public Health Department.	Police—Coroners.	Police—C.I.B.	Police—Liquor Inspection Branch.	Government Stores and Tender Board.	Department of Agriculture.	Mines—Explosives Branch.	Department of Industrial Development.	Hospitals.	Chief Inspector of Factories.	Metropolitan Water Supply, Sewerage, and Drainage Dept.	State Mining Engineer.	Superintendent of State Batteries.	Forests Department.	State Treasury Department.	Department of Works and Labour.	Pay—War Organisation of Industry Department.	Pay—Aeronautical Inspection Directorate.	Pay—United States Navy.	Pay—W.A. Government Railways.	Pay—Public.	Pay—Department of the Army.	Pay—Royal Australian Air Force.	Pay—State Wool Committee.	Pay—State Sawmills.	Pay—Royal Australian Navy.	Pay—Royal Navy.	Pay—City of Perth.	Free.	Total.
No. of Samples	101	63	40	8	5	343	3	5	28	19	724	2	4	10	1	21	4	47	452	30	14	36	9	3	2	1	1	13	6	1,995
Foods—																														
Cows' Milk	63	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	13	....	76
Human Milk and Infant Foods	16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	17
Coffee and Vegetable Extracts	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	5
Liquors	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Fruit Investigation	....	....	....	....	....	63	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	63
Vegetable Investigation	....	....	....	....	....	67	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	67
Bacon Fat	....	....	....	....	....	32	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	32
Loquat Meal	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Self-raising Flour	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Fruit Preservative	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Drugs and Medicines—																														
Preparations	2	....	....	2	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	7
Mouth Wash	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Narcotics	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Dangerous Drugs	....	....	6	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	8
Ether	....	....	....	....	....	....	....	....	16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	17
Toxicology—																														
Human Poisoning	1	63	9	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	2	....	....	1	....	....	....	....	....	....	....	77
Criminal Investigation Abortifacients and Drugs	....	....	10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10
Poisoning of Station Natives	....	....	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Poison Gas Preparations	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Animal Poisoning	....	....	6	....	....	17	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	23
Cattle Dips	....	....	....	....	....	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12
Sheep Breeding Problems	....	....	....	....	....	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12
Industrial Hygiene—																														
Can Lacquer	....	....	....	....	....	....	....	....	....	10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10
Fumigated Wheat	....	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Proofed Canvas	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Respirator Pads	....	....	....	....	....	....	....	....	....	8	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8
Urine Analyses	11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7	30	5	....	....	....	....	....	....	....	....	53
Water—																														
Hygienic and Mineral	....	....	....	....	....	....	....	....	....	....	40	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	40
Installations—Hot and Cold	....	....	....	....	....	....	....	....	9	....	....	....	....	....	....	7	....	....	....	....	....	....	....	....	....	....	....	....	....	16
Aerated Water Investigation	....	....	....	....	....	....	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Corrosion and Linings	....	....	....	....	....	....	....	....	....	....	4	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	7
Sewage—																														
Treatment Controls (Weekly)	....	....	....	....	....	....	....	....	....	....	648	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	648
Treatment Controls (Quarterly)	....	....	....	....	....	....	....	....	....	....	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Investigational	....	....	....	....	....	....	....	....	....	....	19	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	19
Trade Wastes	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3

Oils—																														
Mineral :																														
Lubricating Oils and Sludges	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	....	1	433	....	2	11	....	....	....	....	....	....	....	453
Fuel Oils	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	1	....	....	....	4
Greases	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	2
Residues	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	2
Vegetable :																														
Linseed	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	2
Petroleum :																														
Putative	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	3
Wood and Wood Products—																														
Wood Identification	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Karri Sleepers	....	....	....	....	....	....	....	....	....	....	....	....	....	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
Wood Tar	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Pine Needles	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Gas Analyses—																														
Air from Coal Mine	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Air from Aircraft Cabin	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	....	....	....	....	....	....	6
Air from Submarine	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1
Instrument Calibration	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	3
Explosives—																														
Gas Neutralising Bullets	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Exudation from Bomb	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Insecticides and Fungicides—																														
Weedicide	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	1
Weevil Spray	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	3
Worm Drench	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Work for Australian and Allied Services—																														
Army Petrol and Kerosene	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	21	....	....	....	....	....	....	....	21
Brake Fluid	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1
Khaki Shirting	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	3
Cotton Duck	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	2
Corrosion Inhibitors	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	2
Alcohol (Torpedo Fuels)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	4
Paints and Primers	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	2
Cleaning Solvent	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1
Carbon tetrachloride	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1
Soldering Flux	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1
Bolts	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	36	....	....	....	....	....	....	....	....	....	....	....	36
Natural Products—																														
Linseed	....	....	....	....	....	128	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	128
Rubber Latex	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Ambergris	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	3
Agar	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Salt	....	....	....	....	....	1	....	1	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Manufactured Products—																														
Tallow	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	3
Leather	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	3
Lime	....	....	....	....	....	....	....	....	....	....	....	....	4	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Miscellaneous—																														
Powellising Fluid	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	2
Disinfectant	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	1
Plastic Beakers	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Etched Serum Bottles	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Metal Polish	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Resin Tank Lining	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Ammonium sulphate	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Plant Hormone	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1

TABLE 3.

SOURCE AND DESCRIPTION OF SAMPLES ALLOCATED TO MINERALOGY, MINERAL TECHNOLOGY AND GEO-CHEMISTRY SECTION, DURING 1944.

	Pay.	Free.	State Batteries.	State Batteries Umpire Samples.	Government Geologist.	Government Mineralogist and Analyst.	State Mining Engineer.	Under Secretary for Mines.	Metropolitan Water Supply, Sewerage & Drainage Dept.	Department of Agriculture.	Department of Industrial Development.	Forests Department.	Alunite Industry Board of Management.	Public Works Department.	Government Printer.	Commonwealth Minerals Production.	Allied Works Council.	Commonwealth Works Department.	Department of the Army.	United States Navy.	Local Governing Bodies.	Aeronautical Inspection Directorate.	Ministry of Munitions.	Department of Navy.	Main Roads Departments.	TOTAL.
Samples Received	108	281	49	16	378	37	48	8	19	8	7	1	1	3	2	47	4	39	1	6	1	2	1	4	1	1,072
Alloys and Metals—																										
Phospho-Bronze	50	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	50
White Metals	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	....	4
Iron and Steel	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	....	....	....	....	....	8
Linotype Metal	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	1	....	....	....	....	....	3
Tungsten Steel	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1
Aluminium Bronze	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1
Graphite Bronze	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	1
Aluminium Alloy	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Ceramics (including Refractories)—																										
Clay—Red Brick	....	5	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8
Clay—White ware	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Clay—Kaolin and Halloysite	....	6	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7
Clay—Miscellaneous	....	5	....	....	2	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	9
Silica (Firestone)	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Kyanite	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Sillimanite	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Talc	....	....	....	....	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
Natural Mineral Pigments—																										
Red Oxides and Ochres	4	13	....	....	11	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	29
Yellow Ochres	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Fuels—																										
Coal	....	....	....	....	....	5	10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	15
Charcoal Briquettes	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Sawdust Briquettes	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
*Metallic Ores**—																										
Arsenic Ore	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Beryllium Ores	11	33	....	....	4	6	5	....	....	....	....	....	....	....	....	21	....	....	....	....	....	....	....	....	....	80
Bismuth Ores	3	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Chromium Ores	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Copper Ores	....	10	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	15
Cobalt Ores	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Gold Ores	6	30	31	16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	83
Gold Concentrates	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Gold Copper Concentrates	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Iron Ores	2	21	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	25
Iron Titanium Ores	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Lead Ores	1	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Lithium Ore	....	....	....	....	2	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7
Manganese Ores	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Mercury Ores	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Molybdenum Ores	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Niobium Ores	2	11	4	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	18
Platinum Ores	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Tantalum Ores	7	4	....	....	....	5	1	....	....	....	....	....	....	....	....	10	....	....	....	....	....	....	....	....	....	27
Tantalum Concentrates	4	12	....	....	243	....	22	....	....	....	....	....	....	....	....	15	....	....	....	....	....	....	....	....	....	296
Tin Ores	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Tungsten Ores	2	8	8	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	18

Other Economic Ores and Minerals—																										
Alunite													1													1
Asbestos		3																								3
Barite						1																				1
Clays—Bentonitic		14																								14
Clays—Fullers Earths		1																								1
Calcite		2																								2
Diatomaceous earth		2																								2
Dolomite		2				1																				3
Felspar		6			3	1																				10
Fluorite		1																								1
Graphite		1			6	2					1															10
Gypsum		6					1																			7
Heavy Sands		3					2																			5
Jarosite		2																								2
Limestone		5					4			5				2				39								55
Lime Mortar														1												1
Mica		6			1	1	1																			9
Opal		3																								3
Quartz Crystal		3																								3
Rare Earth Minerals		3			3			2																		8
Talc		3			8			3																		14
Topaz		1					1																			2
Tourmaline	1	5			1																					7
Vermiculite		1																								1
Minerals and Rocks for complete analysis—																										
Antimony Tantalates						3																				3
Beryl						3																				3
Pigments					3																					3
Rocks					6																					6
Sapphirine						1																				1
Talc					4																					4
Miscellaneous—																										
Actinolite		2																								2
Borings (testing ground)					72																					72
Brick (house)											1															1
Carborundum		1																								1
Efflorescence										1																1
Epidote						1																				1
Fibrolite Water Pipes									19																	19
Lake Mud							1																			1
Quartz and Chalcedony		3																								3
Rust																			1							1
Soils	1	1								1							4									7
Unclassified determinations	7	23																								30
Water																					1					1
																										1,072

* Metallic ores. Samples are classified according to the metal they were reputed to carry whether present or not.

TABLE 4.

SOIL MINERALOGY SECTION.

Source and Description of Samples Received during 1944.

——	Government Mineralogist and Analyst.	State Mining Engineer.	Public Free.	Department of Agriculture.	Totals.
Soils	...	...	...	46	46
Tin-Tantalum concentrates	19	37	...	...	56
Quartz crystal samples	...	...	9	...	9
Bentonite	7	...	...	...	7
Mineral determinations	...	...	1	...	1
Total	26	37	10	46	119

Division VIII.

Annual Report of the Chief Inspector of Explosives for the Year 1944.

The Under Secretary for Mines.

I have the honour to submit for the information of the Honourable Minister for Mines, in compliance with section 45 of the Explosives Act, 1895, my report on the working of the Branch for the year 1944.

The quantity of explosives imported into the State during the year is shown in Table No. 1, and Table No. 2 gives a comparison of the quantities imported during the past five years.

Table No. 1.

Importation of Explosives into Western Australia during 1944.

	lbs.
Gelignite	1,481,500
Gelatine Dynamite	154,800
Permitted Explosives	160,000
Blasting Powder	11,150
Total	1,807,450
Detonators: Number	1,300,000
Fuse: Yards	1,864,800

Table No. 2.

Explosives.	1940.	1941.	1942.	1943.	1944.
	lbs.	lbs.	lbs.	lbs.	lbs.
Gelignite	5,236,050	5,131,650	2,219,900	2,230,800	1,481,500
Gelatine Dynamite	1,720,150	902,540	60,750	139,850	154 800
Permitted Explosives	250,050	239,800	115,500	265,900	160,000
Powder (Blasting and Pellett)	92,300	32,450	23,950	67,500	11,150
	No.	No.	No.	No.	No.
Detonators	3,203,200	2,970,000	1,740,000	1,933,000	1,300,000
	yds.	yds.	yds.	yds.	yds.
Fuse	8,815,200	7,044,000	2,822,400	3,861,600	1,864,800

The quantity of explosives used in the different classes of industry during the years 1943 and 1944 is given hereunder:—

	1943. lbs. used.	1944. lbs. used.
Gold Mining	2,006,250	2,044,150
Coal Mining	72,700	175,750
Agriculture	3,450	7,750
Quarrying	50,950	50,200
Mining and base metals ..	24,600	46,050
Government Departments ..	66,700	39,700
Miscellaneous	217,550	17,850
	2,442,200	2,381,450

The following tests were made during the year for the purpose of determining the suitability for use and the chemical stability of explosives:—

Explosives	723
Fuse	217

The following table shows the number of licenses issued during the year:—

Magazines on Government Reserves ..	16
Magazines used by Government Departments and on private property	78
Store Licenses, Mode A	70
Fireworks Licenses	nil
Importation Licenses	2

During the year inspections were made of licensed premises and enquiries made with a view of ascertaining whether the requirements of the Act and regulations were being complied with. As a result of these inspections and enquiries it was found necessary to have the undermentioned explosives destroyed:—

Date	Place.	Kind and Quantity.	Reason for destruction.
10-1-44	Harvey	5 lbs. Gelignite	Owing to chemical deterioration.
17-1-44	Bunbury	10 lbs. Gelignite	Owing to having absorbed moisture.
10-2-44	Fremantle	25 lbs. Gelignite	Owing to having absorbed moisture.
9-3-44	Woodman's Point	135 lbs. Gelignite	Owing to having absorbed moisture.
11-2-44	Mundaring	30 lbs. Gelignite	Owing to having absorbed moisture.
9-8-44	Mt. Magnet	1,000 lbs. Gelatine Dynamite	Owing to chemical deterioration.
9-8-44	Cue	200 lbs. Gelignite	Owing to chemical deterioration.

T. N. KIRTON,
Chief Inspector of Explosives.

16th March, 1945.

Division IX.

Report of the Chairman, Miner's Phthisis Board, and Superintendent, Mine Workers' Relief Act.

The Under Secretary for Mines.

I have the honour to submit for the information of the Hon. Minister for Mines, my report on this Branch of the Mines Department for the year 1944.

Under arrangements similar to previous years, the Commonwealth Health Department continued the periodical examination of mine workers, the work being continuously carried on by the Health Laboratory at Kalgoorlie and by a Mobile Laboratory which visits the mining centres in the various Goldfields. The Goldfields not visited during the year were the Ashburton, Gascoyne, Kimberley, Phillips River, Pilbara, West Kimberley and West Pilbara, which are all remote, and with the exception of Pilbara, contain few mine workers.

MINE WORKERS' RELIEF ACT.

Examinations under the Mine Workers' Relief Act during the year totalled 4,468, compared with 4,298 for the previous year, the increased number being due to the Mobile Unit having visited several localities on two occasions during the year, and a number of mine workers having been examined on each occasion.

The results of the examinations for 1944, together with those for the previous years, are shown in the tables annexed hereto. A graph is also attached illustrating the trend of the examinations since their inception. In explanation of these figures, I desire to make the following comments:—

Normals, etc.—These number 4,079 or 91·51 per cent. of the men examined, and include men having first-class lives or suffering from pneumoconiosis only. The figure for the previous year was 91·47 per cent.

Early Silicosis.—These number 340, an increase of 15 over the previous year, of which 70 were new cases and 270 had been reported previously, the figures for 1943 being 63 and 262 respectively. Early silicotics represent 7·45 per cent. of the men examined, the percentage for the previous year being 5·563.

Advanced Silicosis.—Of the 35 cases reported, 21 were men who advanced from early silicosis during the year, the other 14 had been reported previously but were continuing in their employment. Advanced silicotics represent 0·76 per cent. of the men examined, compared with 0·75 for 1943.

Silicosis plus Tuberculosis.—Eight cases were reported compared with five for the previous year, and represent 0·15 per cent. of the men examined.

Tuberculosis only.—Six cases were reported compared with four for the previous year, and represents 0·13 per cent. of the men examined. By an amendment to the Mine Workers' Relief Act which came into operation during the year, mine workers suffering from tuberculosis only are, if they so desire, eligible for curative treatment at the expense of the Mine Workers' Relief Fund. One man is at present receiving treatment under this provision, and his progress will be watched with interest.

General.—The Mobile X-Ray Unit continued to function fairly satisfactorily during the year, with a minimum of repairs, but in view of its advanced age, an entirely new unit will be necessary in the near future.

MINES REGULATION ACT.

Examinations under the Mines Regulation Act totalled 850. This was in addition to the 4,468 examined under the Mine Workers' Relief Act. These examinations showed a reduction of 18 compared with the previous year.

The 850 men comprise 381 new applicants and 469 re-examinees for the Initial Certificate.

Particulars of the examinations are as follows:—

NEW APPLICANTS.

Normal	336
Pneumoconiosis	11
Silicosis early	1
Silicosis advanced	—
Query tuberculosis	6
Tuberculosis	2
Pneumoconiosis plus query tuberculosis	1
Pneumoconiosis plus tuberculosis	—
Silicosis early plus query tuberculosis	1
Silicosis early plus tuberculosis	1
Silicosis advanced plus query tuberculosis	—
Silicosis advanced plus tuberculosis	1
Other conditions	21
	381

Of the above applications for admission to the industry, 336 received the Initial Certificate (Form 2); 10 received Re-Admission Certificates (Form 6); 31 received Special Certificates (Form 9); and four received Rejection Certificates (Form 4). Thus of 381 applicants, 336 were eligible for employment anywhere on a mine; 41 were eligible for surface employment, and four were not eligible for any employment on a mine. There is, however, no information as to the number of these new applicants who actually entered the industry.

RE-EXAMINATIONS.

Normal	245
Pneumoconiosis	144
Silicosis early	18
Silicosis advanced	—
Query tuberculosis	23
Tuberculosis	1
Pneumoconiosis plus query tuberculosis	15
Pneumoconiosis plus tuberculosis	—
Silicosis early plus query tuberculosis	3
Silicosis early plus tuberculosis	2
Silicosis advanced plus query tuberculosis	—
Silicosis advanced plus tuberculosis	—
Other conditions	18
	469

These men had previously been examined and some were engaged in the industry prior to this examination. Two hundred and forty-five received the Initial Certificate (Form 2); one received a Rejection Certificate (Form 4); 69 received Re-Admission Certificates (Form 6); 152 received Special Certificates (Form 9); and two received Prohibition Certificates (Form 10). Thus of the 469 re-examinees, 245 were eligible for employ-

ment anywhere on a mine; 221 were eligible for surface employment, and three were not eligible for any employment on a mine.

Grouping the two sets of figures discloses that the following certificates were issued under the Mines Regulation Act, 1906:—

Initial Certificates (Form 2)	581
Rejection Certificates (Form 4)	5
Re-Admission Certificates (Form 6)	79
Special Certificates (Form 9)	183
Prohibition Certificates (Form 10)	2
	850

The percentage of men of normal health to the number examined was 68.35 as compared with 67.176 for the previous year.

MINER'S PHTHISIS BOARD.

The amount of compensation paid during the year totalled £35,455 16s. 5d., compared with £37,359 14s. 2d. for the previous year, the reduction being due to the deaths of beneficiaries and the attainment of the age of 16 years by some of the dependant children.

The number of beneficiaries under the Act on the 31st December, 1944, totalled 264, being 59 ex-miners; 202 widows, and three orphan children; the figures for 1943 being 278 (70, 204 and four respectively).

J. THOMAS,
Acting Chairman Miner's Phthisis Board and Superintendent Mine Workers' Relief Act.

21st February, 1945.

TABLE SHOWING RESULTS OF PERIODICAL EXAMINATION OF MINE WORKERS FROM INCEPTION OF EXAMINATION (1925) TO 31st DECEMBER, 1944.

First Examination (1925–26).

		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

Second Examination (1927).

			Per cent.
Normals, etc.—			
Previously reported as normal, etc.	2,290		
New cases (*i.e.*, cases examined for the first time)	826		
		3,116	83·6
Silicosis Early—			
Previously reported as early	348		
New cases	33		
		381	10·2
Silicosis Advanced—			
Previously reported as Advanced	85		
New cases	8		
		93	2·5
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	13		
Previously reported as Silicosis Early	27		
Previously reported as Silicosis Advanced	62		
New cases	26		
		128	3·4
Tuberculosis only		10	·3
Total number of men examined		3,728	100·0

PERIODICAL EXAMINATION OF MINE WORKERS—*continued.*

Third Examination (1928).

			Per cent.
Normals, etc.—			
Previously reported as Normal, etc.	2,738		
New cases	239		
		2,977	85·5
Silicosis Early—			
Previously reported as Normal, etc.	47		
Previously reported as Silicosis Early	303		
New cases	12		
		362	10·4
Silicosis Advanced—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	16		
Previously reported as Silicosis Advanced	79		
New cases	2		
		98	2·8
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	10		
Previously reported as Silicosis Early	14		
Previously reported as Silicosis Advanced	10		
New cases	8		
		42	1·2
Tuberculosis only—			
Previously reported as Normal, etc.	3		
New cases	1		
		4	·1
Total number of men examined		3,483	100·0

Fourth Examination (1929).

			Per cent.
Normals, etc.—			
Previously reported as Normal, etc.	2,099		
New cases	21		
		2,120	81·9
Silicosis Early—			
Previously reported as Normal, etc.	100		
Previously reported as Silicosis Early	224		
New cases	2		
		326	12·6
Silicosis Advanced—			
Previously reported as Silicosis Early	34		
Previously reported as Silicosis Advanced	60		
		94	3·6
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	8		
Previously reported as Silicosis Early	14		
Previously reported as Silicosis Advanced	19		
		41	1·6
Tuberculosis only—			
Previously reported as Normal, etc.		7	·3
Total number of men examined		2,588	100·0

Fifth Examination (1930).

			Per cent.
Normals, etc.—			
Previously reported as Normal, etc.	2,751		
New cases	34		
		2,785	81·9
Silicosis Early—			
Previously reported as Normal, etc.	133		
Previously reported as Silicosis Early	247		
New cases	3		
		383	11·3
Silicosis Advanced—			
Previously reported as Silicosis Early	22		
Previously reported as Silicosis Advanced	43		
New cases	2		
		67	2·0
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	6		
Previously reported as Silicosis Early	60		
Previously reported as Silicosis Advanced	46		
New cases	2		
		114	3·3
Tuberculosis only—			
Previously reported as Normal, etc.	47		
New cases	3		
		50	1·5
Total number of men examined		3,399	100·0

Sixth Examination (1931).

			Per cent.
Normals, etc.—			
Previously reported as Normal, etc.		2,530	84·0
Silicosis Early —			
Previously reported as Normal, etc.	94		
Previously reported as Silicosis Early	252		
		346	11·5
Silicosis Advanced—			
Previously reported as Silicosis Early	18		
Previously reported as Silicosis Advanced	35		
		53	1·8
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	4		
Previously reported as Silicosis Early	35		
Previously reported as Silicosis Advanced	19		
		58	1·9
Tuberculosis only—			
Previously reported as Normal, etc.		25	·8
Total number of men examined		3,012	100·0

PERIODICAL EXAMINATION OF MINE WORKERS—*continued.*

Seventh Examination (1932).

			Per cent.
Normals, etc.		3,835 =	89·5
Silicosis Early—			
Previously reported as Normal, etc.	35		
Previously reported as Silicosis Early	338		
		373 =	8·7
Silicosis Advanced—			
Previously reported as Silicosis Early	6		
Previously reported as Silicosis Advanced	47		
		53 =	1·2
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	3		
Previously reported as Silicosis Early	9		
Previously reported as Silicosis Advanced	4		
		16 =	·4
Tuberculosis only—			
Previously reported as Normal, etc.		8 =	·2
Total number of men examined		4,285 =	100·0

Eighth Examination (1933).

			Per cent
Normals, etc.		2,920 =	86·5
Silicosis Early—			
Previously reported as Normal, etc.	57		
Previously reported as Silicosis Early	322		
		379 =	11·2
Silicosis Advanced—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	15		
Previously reported as Silicosis Advanced	44		
		60 =	1·8
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	2		
Previously reported as Silicosis Early	9		
Previously reported as Silicosis Advanced	4		
		15 =	·4
Tuberculosis only—			
Previously reported as Normal, etc.		3 =	·1
Total number of men examined		3,377 =	100·0

Ninth Examination (1934).

			Per cent.
Normals, etc.		5,140 =	92·4
Silicosis Early—			
Previously reported as Normal, etc.	54		
Previously reported as Silicosis Early	315		
		369 =	6·6
Silicosis Advanced—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	24		
Previously reported as Silicosis Advanced	12		
		37 =	·7
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	6		
Previously reported as Silicosis Advanced	6		
		12 =	·2
Tuberculosis only—			
Previously reported as Normal, etc.		5 =	·1
Total number of men examined		5,563 =	100·0

Tenth Examination (1935).

			Per cent.
Normals, etc.		4,437 =	92·3
Silicosis Early—			
Previously reported as Normal, etc.	35		
Previously reported as Silicosis Early	303		
		338 =	7·0
Silicosis Advanced—			
Previously reported as Silicosis Early	24		
Previously reported as Silicosis Advanced	2		
		26 =	·6
Silicosis plus Tuberculosis—			
Previously reported as Silicosis Early		5 =	·1
Tuberculosis only—			
Previously reported as Normal, etc.		2 =	·0
Total number of men examined		4,808 =	100·0

Eleventh Examination (1936).

			Per cent.
Normals, etc.		6,972 =	94·7
Silicosis Early—			
Previously reported as Normal, etc.	29		
Previously reported as Silicosis Early	323		
		352 =	4·8
(Note.—Of the 352 cases of Early Silicosis reported, 23 were already suffering from Early Silicosis and 4 from Pneumoconiosis when re-admitted to the industry on the Re-Admission Certificate under Regulation 7 of the Mines Regulation Act, 1906).			
Silicosis Advanced—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	15		
Previously reported as Silicosis Advanced	4		
		20 =	·3
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	3		
Previously reported as Silicosis Early	8		
		11 =	·1
Tuberculosis only		8 =	·1
Total number of men examined		7,363 =	100·0

PERIODICAL EXAMINATION OF MINE WORKERS—*continued.*

Twelfth Examination (1937).

			Per cent.
Normals, etc.		7,487 =	95·4
Silicosis Early—			
Previously reported as Normal, etc.	15		
Previously reported as Silicosis Early	319		
		334 =	4·3
(Note.—Of the 334 cases of Early Silicosis reported, 37 were already suffering from Early Silicosis when re-admitted to the industry on the Re-Admission Certificate under Regulation 7 of the Mines Regulation Act, 1906).			
Silicosis Advanced—			
Previously reported as Silicosis Early	14		
Previously reported as Silicosis Advanced	4		
		18 =	·2
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	10		
		11 =	·1
Tuberculosis only		2 =	·0
Total number of men examined		7,852 =	100·0

Thirteenth Examination (1938).

			Per cent.
Normals, etc.		6,833 =	95·68
Silicosis Early—			
Previously reported as Normal, etc.	13		
Previously reported as Silicosis Early	266		
		279 =	3·91
(Note.—Of the 279 cases of Silicosis Early reported, 32 were already suffering from Early Silicosis and 4 from Pneumoconiosis when re-admitted to the industry on Re-admission Certificates under Regulation 7 of the Mines Regulation Act, 1906).			
Silicosis Advanced—			
Previously reported as Normal, etc.			
Previously reported as Silicosis Early	15		
Previously reported as Silicosis Advanced	2		
		17 =	·24
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	8		
Previously reported as Silicosis Advanced			
		9 =	·13
Tuberculosis only—			
Previously reported as Normal, etc.		3 =	·04
Total number of men examined		7,141 =	100·00

Fourteenth Examination (1939).

			Per cent.
Normals, etc.		6,670 =	95·63
Silicosis Early—			
Previously reported as Normal, etc.	18		
Previously reported as Silicosis Early	264		
		282 =	4·04
(Note.—Of the 282 cases of Early Silicosis reported, 28 were already suffering from Early Silicosis and one from Pneumoconiosis when re-admitted to the industry on Re-Admission Certificates under Regulation 7 of the Mines Regulation Act, 1906).			
Silicosis Advanced—			
Previously reported as Normal, etc.			
Previously reported as Silicosis Early	7		
Previously reported as Silicosis Advanced	3		
		10 =	·14
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	9		
Previously reported as Silicosis Advanced	1		
		11 =	·16
Tuberculosis only—			
Previously reported as Normal, etc.		2 =	·03
Total number of men examined		6,975 =	100·00

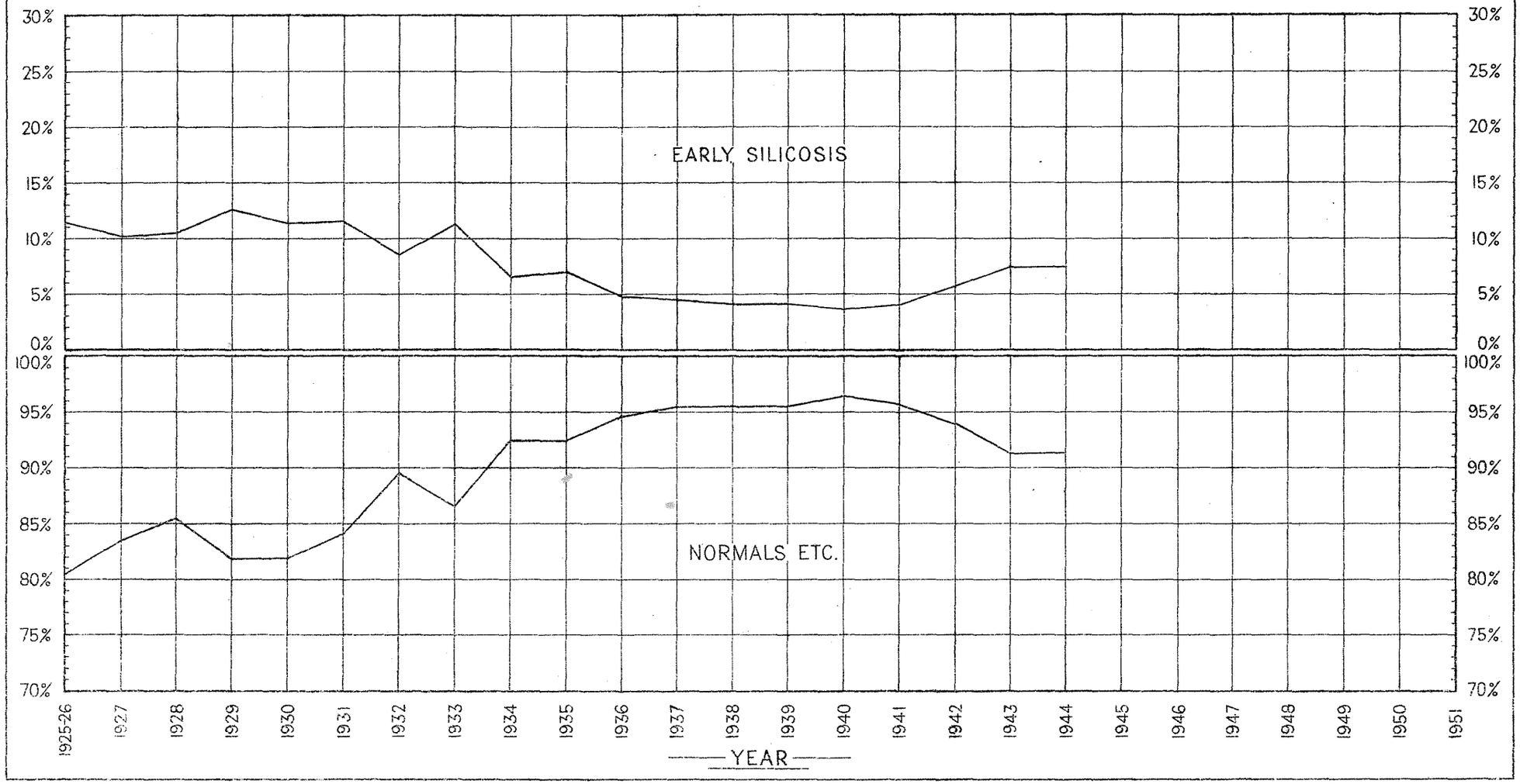
Fifteenth Examination (1940.)

			Per cent.
Normals, etc.		7,023 =	96·218
Silicosis Early—			
Previously reported as Normal, etc.	12		
Previously reported as Silicosis Early	245		
		257 =	3·521
(Note.—Of the 257 cases of Early Silicosis reported, 23 were suffering from Early Silicosis and 12 from Pneumoconiosis when re-admitted to the industry on Re-Admission Certificates under Regulation 7 of the Mines Regulation Act, 1906).			
Silicosis Advanced—			
Previously reported as Normal, etc.			
Previously reported as Silicosis Early	10		
Previously reported as Silicosis Advanced	1		
		11 =	·151
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.			
Previously reported as Silicosis Early	4		
Previously reported as Silicosis Advanced			
		4 =	·055
Tuberculosis only—			
Previously reported as Normal, etc.		4 =	·055
Total number of men examined		7,299 =	100·000

PERIODICAL EXAMINATION OF MINE WORKERS

GRAPH No.1

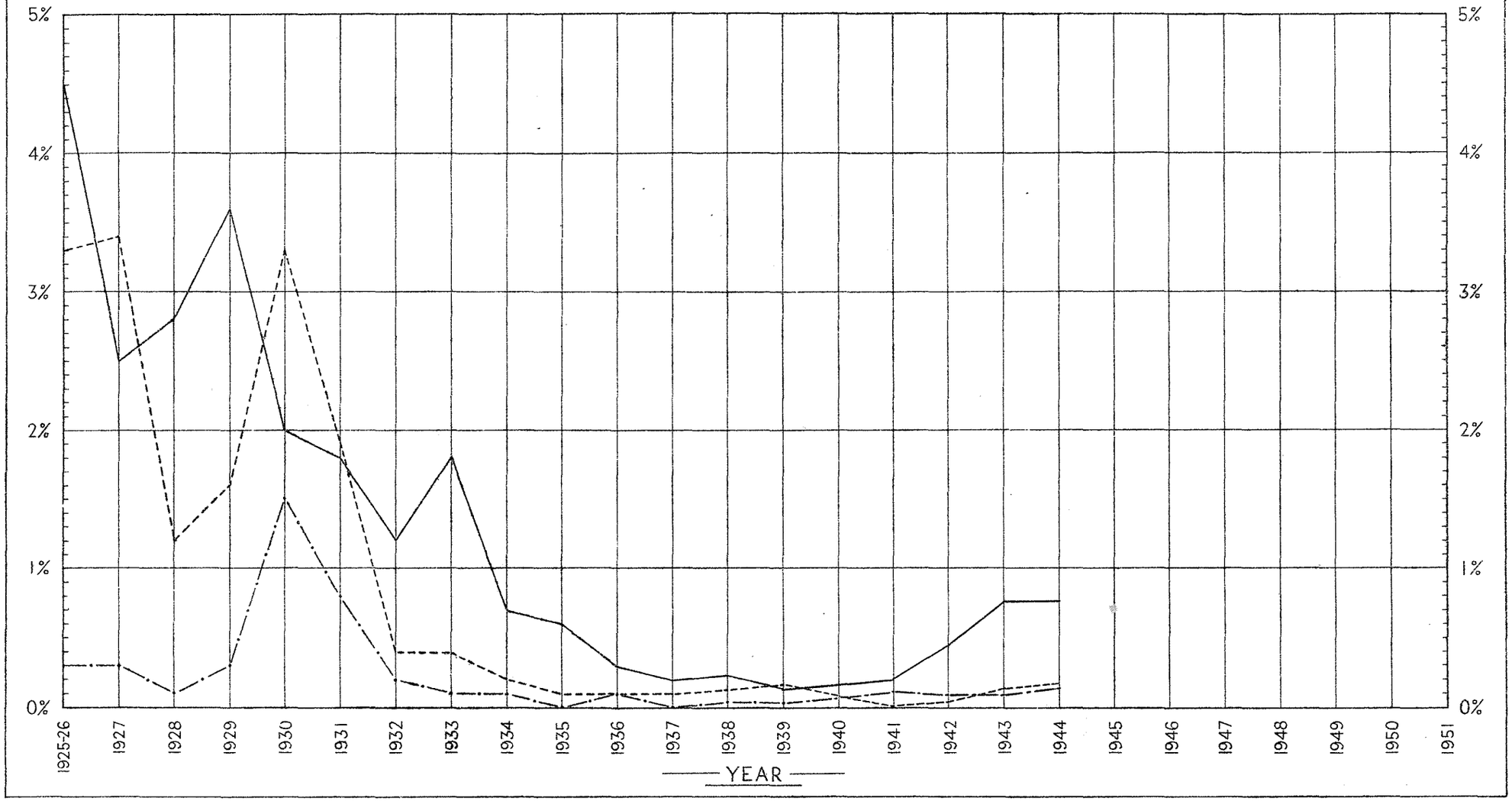
Showing Percentages of Normals and Early Silicotics, from 1925-26 onwards



PERIODICAL EXAMINATION OF MINE WORKERS

GRAPH Nº 2

Showing Percentages of Silicosis Advanced, Silicosis plus Tuberculosis and Tuberculosis only, from 1925-26 onwards



Silicosis Advanced ——————— *Silicosis Plus Tuberculosis* - - - - - - - - - *Tuberculosis Only* —·—·—·—·—

PERIODICAL EXAMINATION OF MINE WORKERS—*continued.*

Sixteenth Examination (1941).

			Per cent.
Normals, etc.		6,840	= 95·785
Silicosis Early—			
Previously reported as Normal, etc.	32		
Previously reported as Silicosis Early	248		
		280	= 3·921
Silicosis Advanced—			
Previously reported as Normal, etc.	....		
Previously reported as Silicosis Early	11		
Previously reported as Silicosis Advanced	3		
		14	= ·196
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	....		
Previously reported as Silicosis Early	....		
Previously reported as Silicosis Advanced	....		
Tuberculosis only—			
Previously reported as Normal, etc.		7	= ·098
Total number of men examined		7,141	= 100·000

Seventeenth Examination (1942).

			Per cent.
Normals, etc.		5,469	= 93·905
Silicosis Early—			
Previously reported as Normal, etc.	61		
Previously reported as Silicosis Early	264		
		325	= 5·580
Silicosis Advanced—			
Previously reported as Normal, etc.	....		
Previously reported as Silicosis Early	20		
Previously reported as Silicosis Advanced	5		
		25	= 0·430
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	....		
Previously reported as Silicosis Early	2		
Previously reported as Silicosis Advanced	....		
		2	= 0·034
Tuberculosis only—			
Previously reported as Normal, etc.		3	= 0·051
Total number of men examined		5,824	= 100·000

PERIODICAL EXAMINATION OF MINE WORKERS—*continued.*

Eighteenth Examination (1943).

			Per cent.
Normals, etc.		3,932	= 91·47
Silicosis Early—			
Previously reported as Normal, etc.	63		
Previously reported as Silicosis Early	262		
		325	= 7·57
Silicosis Advanced—			
Previously reported as Normal, etc.	....		
Previously reported as Silicosis Early	25		
Previously reported as Silicosis Advanced	7		
		32	= 0·75
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	....		
Previously reported as Silicosis Early	5		
Previously reported as Silicosis Advanced	....		
		5	= 0·12
Tuberculosis only—			
Previously reported as Normal, etc.		4	= 0·09
Total number of men examined		4,298	= 100·0

Nineteenth Examination (1944).

			Per cent.
Normals, etc.		4,079	= 91·51
Silicosis Early—			
Previously reported as Normal, etc.	70		
Previously reported as Silicosis Early	270		
		340	= 7·45
Silicosis Advanced—			
Previously reported as Normal, etc.	....		
Previously reported as Silicosis Early	21		
Previously reported as Silicosis Advanced	14		
		35	= 0·76
Silicosis plus Tuberculosis—			
Previously reported as Normal, etc.	1		
Previously reported as Silicosis Early	7		
Previously reported as Silicosis Advanced	....		
		8	= 0·15
Tuberculosis only—			
Previously reported as Normal, etc.		6	= 0·13
Total number of men examined		4,468	= 100·00

Men employed in the outlying districts were not examined during 1929 or 1931; only those employed in Kalgoorlie and surrounding districts being examined. The increase in numbers diagnosed as Early Silicosis and Tuberculosis in 1930 was due to the improved plant and radiographic technique.

Only new miners and those whose previous diagnosis warranted review were examined in the outlying districts during 1933.

Mining Statistics to 31st December, 1944.

TABLE OF CONTENTS.

TABLE I.

PRODUCTION OF GOLD AND SILVER FROM ALL SOURCES, SHOWING IN FINE OUNCES THE OUTPUT AS REPORTED TO THE MINES DEPARTMENT DURING 1944. AND THE TOTAL PRODUCTION TO DATE.

(*Note.*—Lease numbers in brackets indicate that the holding was *voided* during the year.)

(*Note.*—* denotes mainly derived from treatment of tailings.)

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Kimberley Goldfield.												
Brockman ...	109	Mt. Bradley	...	...	...	...	...	...	...	193·00	50·94	...
		Voided leases	...	...	...	...	...	...	...	1,352·75	1,404·40	...
		Sundry claims	...	...	...	...	...	7·62	7·62	2,484·00	1,871·92	...
Hall's Creek ...	...	Voided leases	...	...	...	...	...	...	...	423·00	477·76	...
		Sundry claims	...	...	...	...	...	27·73	...	204·55	159·68	...
Mt. Dockrell ...	95	Irish Lass	...	...	...	...	...	9·17	13·66	341·00	266·75	...
		Voided leases	...	...	...	...	...	...	...	832·70	939·34	93·00
		Sundry claims	...	...	...	...	...	...	20·03	160·00	89·64	...
Ruby Creek ...	98 ...	Goliath	...	...	...	...	...	...	...	120·70	103·72	...
	97 ...	Ruby Queen	...	...	...	...	...	...	...	2,799·25	1,556·85	...
	100 ...	St. Lawrence	...	...	...	...	...	...	...	10·00	11·32	...
	96	West & Left	...	...	...	...	...	...	...	10·00	5·30	...
		Voided leases	...	...	...	...	...	...	16·05	12,761·50	9,499·48	...
		Sundry claims	...	...	...	...	...	...	...	273·25	177·27	...
The Mary ...	...	Voided leases	...	...	...	...	...	...	...	399·00	210·03	...
		Sundry claims	...	...	...	...	...	...	...	46·85	53·66	...
The Panton ...	...	Voided leases	...	...	...	...	...	...	...	34·70	138·70	...
		Sundry claims	...	...	...	...	...	...	...	6·15	18·01	...
		From Goldfield generally :— Reported by Banks and Gold Dealers	199·20	...	...	...	...	7,780·68	85·07	·75	1·54	...
		Totals	**199·20**	...	...	...	...	**7,825·20**	**142·43**	**22,453·15**	**17,036·31**	**93·00**
Pilbara Goldfield.												
MARBLE BAR DISTRICT.												
Bamboo Creek ...	856	Bulletin	...	...	101·00	9·95	...	...	8·36	3,072·00	964·31	...
	850	Federation	...	...	24·50	3·09	...	...	...	1,280·50	835·65	...
	866, 901 ...	Greater Bonnie Doon (1935) Limited ...	...	...	...	...	...	...	...	2,530·00	1,043·86	...
	866	(Bonnie Doon)	...	...	...	...	...	...	...	204·00	78·03	...
	707	Kitchener	...	...	146·50	29·19	...	...	...	9,541·50	13,572·32	...

	1010	Mickey	...	...	...	...	...	...	...	1,300·00	351·99	...
	740, 794, 878 ...	Mt. Prophecy Leases	...	...	...	...	...	...	...	8,090·50	8,262·79	...
	740	(Mt. Prophecy)	...	...	...	...	...	...	1·11	1,040·50	1,898·07	...
	794	(Perseverance)	...	...	...	...	...	...	...	290·50	584·21	...
	817	Prince Charlie	...	...	10·00	9·07	...	...	3·68	1,961·00	3,022·23	...
	924	True Blue	...	...	381·00	2·80	...	...	...	1,538·25	78·24	...
		Voided leases	...	...	...	...	...	13·54	550·72	18,375·85	25,744·37	...
		Sundry claims	...	...	26·50	6·02	...	8·97	307·83	4,769·85	2,909·38	...
Boodalyerri ...	...	Voided leases	...	...	...	...	...	...	292·07	120·25	587·86	...
		Sundry claims	...	...	...	...	...	...	7·16	...	...	...
Lalla Rookh ...	...	Voided leases	...	...	...	...	...	...	4·78	3,612·00	4,696·33	574·01
		Sundry claims	...	...	...	...	...	...	...	7,943·00	7,675·09	...
Marble Bar ...	927, etc. ...	Comet Gold Mines, Limited	...	...	12,967·90	13,125·11	...	...	...	81,253·19	78,910·18	...
	1019	(Alethia)	...	...	...	...	...	...	...	586·75	23·70	...
	930, etc. ...	Prior to transfer to present holders	...	...	...	...	...	...	...	1,609·00	1,211·72	...
	1063	General	...	...	144·75	351·46	...	...	...	144·75	351·46	...
	912	Homeward Bound	...	...	210·75	69·45	...	...	...	4,651·75	2,349·63	...
	(926)	Leviathan	...	2·68	...	...	...	...	10·01	3,733·75	1,236·10	...
	929 (1023), (1024)	Ora Banda South Mines, N.L. ...	...	...	140·25	87·80	...	...	...	1,293·75	594·32	...
	929	(Tassy Queen)	...	...	...	...	...	...	...	2,323·50	1,534·75	...
	1062	Outward Bound East	...	...	51·25	22·03	...	...	...	81·25	37·03	...
	(1058)	Pariah	...	...	...	...	...	...	...	117·50	19·01	...
	1050	Stray Shot	...	...	25·75	38·64	...	...	...	85·25	73·83	...
		Voided leases	...	...	...	...	...	...	189·08	32,084·00	36,594·67	...
		Sundry claims	...	·50	72·25	34·24	...	67·08	251·77	19,178·39	12,110·73	...
North Pole ...	1040	Normay	...	...	...	...	...	...	...	69·00	31·07	...
		Voided leases	...	...	...	...	...	...	...	548·00	400·52	...
		Sundry claims	...	...	...	...	...	...	...	549·75	286·38	...
North Shaw ...	...	Voided leases	...	...	...	...	...	7·53	...	1,072·45	996·29	...
		Sundry claims	...	...	...	...	...	2·84	567·06	179·75	121·72	...
Pilgangoora ...	...	Voided leases	...	...	...	...	...	16·65	...	2,255·00	403·60	...
		Sundry claims	...	...	...	...	...	161·08	8·13	481·60	146·39	...
Sharks	1057	Edelweis	...	...	89·50	36·41	...	...	...	195·50	139·38	...
	868	Mount Ada	...	...	...	...	...	1·43	...	1,447·25	1,589·68	...
		Voided leases	...	...	...	...	...	...	...	78·00	222·02	...
		Sundry claims	...	...	4·50	5·64	...	162·10	41·42	1,066·50	1,583·01	...
Talga	...	Voided leases	...	...	...	...	...	...	93·15	1,799·00	1,760·68	...
		Sundry claims	...	5·44	...	...	...	64·70	85·18	1,967·90	1,498·10	...
Tambourah ...	...	Voided leases	...	...	...	...	...	...	73·90	1,576·50	1,882·29	...
		Sundry claims	...	...	...	...	...	89·52	294·75	3,742·25	2,689·78	...
Warrawoona ...	1046	Klondyke Queen	...	...	159·00	49·40	...	...	...	1,966·00	439·86	...
		Voided leases	...	...	...	...	...	...	16·99	10,708·80	18,253·32	...
		Sundry claims	...	...	75·00	30·42	...	70·98	623·67	6,143·04	4,195·34	...
Western Shaw ...	...	Voided leases	...	...	...	...	...	...	...	1,222·50	957·80	...
		Sundry claims	...	...	...	...	...	22·34	67·47	71·50	81·49	...

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

PILBARA GOLDFIELD—*continued.*

MARBLE BAR DISTRICT—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Wymans Well ...	1002, 1003 ...	Copenhagen Leases	...	...	...	...	...	...	...	785·75	39·29	...
	1002	(Copenhagen)	...	...	...	...	...	...	...	1,046·75	42·87	...
	1013	Trump	...	...	163·50	26·52	...	...	...	1,759·50	314·36	...
		Voided leases	...	...	...	...	...	...	42·86	1,144·79	1,176·28	...
		Sundry claims	...	...	...	...	...	1·14	51·52	2,371·11	1,193·65	...
Yandicoogina ...	...	Voided leases	...	...	...	...	...	...	140·76	3,159·20	6,218·83	...
		Sundry claims	...	...	...	...	...	4·32	239·89	565·75	630·87	...
		From District generally :—										
		Sundry Parcels treated at :										
		Bamboo Creek State Battery	...	...	...	*109·00	...	...	...	40·00	*9,588·84	*181·04
		Marble Bar State Battery	...	...	...	...	...	...	...	12·00	*9,203·82	...
		Ironclad Battery	...	...	...	...	...	...	...	...	*237·71	...
		The Great North-Western Gold Co., Limited ...	...	...	...	...	...	...	...	...	*244·30	...
		Various Works	...	...	...	...	...	...	...	237·95	*1,391·56	...
		Reported by Banks and Gold Dealers	·60	1·00	...	...	...	14,003·12	436·76	...	·90	...
		Totals	**·60**	**9·62**	**14,793·90**	**14,046·24**	...	**14,697·34**	**4,410·08**	**261,075·62**	**275,313·86**	**755·05**

NULLAGINE DISTRICT.

Eastern Creek ...	268L	Doherty's Reward	...	...	15·00	6·89	...	...	...	442·50	389·78	...
	276L	Rose	...	...	6·00	7·99	...	...	...	26·50	32·41	...
	253L	Shamrock	...	...	...	12·69	...	8·96	...	77·50	75·15	...
		Voided leases	...	...	...	...	...	...	8·19	4,696·00	9,069·61	11·77
		Sundry claims	...	...	...	...	...	...	12·74	1,403·60	1,593·97	16·90
Elsie	...	Voided leases	...	...	...	...	...	...	...	586·25	1,675·91	...
		Sundry claims	...	...	...	...	...	...	8·28	58·00	188·08	...
McPhee's Creek ...	...	Voided leases	...	...	...	...	...	...	...	113·00	137·92	...
		Sundry claims	...	...	...	...	...	...	...	134·00	197·09	...
Middle Creek ...	279L	All Nations	...	...	103·00	28·13	...	...	...	275·00	79·16	...
	229L	Barton	...	...	...	...	...	1·22	...	1,343·50	215·96	...
	231L, etc. ...	Blue Spec Leases	...	...	228·00	73·14	...	...	...	3,535·50	1,979·43	...
	247L	Hopetoun North	...	...	...	...	...	...	...	213·00	51·43	...
	267L	Little Wonder	...	...	122·00	22·29	...	...	...	3,226·00	869·72	...
		Voided leases	...	...	...	...	...	...	...	11,683·15	9,896·69	...
		Sundry claims	...	...	87·00	30·35	...	...	...	4,466·60	2,001·74	...

Mosquito Creek ...	...	Voided leases	...	...	...	...	...	1·07	30·12	8,232·30	12,814·22	...
		Sundry claims	...	...	...	...	...	...	168·71	3,601·94	3,740·65	...
Nullagine	270L	Valentine	...	...	...	...	...	...	...	135·00	64·34	...
		Voided leases	...	...	...	...	...	...	32·79	8,646·25	12,306·39	...
		Sundry claims	...	38·52	47·00	26·77	...	313·02	249·48	5,743·05	10,047·18	...
Twenty Mile Sandy	256L	Bill Jim	...	...	209·00	208·31	...	...	...	1,584·00	933·74	...
		Voided leases	...	...	...	...	...	...	3·20	5,221·20	7,971·21	...
		Sundry claims	...	...	19·00	42·06	...	33·10	30·50	7,081·35	5,828·26	...
		From District generally :—										
		Sundry Parcels treated at :										
		Greig's Cyanide Plant	...	...	...	...	...	...	...	...	*121·93	...
		Simpson's Cyanide Plant (Twenty Mile Sandy)	...	...	...	*87·34	...	...	...	...	*1,215·32	...
		Various Works	...	...	...	...	...	...	...	112·50	*6,218·62	...
		Reported by Banks and Gold Dealers	60·71	...	...	...	...	9,230·28	97·45	...	24·77	...
		Totals	**60·71**	**38·52**	**836·00**	**545·96**	...	**9,587·65**	**641·46**	**72,637·69**	**89,740·68**	**28·67**

Ashburton Goldfield.

Belvedere ...	...	Voided leases	...	...	...	...	...	...	9·88	1,560·00	435·86	176·48
	47	Star of the West	...	...	...	...	...	...	...	448·50	293·64	...
Dead Finish ...		Voided leases	...	...	...	...	...	...	...	281·50	279·51	...
		Sundry claims	...	...	...	...	...	...	11·89	78·75	235·31	...
Melrose	...	Voided leases	...	...	...	...	...	...	...	2,704·00	840·26	213·11
		Sundry claims	...	...	...	...	...	12·41	21·88	562·00	262·78	6·40
Mt. Edith ...	...	Sundry claims	...	...	...	...	...	...	...	5·00	3·97	...
Mt. Mortimer ...	...	Sundry claims	...	...	...	...	...	364·63	315·64	44·50	40·25	74·47
Uaroo	...	Voided leases	...	...	...	...	...	...	...	...	...	7,713·22
		From Goldfield generally :—										
		Reported by Banks and Gold Dealers	17·50	...	...	...	...	8,861·44	47·10	...	7·12	...
		Totals	**17·50**	...	...	...	...	**9,238·48**	**406·39**	**5,684·25**	**2,398·70**	**8,183·68**

Gascoyne Goldfield.

Bangemall ...	...	Voided leases	...	...	...	...	...	...	6·22	350·70	313·82	...
		Sundry claims	...	...	...	...	...	88·97	33·55	36·30	203·47	...
		From Goldfield generally :—										
		Reported by Banks and Gold Dealers	...	...	...	...	...	588·55	1·80	...	...	...
		Totals	...	...	...	...	...	**677·52**	**41·57**	**387·00**	**517·29**	...

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

Peak Hill Goldfield.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Egerton	556P	Pegasus	...	84·84	48·00	28·90	...	...	84·84	1,018·00	2,293·03	...
		Voided leases	...	...	...	...	...	60·86	30·91	5,077·25	2,842·45	...
		Sundry claims	...	...	...	...	...	235·35	23·51	1,431·77	765·74	...
Horseshoe ...	(561P)	Nathan Bitter	...	...	...	...	...	...	...	191·00	92·73	...
		Voided leases	...	...	...	...	...	15·57	1,962·66	1,860·88	2,147·36	2·00
		Sundry claims	...	...	...	...	...	20·12	829·58	1,794·55	673·36	...
Jimblebar ...	...	Voided leases	...	...	...	...	...	...	172·75	7,526·25	2,561·95	·58
		Sundry claims	...	...	...	...	...	13·79	65·95	1,048·05	574·16	...
Mt. Fraser ...	...	Voided leases	...	...	...	...	...	...	...	389·50	320·96	...
		Sundry claims	...	...	...	...	...	88·28	40·61	400·75	341·14	...
Mt. Seabrook ...	...	Voided leases	...	...	...	...	...	...	5·05	620·25	428·26	...
		Sundry claims	...	...	...	...	...	...	...	1,038·10	791·51	...
Peak Hill ...	562P	Anti Axis	...	...	78·00	39·43	...	...	...	279·00	144·93	...
	512P	Atlantic	...	...	...	...	...	1·69	2·87	4,128·75	515·53	...
	552P	Bobby Dazzler	...	...	...	...	...	·63	...	505·50	258·87	...
	511P	Commercial	...	...	...	...	...	...	...	2,702·75	470·23	...
	448P	Evening Star	...	...	27·00	16·07	...	...	70·17	6,933·00	4,865·94	...
	553P	Morning Star	...	...	...	...	...	...	4·43	2,474·25	308·83	...
	506P	No. 1 North	...	22·79	24·50	23·23	...	...	45·91	5,739·20	1,293·35	...
	492P	North Star	...	...	...	...	...	23·20	69·63	12,354·50	1,867·56	...
		Voided leases	...	...	...	...	...	6·76	850·04	512,763·83	241,638·21	2,285·63
		Sundry claims	...	...	29·00	46·18	...	61·51	275·61	33,763·85	8,849·51	...
Ravelstone ...	...	Voided leases	...	...	...	...	...	...	101·64	4,219·85	3,117·68	...
		Sundry claims	...	...	...	...	...	...	...	553·60	283·17	...
Wilgeena	...	Voided leases	...	...	...	...	...	...	23·54	128·50	146·79	...
Wilthorpe ...	...	Voided leases	...	...	...	...	...	...	...	47·00	20·93	...
		Sundry claims	...	...	...	...	...	...	...	89·00	25·71	...
Yowereena ...	...	Voided leases	...	...	...	...	...	...	...	19·50	36·46	...
		Sundry claims	...	...	...	...	...	...	...	117·25	203·16	...
	From Goldfield generally :—											
	Sundry Parcels treated at :											
	State Battery, Peak Hill		...	...	...	...	...	...	3·05	15·00	*6,431·91	...
	Australian Machinery and Investment Co. ...		...	...	...	*280·47	...	...	...	...	*1,251·25	...
	Various Works		...	...	...	...	...	...	...	30·00	*5,661·37	23·12
	Reported by Banks and Gold Dealers		12·72	1·15	...	9·46	...	2,846·65	444·36	...	11·43	...
	Totals		**12·72**	**108·78**	**206·50**	**443·74**	...	**3,374·41**	**5,107·11**	**609,260·68**	**291,235·47**	**2,311·33**

East Murchison Goldfield.

LAWLERS DISTRICT.

Kathleen Valley ...	1330	Beth-Heno	...	...	...	...	...	...	...	503·00	216·47	...
		Voided leases	...	...	...	...	...	...	144·85	78,824·00	48,174·48	...
		Sundry claims	...	...	90·00	43·29	...	14·37	526·03	5,133·00	2,120·94	...
Lawlers	1341	Boomer	...	...	318·00	217·87	...	...	...	318·00	217·87	...
	1336	Caroline East	...	...	...	...	...	...	...	117·00	65·95	...
	1236, 1240, etc.	Emu Gold Mines, Ltd.	...	...	18,816·00	4,539·33	...	...	...	250,367·68	61,316·73	452·00
	1236, 1240, 1249	Prior to transfer to present holders	...	...	...	...	...	13·02	...	168·50	1,216·93	...
	1340	Never-can-Tell	...	...	12·50	5·67	...	...	...	12·50	5·67	...
		Voided leases	...	...	...	...	...	...	690·66	1,284,499·72	491,020·56	14,350·93
		Sundry claims	...	...	90·00	44·70	...	399·86	388·51	16,398·48	9,029·40	268·34
Sir Samuel ...	1333	Vanguard	...	...	...	9·29	...	...	...	1,462·00	190·98	...
		Voided leases	...	...	...	...	...	...	359·03	273,477·55	141,386·56	10,227·52
		Sundry claims	...	...	37·50	19·14	...	53·89	64·96	7,050·75	4,383·82	...
	From District generally :—											
	Sundry parcels treated at :											
	State Battery, Sir Samuel		...	...	...	*10·46	...	...	...	53·50	*2,267·46	...
	McPherson's Cyanide Plant		...	...	...	...	...	2·12	...	12·03	*4,265·25	...
	Norwood Vickery & Lewis		...	...	...	...	...	...	...	...	*352·19	·12
	Vanguard Cyanide Plant		...	...	...	...	...	...	...	4·00	*700·47	...
	Westralian Tailings Treatment, Ltd.		...	...	...	...	...	...	...	5·00	*5,643·48	*44·64
	Various Works		...	...	...	...	...	...	2·35	1,699·50	*26,067·02	*936·09
	Reported by Banks and Gold Dealers		·36	...	...	...	...	6,372·79	101·09	·05	9·84	...
	Totals		**·36**	...	**19,364·00**	**4,889·75**	...	**6,856·05**	**2,277·48**	**1,920,106·26**	**798,652·07**	**26,279·64**

WILUNA DISTRICT.

Coles	662J	Black Adder	...	...	...	...	...	...	...	1,108·50	520·33	...
	665J	New Venture	...	...	...	...	...	...	...	49·00	6·30	...
		Voided leases	...	...	...	...	...	...	...	767·25	149·14	...
		Sundry claims	...	...	23·50	7·61	...	...	12·77	3,806·50	1,477·44	...
Corboy's	(670J)	Black Jack	...	...	239·00	107·01	...	...	...	498·00	205·95	...
	435J	Old Toscana	...	...	101·00	27·44	...	5·24	...	860·00	598·76	...
	669J	Vinaurum	...	...	170·00	94·15	...	...	...	312·00	259·60	...
	433J	Waratah leases	...	...	...	...	...	...	...	1,226·04	627·83	...
	(433J, 434J) ...	(Waratah Gold Mines, Limited, N.L.)...	...	...	...	...	...	...	...	359·00	587·92	...
		Voided leases	...	...	...	...	...	...	1·25	10,095·25	7,197·64	5·00
		Sundry claims	...	...	341·50	142·40	...	21·58	...	7,261·85	4,389·08	...
Gum Creek ...	...	Voided leases	...	...	...	...	...	20·75	...	1,380·00	595·73	...
		Sundry claims	...	...	...	...	...	...	1·36	379·25	120·89	...
Mt. Eureka ...	...	Voided leases	...	...	...	...	...	...	...	142·25	96·36	...
		Sundry claims	...	...	...	...	...	...	...	783·75	548·56	...
Mt. Keith ...	...	Voided leases	...	...	...	...	...	...	44·54	20,259·50	13,551·08	...
		Sundry claims	...	...	7·50	7·69	...	4·81	227·29	3,862·50	2,480·03	...
New England ...	...	Voided leases	...	...	...	...	...	5·74	95·70	5,336·25	3,471·17	...
		Sundry claims	3·48	...	66·00	154·28	...	9·31	5·78	4,462·75	2,957·87	...

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued

EAST MURCHISON GOLDFIELD—*continued.*

WILUNA DISTRICT—*continued.*

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1944.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Wiluna	631J	Brilliant Reduced	...	...	...	...	...	...	...	1,756·75	243·35	...
	552J	Coolgardie Brilliant, N.L.	...	...	...	*307·30	...	...	...	21,267·00	7,146·06	...
	552J	Prior to transfer to present holders	...	...	...	...	...	...	...	7,257·00	2,202·75	12·40
	607J	Coolgardie Brilliant, N.L.	...		...	...	...	...	...	1,140·00	1,152·53	...
	607J (663J) ...	Linden (W.A.) Gold, N.L.	...	...	...	...	...	...	...	21,619·00	6,024·02	...
	607J	Prior to transfer to present holders	...	...	...	...	...	...	...	1,156·75	655·83	...
	10J, 37J, etc. ...	Moonlight Wiluna Gold Mines, Ltd. ...	...	...	75,375·00	12,019·00	...	...	...	829,034·83	197,799·40	1,213·00
	10J, 37J, etc. ...	Prior to transfer to present holders	...	...	...	...	...	...	...	36,975·50	14,174·75	...
	6J, etc. ...	Wiluna Gold Mines, Limited	...	...	392,246·00	39,028·27	...	...	...	6,857,778·00	1,247,250·48	1,213·99
		Prior to transfer to present holders	...	...	...	...	...	...	...	341,730·57	133,457·92	89·32
		Voided leases	...	...	...	...	...	...	574·76	140,807·75	79,753·12	124·00
		Sundry claims	...	3·29	191·00	73·68	...	105·39	219·08	24,129·55	9,999·23	·33
	From District generally :—											
	Sundry parcels treated at :											
	State Battery, Wiluna		...	...	...	*9·32	...	...	...	592·00	*22,158·18	*218·70
	Black Adder Battery		...	...	...	...	...	...	...	...	*85·93	...
	Toscana Cyanide Plant		...	...	...	...	...	...	...	...	*2,445·85	...
	Waratah Cyanide Plant		...	...	...	...	...	...	...	...	*527·22	...
	Various Works		...	...	...	...	...	...	...	...	*1,237·68	*12·68
	Reported by Banks and Gold Dealers		·27	...	...	...	...	49·54	56·58	...	51·48	...
	Totals		**3·75**	**3·29**	**468,760·50**	**51,978·15**	...	**222·36**	**1,239·11**	**8,348,194·34**	**1,766,207·46**	**2,889·42**

BLACK RANGE DISTRICT.

Barrambie ...	972B, 976B ...	Sheelite leases	...	...	79·00	86·69	...	...	...	616·50	698·11	...
	972B	(Sheelite)	...	...	...	...	...	...	...	105·50	108·88	...
	976B	(Sheelite North)	...	...	...	...	...	...	...	92·75	92·83	...
		Voided leases	...	...	...	...	...	...	22·49	17,359·42	16,200·76	125·60
		Sundry claims	...	...	...	...	...	5·07	168·10	833·55	915·51	...
Bellchambers ...	...	Voided leases	...	...	...	...	...	...	111·80	3,437·27	1,758·90	...
		Sundry claims	...	...	...	...	...	...	...	619·80	386·08	...
Birrigrin	...	Voided leases	...	...	...	...	...	...	820·68	12,042·93	15,086·09	...
		Sundry claims	...	...	...	...	...	...	179·92	2,487·55	1,238·22	...
Curran's Find ...	...	Voided leases	...	...	...	...	...	18·24	222·89	7,252·25	3,116·68	...
		Sundry claims	...	...	...	...	...	...	29·38	2,158·75	827·18	...

Erroll's	...	Voided leases	...	...	...	...	...	14·17	152·29	14,170·50	9,328·92	...
		Sundry claims	...	...	...	...	...	6·53	399·11	964·75	595·45	...
Hancock's ...	1074B	Apples	...	12·71	42·75	63·60	...	...	443·79	599·75	651·16	...
	1050B	Duke of Windsor	...	...	...	...	...	...	·78	649·25	334·39	...
		Voided leases	...	...	...	...	...	...	6,523·59	31,975·25	33,098·94	55·72
		Sundry claims	...	...	33·50	6·46	...	4·21	142·89	8,288·60	3,149·81	...
Maninga Marley ...	...	Voided leases	...	...	...	...	...	...	195·20	60,833·48	48,494·40	22·55
		Sundry claims	...	...	...	...	...	...	158·16	3,071·40	1,764·28	...
Montague ...	967B, 998B ...	North End Leases	...	...	...	...	...	...	...	35,372·95	4,871·16	...
		Voided leases	...	...	...	...	...	...	100·17	39,672·65	16,888·02	...
		Sundry claims	...	...	...	...	...	...	71·09	5,018·60	3,147·93	...
Nungarra	...	Voided leases	...	...	...	...	...	25·94	952·34	10,395·75	5,015·04	...
		Sundry claims	...	...	...	...	...	50·27	1,458·06	7,494·15	2,930·91	...
Sandstone ...	959B, etc. ...	Atlas Gold Mines, Limited	...	...	...	...	...	...	...	959·00	168·60	...
		Prior to transfer to present holders	...	...	...	...	...	...	136·06	537·75	686·59	...
	1076B	Black Range Gold Mines, Limited ...	...	...	...	...	...	...	...	84·00	14·34	...
	1075B	Doolette South	...	...	368·75	512·44	...	...	217·54	767·00	967·93	...
	958B	Lady Mary	...	...	171·75	155·91	...	...	...	5,581·50	4,978·87	2·28
	1069B	Sonny Boy	...	223·86	195·75	474·10	...	...	394·38	326·00	532·88	...
		Voided leases	...	...	...	...	...	4·75	3,615·71	692,204·07	443,769·55	11,754·22
		Sundry claims	...	...	22·25	7·77	...	44·95	1,421·07	14,691·70	6,627·09	...
Youanme	1046B	Canberra	...	...	...	...	...	...	...	1,501·00	443·13	...
	960B, etc. ...	Youanmi Gold Mines, Limited ...	...	...	...	...	...	...	...	370,977·77	96,279·42	5,865·55
	960B, etc. ...	(Youanmi)	...	...	...	...	...	...	...	38·50	3·91	...
		Voided leases	...	...	...	...	...	·36	126·92	358,978·78	176,882·54	4,608·55
		Sundry claims	...	...	...	...	...	1·07	18·79	6,258·55	1,814·66	...
	From District generally :—											
	Sundry Parcels treated at :											
	State Battery, Sandstone	...	...	...	*323·97	...	...	...	...	266·00	*22,319·25	*59·53
	State Battery, Youanmi	...	...	...	...	...	...	...	...	40·00	*5,461·83	...
	North End Cyanide Plant	...	...	...	...	...	...	...	...	...	*4,911·99	...
	Various Works	...	...	...	...	...	...	...	...	37·00	*6,505·69	...
	Reported by Banks and Gold Dealers	...	...	...	...	...	...	1,441·81	50·84	...	20·38	
	Totals	...	**236·57**	**913·75**	**1,630·94**	...	**1,617·37**	**18,134·04**	**1,718,761·97**	**943,088·30**	**22,494·00**

Murchison Goldfield.

CUE DISTRICT.

Big Bell	2050, etc. ...	Big Bell Mines, Limited	...	...	...	...	...	...	...	2,226,219·00	290,615·52	99,156·65
	2050	(Little Bell)	...	...	...	...	...	...	4·49	579·75	60·95	...
	2219	Pindar	...	...	...	...	...	...	...	65·00	79·35	...
		Voided leases	...	...	...	...	...	...	...	274·75	278·83	...
		Sundry claims	...	...	21·00	30·44	...	·39	6·32	359·50	339·41	...
Cuddingwarra ...	...	Voided leases	...	...	...	...	...	10·59	132·46	102,020·41	56,131·93	100·71
		Sundry claims	6·31	...	25·25	24·13	...	18·46	354·57	8,084·64	4,738·25	9·00

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

MURCHISON GOLDFIELD—*continued.*

CUE DISTRICT.—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Cue	2236	Hill View	95·96	55·90	249·50	264·92	2·48	95·96	55·90	571·00	826·70	2·48
		Voided leases	...	...	...	...	...	106·75	580·59	287,720·44	220,011·47	66·63
		Sundry claims	7·01	3·60	151·00	56·70	...	243·45	894·70	41,164·99	18,839·95	...
Eelya	...	Voided leases	...	...	...	...	...	...	8·78	1,069·00	1,811·26	...
		Sundry claims	...	...	...	...	...	6·20	101·86	842·90	739·93	...
Mindoolah ...	...	Voided leases	...	...	...	...	...	3·07	2·54	9,380·28	5,672·31	42·97
		Sundry claims	...	...	38·25	11·29	...	...	29·30	3,002·10	2,180·55	...
Reedy	1977, etc. ...	Triton Gold Mines, N.L.	...	...	...	...	...	...	...	604,070·00	191,041·46	17,791·92
		Prior to transfer to present holders	...	...	...	...	...	...	...	14,492·50	7,073·36	5·00
	2071, 2191 ...	Western Gold Mines, N.L.	...	...	...	...	...	...	...	1,846·00	398·14	...
		Voided leases	...	...	...	...	...	1·46	214·65	6,552·93	10,128·90	1·22
		Sundry claims	...	...	...	...	...	170·71	120·73	4,940·05	2,252·12	...
Tuckabianna ...	2130	Garibaldi	...	...	...	...	...	...	45·22	298·88	544·36	...
	2237	Gidgie	...	...	1,208·75	269·38	...	...	...	1,687·00	596·64	...
	2234	Winston	326·39	44·60	30·25	3·58	...	649·70	75·91	110·75	190·56	...
	(2235)	Uranus	...	...	57·25	13·49	...	...	...	360·75	147·28	...
		Voided leases	...	...	...	...	...	...	176·55	12,119·35	6,426·36	...
		Sundry claims	45·47	...	46·25	10·76	...	137·34	480·56	4,100·85	2,449·32	...
Tuckanarra ...	2079	Batchelor	3·06	...	...	...	...	70·72	75·39	450·25	381·43	...
	2238	Last Chance	...	...	...	...	...	...	85·94	10·25	18·44	...
		Voided leases	...	...	...	...	...	14·65	3,349·77	19,023·75	22,418·32	172·77
		Sundry claims	...	12·22	...	...	...	115·23	769·93	9,829·55	10,189·33	...
Weld Range ...	2183	Joy Long	...	...	108·75	26·35	...	...	...	1,010·25	334·63	...
		Voided leases	...	...	...	...	...	...	23·64	545·75	486·41	...
		Sundry claims	...	...	55·25	15·59	...	...	3·90	1,203·75	766·13	...
	From District generally :—											
	Sundry Parcels treated at :											
	State Battery, Cue		...	...	40·75	*342·65	...	...	...	53·50	*19,852·95	*91·93
	State Battery, Tuckanarra		...	...	...	*22·04	...	...	...	518·50	*5,523·88	...
	Various Works		...	...	...	...	...	...	...	7,158·52	29,387·81	1,147·77
	Reported by Banks and Gold Dealers		29·56	1·56	...	...	...	3,287·24	93·99	...	22·62	...
	Totals		**513·76**	**117·88**	**2,032·25**	**1,091·32**	**2·48**	**4,931·92**	**7,687·69**	**3,371,736·89**	**912,956·86**	**118,589·05**

Abbott's	...	Voided leases	...	...	...	...	...	...	26·45	36,841·35	38,775·28	...	
		Sundry claims	...	...	...	...	...	...	5·29	3,661·27	2,237·83	...	
Barnakura ...	1849N	New Alliance	...	...	...	...	...	...	...	132·25	114·39	...	
		Voided leases	...	...	...	...	...	...	3,247·59	39,040·45	30,775·77	26·90	
		Sundry claims	...	...	...	...	...	17·03	129·24	1,992·55	1,071·97	1·54	
Chesterfield ...	...	Voided leases	...	...	...	...	...	29·02	420·32	6,869·26	7,483·76	·80	
		Sundry claims	...	...	...	...	...	...	42·19	888·55	714·20	...	
Gabanintha ...	1854N	Golden Star	...	...	...	...	...	...	...	203·25	251·06	...	
	(1844N) ...	Mab	...	...	64·00	26·13	...	...	...	852·50	223·52	...	
	1725N	New Brew	...	...	164·00	228·86	...	...	...	1,201·10	1,512·05	...	
		Voided leases	...	...	...	...	...	11·79	28·82	22,974·25	13,816·35	815·57	
		Sundry claims	...	...	...	...	...	16·78	147·72	3,497·00	2,200·74	...	
Garden Gully ...	...	Voided leases	...	...	...	...	...	26·36	74·91	30,238·32	21,847·71	1,102·59	
		Sundry claims	...	...	...	...	...	...	7·51	2,843·69	1,677·23	...	
Gum Creek ...	...	Voided leases	...	...	...	...	...	25·27	91·96	3,893·08	3,819·91	...	
		Sundry claims	...	...	...	...	...	4·37	84·86	727·25	636·85	...	
Holden's	1551N	New Waterloo	...	...	...	...	...	...	·99	1,468·00	918·92	...	
		Voided leases	...	...	...	...	...	...	18·00	16,593·00	6,401·50	...	
		Sundry claims	...	...	...	...	...	164·95	49·07	425·15	279·25	...	
Jillawarra ...	1871N	Werribee	...	...	...	...	...	...	128·85	298·25	598·46	...	
		Voided leases	...	...	...	...	...	...	1,134·68	1,499·55	2,801·53	...	
		Sundry claims	...	...	...	...	...	173·02	150·04	366·50	346·48	...	
Meeka Pools ...	...	Voided leases	...	...	...	...	...	...	...	111·58	82·27	...	
		Sundry claims	...	...	...	...	...	...	2·84	233·57	205·38	...	
Meekatharra ...	1861N	Adele May	...	...	...	...	...	...	...	9·00	4·37	...	
	1883N	Coffee Pot	...	...	...	...	...	...	...	99·00	45·92	...	
	1855N	Commodore	...	...	...	...	...	...	...	575·75	181·96	...	
	1553N	Consols North	...	...	...	...	...	...	...	581·00	1,241·10	...	
	477N	Fenian	...	...	338·75	226·37	...	...	...	24,234·50	23,599·47	...	
	477N, 814N ...	(Fenian leases)	...	...	...	...	...	...	...	313,485·94	254,989·70	...	
	1884N	Fortune Teller	...	...	...	...	...	...	7·09	794·00	102·63	...	
	1893N	Halcyon	...	·78	...	...	...	...	·78	...	...	...	
	1559N	Ingleston	...	...	...	...	...	...	476·76	1,705·05	1,519·62	...	
	1542N	Ingleston Alberts	...	...	...	...	...	...	...	279·50	416·89	...	
	1542N (1566N, 1575N)	Ingliston Albert's leases	...	...	...	...	...	...	...	2,983·70	1,283·06	...	
	475N, etc. ...	Ingliston Consols Extended leases	...	...	39·00	35·21	...	...	...	873,655·47	356,930·42	...	
	475N	Prior to transfer to present holders	...	...	...	...	...	...	...	1,536·25	4,248·25	·30	
	1539N ...	Ingliston South Gold Development, N.L.	...	...	19·25	40·43	...	...	...	1,237·00	1,990·39	...	
		Prior to transfer to present holders	...	...	...	...	...	...	...	16,274·61	12,815·17	...	
	1547N ...	Lady Central	...	...	...	...	...	...	...	32·75	26·05	...	
	1889N	Lady Mary	...	...	23·00	35·86	...	...	...	23·00	35·86	...	
	533N	Marmont	...	...	139·75	260·54	...	...	89·33	60,259·70	43,059·08	...	
	580N	Marmont Extended	...	...	...	...	...	...	...	1,667·95	1,562·40	...	
	580N (888N) ...	Marmont Extended leases ...	...	...	...	...	...	...	...	152·00	129·61	...	
	1547N (1576N)	Meekatharra Central Gold, N.L. ...	...	...	...	...	...	...	5·29	4,842·25	2,463·30	...	
		Prior to transfer to present holders	...	...	...	...	...	...	11·06	2,951·42	5,198·33	...	
	1577N	Mopoke	...	...	23·00	31·57	...	...	12·47	1,338·25	820·16	...	
	1860N	New Gwalia	...	...	...	...	...	...	...	421·75	56·44	...	

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

MURCHISON GOLDFIELD—*continued.*

MEEKATHARRA DISTRICT—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Meekatharra—*continued*	1571N	Pharlap	...	...	697·00	340·77	...	...	...	6,212·25	4,061·68	...
	1529N, etc. ...	Prohibition Gold Mining Co., N.L. ...	...	...	...	...	...	...	...	24,844·25	4,533·85	11·83
	1529N	Prior to transfer to present holders	...	...	...	...	...	...	...	29,422·00	4,971·30	...
		Voided leases	...	...	...	...	...	3·88	1,316·68	375,358·37	203,085·23	2,454·74
		Sundry claims	...	...	385·25	83·83	...	229·71	574·17	22,372·95	8,961·22	...
Mistletoe	...	Voided leases	...	...	...	...	...	4·15	1,000·24	417·00	486·21	...
		Sundry claims	...	...	...	...	...	119·14	71·85	19·75	2·03	...
Mt. Maitland ...	...	Voided leases	...	...	...	...	...	...	...	88·00	80·11	...
		Sundry claims	...	...	...	...	...	...	...	420·75	240·86	...
Munara Gully ...	...	Voided leases	...	...	...	...	...	...	...	13,283·50	6,559·93	...
		Sundry claims	...	...	...	...	...	...	34·23	1,009·75	373·74	...
Nannine	1872N	Blue Pedro	...	...	...	...	...	...	...	7,003·75	1,650·12	...
	1580N	Caledonian	...	...	...	...	...	...	...	1,025·10	492·72	...
	1879N	Called Back	...	...	...	...	...	...	29·96	4·25	34·36	...
		Voided leases	...	...	...	...	...	37·25	796·62	113,287·32	72,331·89	167·45
		Sundry claims	...	...	...	...	...	116·99	1,248·76	6,007·68	4,647·29	...
Quinn's	...	Voided leases	...	...	...	...	...	7·30	1,186·50	33,356·91	13,464·37	90·70
		Sundry claims	...	...	...	...	...	15·07	1,289·65	3,829·17	2,716·66	...
Ruby Well ...	...	Voided leases	...	...	...	...	...	...	43·46	7,461·00	4,046·70	...
		Sundry claims	...	...	...	...	...	1,015·87	409·39	520·25	629·60	...
Stake Well ...	...	Voided leases	...	...	...	...	...	...	200·12	21,362·00	9,566·18	...
		Sundry claims	...	...	...	...	...	31·91	34·73	1,003·60	584·54	...
Star of the East	...	Voided leases	...	...	...	...	...	...	...	27,244·00	20,305·40	...
		Sundry claims	...	...	...	...	...	...	...	127·62	94·97	...
Yaloginda ...	1853N	Blue Bird	...	...	...	...	...	...	...	4,002·00	1,219·21	...
		Voided leases	...	...	...	...	...	19·03	1,972·23	28,067·04	14,541·80	8·68
		Sundry claims	...	...	64·50	57·43	...	61·89	647·51	9,858·92	4,500·48	...
	From District generally :—											
	Sundry Parcels treated at :											
	State Battery, Meekatharra		...	...	...	*769·03	...	...	...	68·50	*23,073·36	*19·00
	Various Works		...	...	...	...	...	...	...	172·75	*6,729·60	*342·17
	Reported by Banks and Gold Dealers		41·31	...	...	1·20	...	12,097·25	176·36	13·50	22·00	...
	Totals		**41·31**	**·78**	**1,957·50**	**2,137·23**	...	**14,228·03**	**17,426·57**	**2,223,855·49**	**1,265,520·00**	**5,042·27**

DAY DAWN DISTRICT.

Day Dawn ...	652D	Creme D'Or	...	...	35·25	15·57	...	...	...	193·00	125·83	...
	573D	Mountain View	...	...	1,481·50	2,723·20	...	...	94·05	5,220·53	7,200·08	...
	576D	New Fingall	...	...	...	...	...	6·12	6·84	2,961·50	1,058·07	...
		Voided leases	...	...	...	...	...	160·64	806·09	1,921,658·86	1,225,373·29	169,210·44
		Sundry claims	...	...	13·50	17·52	...	96·42	410·31	12,291·26	6,109·57	...
Lake Austin ...	656D	Eureka	...	...	41·25	16·20	...	11·08	12·31	264·25	124·57	...
		Voided leases	...	...	...	...	...	601·92	3,067·31	36,607·95	50,925·92	...
		Sundry claims	...	...	18·25	38·61	...	59·07	915·27	3,103·69	1,228·23	...
Mainland	...	Voided leases	...	...	...	...	...	·41	3,296·77	7,575·62	25,026·07	...
		Sundry claims	...	...	...	...	...	16·57	746·58	1,337·95	701·31	...
Pinnacles	...	Voided leases	...	...	...	...	...	4·90	1,213·68	18,117·00	9,869·29	...
		Sundry claims	...	...	20·25	3·99	...	62·93	446·50	4,203·92	1,607·19	...
	From District generally :—											
	Sundry Parcels treated at :											
		G. Santucci's Plant	...	...	22·00	17·93	...	...	...	22·00	17·93	...
		Various Works	...	...	...	...	...	...	16·16	940·75	1,967·72	...
		Reported by Banks and Gold Dealers	...	...	...	...	...	1,969·02	33·97	...	·77	...
		Totals	...	...	**1,632·00**	**2,833·02**	...	**2,989·08**	**11,066·29**	**2,014,498·28**	**1,331,335·84**	**169,210·44**

MOUNT MAGNET DISTRICT.

Jumbulyer ...	1410M	Gold Bug	...	...	...	...	...	...	...	67·75	119·79	...
	1406M	Granites	...	...	...	...	...	...	...	12·25	26·45	...
		Voided leases	...	...	...	...	...	...	13·37	660·35	328·81	...
		Sundry claims	...	...	8·00	6·81	...	18·45	116·27	1,043·45	767·37	...
Lennonville ...	1405M	Banker	...	...	24·25	22·55	...	...	7·85	205·25	197·16	...
	1308M	Empress	...	...	20·00	9·64	...	...	...	405·00	153·59	...
	1379M	Galtee Moore	...	...	506·00	182·33	...	...	...	5,294·00	1,398·43	...
	1378M	Gambier Lass	...	...	...	...	...	...	5·85	419·00	101·26	...
	(1374M) ...	Souvenir	...	...	16·00	33·15	...	...	2·90	213·50	552·11	...
		Voided leases	...	...	...	...	...	...	3,209·58	143,676·55	125,312·10	458·82
		Sundry claims	...	...	30·00	38·05	...	19·14	108·82	13,562·77	5,164·63	...
Mt. Magnet ...	1382M	Corona	...	...	...	...	...	...	...	3,472·65	2,722·09	...
	1255M	Edward Carson Leases	...	...	912·00	428·31	...	...	...	17,740·50	12,596·76	7·00
	1286M	Evening Star	...	...	236·25	58·81	...	...	36·37	2,716·32	1,166·78	...
	1287M	Havelock	...	...	5·00	2·20	...	...	11·05	4,318·75	837·12	...
	1424M	Havilah	...	...	...	...	...	...	...	9·25	9·23	...
	1282M, etc. ...	Hill 50 Gold Mine, N.L.	...	...	32,082·00	9,570·55	177·01	...	...	241,943·90	73,087·84	341·45
	1361M	Jupiter	...	...	...	...	...	...	·83	307·00	102·98	...
	1411M	Leap Year	...	...	126·00	102·74	...	...	...	527·25	408·09	...
	1416M	Myra Lydia	...	...	...	...	...	...	...	45·25	2·83	...
	1246M	Neptune	...	...	...	...	...	...	829·41	8,787·65	4,094·37	...
	1281M, etc. ...	Saturn Leases	...	...	...	...	...	...	101·24	37,413·00	5,741·32	...
	(1427M) ...	South End	...	...	9·75	26·89	...	...	...	9·75	26·89	...
	1251M, etc. ...	Swan Bitter G.M. Co., N.L.	...	...	117·75	473·10	...	...	15·25	13,759·25	5,206·94	...
	1251M	Prior to transfer to present holders	...	...	...	...	...	...	320·12	6,081·25	3,180·61	
	1322M	Three Boys	...	...	...	...	...	...	229·73	480·28	664·00	...
	(1388M) ...	Top-not	...	...	17·25	21·10	...	...	...	362·00	272·88	...

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

MURCHISON GOLDFIELD—*continued.*

MOUNT MAGNET DISTRICT—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Mt. Magnet—*continued*	1426M	Zenith	...	...	9·50	8·79	...	...	...	41·00	40·30	...
		Voided leases	...	...	...	...	...	29·26	9,098·14	766,124·26	292,291·38	851·37
		Sundry claims	1·58	4·00	739·75	335·17	4·49	122·21	2,543·52	55,793·85	27,826·06	4·49
Mt. Magnet East	...	Voided leases	...	...	...	...	...	63·29	764 53	5,522·28	2,811·75	...
		Sundry claims	...	...	...	...	...	...	37·22	418·25	428·29	...
Moyagee	1355M (1398M)	Moyagee Leases	...	...	...	37·77	...	...	...	4,641·00	5,053·55	326·80
	1355M	Moyagee	...	...	...	...	...	...	...	2,547·50	4,198·30	347·04
		Voided leases	...	...	...	...	...	...	23·59	5,107·60	7,575·88	...
		Sundry claims	...	11·89	...	...	...	2·83	168·99	1,484·00	1,677·51	...
Paynesville ...	...	Voided leases	...	...	...	...	...	...	1,613·34	449·77	1,116·15	...
		Sundry claims	...	...	...	...	...	3·36	540·21	882·57	1,372·00	...
Winjangoo ...	...	Voided leases	...	...	...	...	...	·99	191·88	72·00	69·98	...
		Sundry claims	...	...	...	...	...	...	223·32	162·78	55·50	...
		From District generally :—										
		Sundry Parcels treated at :										
		State Battery, Boogardie	...	...	...	*132·57	...	...	...	125·26	*32,953·98	...
		Welcome Cyanide Works	...	...	...	...	...	...	...	10·00	*941·39	...
		Various Works	...	...	...	...	...	...	...	43·06	*17,428·06	1·00
		Reported by Banks and Gold Dealers	12·28	·61	8·00	11·06	...	2,206·04	80·53	8·00	64·95	...
		Totals	**13·86**	**16·50**	**34,867·50**	**11,501·59**	...	**2,465·57**	**20,293·91**	**1,346,967·10**	**640,147·46**	**2,337·97**

Yalgoo Goldfield.

Bilberatha ...	1139	Blaney's Gold Mine	...	...	92·00	28·31	...	1·27	90·94	1,980·00	1,293·32	...
		Voided leases	...	...	...	...	...	...	...	1,263·00	491·84	...
		Sundry claims	...	...	...	...	...	...	6·64	3,075·05	1,401·56	...
Carlaminda ...	...	Voided leases	...	...	...	...	...	1·28	3·39	2,056·57	862·42	3·30
		Sundry claims	...	...	...	...	...	...	...	1,368·50	600·68	...
Field's Find ...	907	Brown's Reward	...	...	...	...	...	...	...	300·00	75·91	...
	907, etc. ...	Brown's Reward Leases	...	...	...	...	...	...	...	4,540·55	3,800·16	...
	(1114) 1119 ...	Field's Find Central West ...	...	...	...	...	...	...	...	4,625·00	1,074·53	56·69
	(1192)	Rose Marie	...	...	35·61	43·82	...	...	...	488·11	638·29	...
		Voided leases	...	...	...	...	...	...	226·72	40,147·30	28,032·74	...
		Sundry claims	...	...	...	...	...	5·77	179·54	5,415·25	1,759·04	...

Goodingnow ...	1063	Ark	...	...	34·00	3·53	...	...	1·23	841·50	379·57	...
	1102	Astor	...	...	68·00	25·09	...	...	...	5,442·75	2,925·64	...
	1198	Aster South	...	...	97·50	17·48	...	...	...	498·50	114·17	...
	1025	Carnation	...	...	397·50	177·14	...	...	...	16,146·55	11,765·96	...
	1175	Marigold	...	...	339·50	92·64	...	...	...	3,379·75	1,361·63	...
	1206	Orchid	...	...	157·50	33·74	...	...	...	157·50	33·74	...
	1145	Oversight	...	...	280·00	72·57	...	...	...	1,052·85	316·50	...
	1085	Sweet William	...	...	...	...	...	...	2·97	792·00	249·45	...
		Voided leases	...	...	...	...	...	146·70	273·40	45,490·31	44,910·49	...
		Sundry claims	...	...	25·50	5·30	...	152·96	169·70	9,863·25	5,048·30	...
Gullewa	1189, etc. ...	King Solomon's Mines, Limited ...	...	...	...	2·48	...	...	...	5,445·10	2,237·14	32·28
	1047	Mugga King	...	...	222·00	172·84	11·58	...	7·76	8,649·50	2,795·10	81·38
		Voided leases	...	...	...	...	...	...	11·29	25,536·00	15,882·93	·04
		Sundry claims	...	...	...	...	...	...	170·45	4,391·25	1,918·24	...
Kirkalucka ...	...	Voided leases	...	...	...	...	...	...	...	61·25	45·10	...
		Sundry claims	...	...	...	...	...	...	17·79	257·30	126·29	...
Messenger's Patch	1197	Gnow's Nest	...	...	...	45·24	...	...	...	6·00	171·36	...
		Voided leases	...	...	...	...	...	...	349·71	39,721·51	28,314·92	1,083·01
		Sundry claims	...	...	...	...	...	463·12	333·98	1,585·35	583·39	...
Mt. Farmer ...	...	Voided leases	...	...	...	...	...	...	...	64·00	40·19	...
		Sundry claims	...	...	...	...	...	...	...	462·90	145·06	...
Mt. Gibson ...	...	Voided leases	...	...	...	...	...	...	6·44	526·50	888·70	...
		Sundry claims	...	...	...	...	...	1·03	44·72	973·10	409·48	1·00
Ningham	...	Voided leases	...	...	...	...	...	...	...	10·00	1·41	...
		Sundry claims	...	...	...	...	...	...	...	324·75	123·28	...
Noongal	1137	City of Melbourne	...	...	...	...	...	...	...	2,046·50	860·05	...
	1201	Hard to Find	...	...	...	...	...	...	...	74·00	107·77	...
	1203	Revival	...	...	...	*46·97	*2·97	...	...	...	*46·97	*2·97
		Voided leases	...	...	...	...	...	7·88	31·96	9,023·25	4,666·85	...
		Sundry claims	...	...	...	...	...	36·16	310·31	8,497·30	3,556·78	...
Nyounda	...	Voided leases	...	...	...	...	...	...	217·63	416·00	183·91	...
		Sundry claims	...	...	...	...	...	...	26·59	701·00	177·19	...
Pinyalling ...	...	Voided leases	...	...	...	...	...	...	93·80	2,296·35	959·50	...
		Sundry claims	...	...	...	...	...	3·13	134·09	1,405·50	621·23	...
Retaliation ...	1046	Alma May	...	...	...	...	...	...	...	1,623·75	684·72	...
		Voided leases	...	...	...	...	...	...	...	3,220·00	1,110·85	...
		Sundry claims	...	...	...	...	...	...	...	778·25	304·71	...
Rothsay	...	Voided leases	...	...	...	...	...	...	...	40,490·75	10,729·58	...
		Sundry claims	...	...	...	...	...	...	·73	6,469·50	2,562·03	...
Wadgingarra ...	...	Voided leases	...	...	...	...	...	...	...	691·11	650·63	...
		Sundry claims	...	...	...	...	...	...	...	2,131·30	559·83	...
Warda Warra ...	...	Voided leases	...	...	...	...	...	...	...	10,760·50	5,862·04	...
		Sundry claims	...	...	...	...	...	...	...	933·75	369·87	...
Warriedar ...	...	Voided leases	...	...	...	...	...	...	...	13,661·50	4,607·88	7·30
		Sundry claims	...	...	...	...	...	...	2·84	8,782·85	1,892·46	...

TABLE I.—*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 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Yalgoo	...	Voided leases	...	...	...	...	...	...	3·23	6,314·50	9,965·18	...
		Sundry claims	...	...	...	...	...	...	23·56	2,615·25	998·46	...
Yuin	...	Voided leases	...	...	...	...	...	...	127·12	68,139·50	27,908·57	130·13
		Sundry claims	...	...	...	...	...	...	4·70	335·50	67·53	...
		From Goldfield generally :—										
		Sundry Parcels treated at :										
		State Battery, Payne's Find	...	...	...	*107·01	...	...	...	38·50	*4,529·92	...
		State Battery, Warriedar	...	...	...	...	...	...	...	...	*6,503·21	...
		State Battery, Yalgoo	...	...	...	...	...	...	...	...	*1,193·63	...
		P. W. Nevill's Rothsay Cyanide Plant ...	...	...	...	*47·45	*72·23	...	...	...	*47·45	*72·23
		Various Works	...	...	...	...	...	9·42	...	664·00	2,958·99	26·67
		Reported by Banks and Gold Dealers	4·68	...	...	...	...	912·22	49·86	...	34·44	...
		Totals	**4·68**	**...**	**1,749·11**	**921·61**	**86·78**	**1,740·94**	**2,923·09**	**429,049·21**	**255,540·76**	**1,497·00**

Mt. Margaret Goldfield.

MOUNT MORGANS DISTRICT.

Australia United...	...	Voided leases	...	...	...	...	...	...	1,911·63	15,913·69	23,305·76	1·76
		Sundry claims	...	...	...	...	...	...	580·98	1,307·50	2,227·65	...
Eucalyptus ...	...	Voided leases	...	...	...	...	...	...	2,878·56	1,603·85	3,251·01	...
		Sundry claims	...	...	5·00	44·54	...	...	588·28	1,976·30	1,909·04	...
Linden	522F	Ailsa	...	...	90·00	30·40	...	...	...	894·50	323·11	...
	528F	Blue Peter	...	...	...	...	...	...	...	141·00	37·04	...
	508F	Coronation	...	...	...	...	...	...	...	306·75	2,320·32	...
	539F	Democrat	...	...	271·00	138·33	...	...	...	979·50	715·22	...
	(517F)	Dunn's Reward	...	...	...	1·31	...	...	10·97	101·50	171·10	...
	(544F)	Happy Days	...	...	...	...	...	...	...	110·00	189·71	...
	494F	Local Lady	...	...	...	...	...	...	1·65	1,370·50	1,240·27	...
	521F	North Democrat	...	...	365·00	687·77	...	...	...	1,799·75	3,897·04	...
	(545F)	Red Star	...	...	72·50	171·40	...	...	...	72·50	171·40	...
	529F	Second Fortune	...	...	...	...	...	...	...	427·50	233·46	...
		Voided leases	...	...	...	...	...	7·53	553·16	57,103·06	42,766·38	·68
		Sundry claims	...	1·45	357·00	156·22	...	132·11	234·81	18,049·60	13,128·37	...
Mt. Margaret ...	M.A. 12F ...	Mt. Margaret Mission Station	...	...	...	1·67	...	113·08	18·87	403·00	133·14	·09
		Voided leases	...	...	...	...	...	12·13	1·89	8,900·39	5,291·51	12·55
		Sundry claims	...	...	...	...	...	25·22	102·12	1,701·35	652·62	...
Mt. Morgans ...	399F, etc. ...	Morgans Gold Mines, Limited	...	...	15·00	12·64	...	...	...	4,442·05	13,755·20	...
		Prior to transfer to present holders	...	...	...	...	...	...	16·66	779,578·43	354,225·86	5,552·63

	547F	Vodice	...	...	194·50	60·88	...	...	...	433·25	94·95	...
		Voided leases	...	...	...	...	...	17·95	148·79	60,503·25	34,541·15	77·86
		Sundry claims	...	...	...	...	...	34·47	360·33	4,653·82	3,153·57	...
Murrin	395F	Arthur Rymer	...	...	...	...	...	...	8·42	3,848·25	744·25	...
	482F	Hill End	...	...	...	...	...	...	...	3,666·75	1,570·74	...
		Voided leases	...	...	...	...	...	10·43	222·93	129,376·47	101,692·22	29·60
		Sundry claims	...	16·68	60·75	29·73	...	51·15	554·97	6,256·73	4,367·33	...
Redcastle	...	Voided leases	...	...	...	...	...	4·49	436·54	4,107·20	4,043·41	...
		Sundry claims	...	...	...	...	...	...	113·84	806·07	562·29	...
Yundamindera ...	510F	Landed at Last	...	...	...	...	...	...	...	4,332·00	683·02	...
	548F	Mulga Rose	...	...	50·00	77·94	...	...	...	50·00	77·94	...
	509F	New Golden Treasure	...	...	...	8·19	...	...	22·83	979·00	386·46	...
	540F	Vera	...	...	10·00	4·41	...	...	...	80·00	32·02	...
		Voided leases	...	...	...	...	...	...	88·10	72,413·85	48,461·93	5·82
		Sundry claims	...	...	30·00	12·20	...	3·01	271·93	6,409·35	4,694·45	...
	M.A. 14F ...	Crocker's Plant	...	...	...	2·34	...	...	...	10·00	16·40	...
	From District generally :—											
	Sundry parcels treated at :											
	State Battery, Linden		...	...	9·00	*570·13	...	...	9·16	275·29	*11,151·42	...
	Hill End Cyanide Plant		...	...	...	...	...	...	...	...	*556·95	...
	Rymer's Cyanide Plant		...	...	...	...	...	...	...	...	*1,159·90	...
	Turbett's Cyanide Plant		...	...	...	*171·57	...	...	...	...	*1,029·28	...
	A. E. Smith (Stack of Ore)		...	...	...	...	...	...	...	7·25	1·39	...
	Various Works		...	...	...	...	...	...	...	1,257·81	*5,587·24	99·97
	Reported by Banks and Gold Dealers		33·82	...	...	...	...	2,889·46	124·62	10·30	94·14	·68
	Totals		**33·82**	**18·13**	**1,529·75**	**2,181·67**	...	**3,301·03**	**9,262·04**	**1,196,659·36**	**694,647·66**	**5,781·64**

MOUNT MALCOLM DISTRICT.

Cardinia	1795C	Rangoon	...	...	...	...	...	...	...	250·00	*106·64	...
		Voided leases	...	...	...	...	...	13·87	1,591·66	4,600·24	3,979·15	...
		Sundry claims	...	...	102·75	14·40	·66	4·25	119·83	1,865·25	575·01	·66
Diorite	(1806C) ...	Little Puzzle	...	...	...	...	...	...	...	92·50	39·56	...
	1786C	Puzzle	...	...	212·00	369·53	...	...	...	1,252·00	1,321·48	...
		Voided leases	...	...	...	...	...	...	945·65	36,010·53	32,296·42	33·18
		Sundry claims	...	...	12·75	10·90	...	11·21	329·32	4,597·30	4,405·51	...
Dodger's Well ...	...	Voided leases	...	...	...	...	...	...	57·90	1,373·30	1,936·52	...
		Sundry claims	...	...	...	...	...	·95	28·32	1,440·25	904·23	...
Lake Darlot ...	1784C	British King West	...	...	65·50	72·38	...	...	...	303·00	305·65	...
		Voided leases	...	...	...	...	...	...	4,482·18	68,013·46	49,993·88	...
		Sundry claims	...	...	...	...	...	67·68	557·70	7,144·34	4,786·99	2·60
Leonora	1754C	Gold Blocks	...	...	35·00	*184·12	46·50	...	...	1,410·00	1,280·85	67·25
	1594C	Leonora Central G.M. Co., N.L.	...	...	...	...	...	...	...	8,621·00	*853·23	...
	1788C	Little Gwalia	...	...	...	...	...	...	...	635·00	15·62	...
	(980C), etc. ...	Sons of Gwalia, Ltd.	...	...	72,652·86	22,656·94	1,935·34	...	...	5,016,973·53	2,076,552·60	144,930·15
		Prior to transfer to present holders	...	...	...	...	...	...	...	109,081·00	55,989·21	8·66
	1557C	Tower Hill	...	...	...	1·21	...	...	·58	526·55	120·73	...
		Voided leases	...	...	...	...	...	...	1,866·28	164,241·45	88,210·02	10·71
		Sundry claims	...	...	71·00	12·68	...	30·31	333·89	17,639·55	11,393·05	...

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

MT. MARGARET GOLDFIELD— *continued.*

MOUNT MALCOLM DISTRICT—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Malcolm	...	Voided leases	...	...	...	...	...	...	47·07	62,656·53	47,560·70	...
		Sundry claims	...	...	...	...	...	5·75	33·39	4,274·47	2,631·37	...
Mertondale ...	...	Voided leases	...	...	...	...	...	...	...	89,024·75	60,935·32	1,497·58
		Sundry claims	...	...	8·50	6·54	...	1·82	85·74	3,112·16	2,249·39	...
Mt. Clifford ...	...	Voided leases	...	...	...	...	...	...	1,623·35	9,556·96	16,492·17	...
		Sundry claims	...	...	30·00	3·88	...	53·98	351·65	5,511·70	3,471·95	...
Pig Well	...	Voided leases	...	...	...	...	...	...	...	13,587·32	14,676·58	63·68
		Sundry claims	...	...	...	...	...	...	34·61	2,896·65	1,225·46	...
Randwick ...	1794c	Mighty Splash	...	...	169·00	13·93	...	...	7·27	664·00	71·16	...
		Voided leases	...	...	...	...	...	...	239·49	10,141·65	9,653·78	...
		Sundry claims	...	...	...	...	...	66·57	164·02	2,464·64	1,299·14	...
Webster's Find ...	...	Voided leases	...	...	...	...	...	30·30	...	22,167·50	14,377·65	...
		Sundry claims	...	...	...	...	...	36·84	695·68	2,227·40	1,499·81	...
Wilson's Creek ...	...	Voided leases	...	...	...	...	...	...	...	333·50	168·27	...
		Sundry claims	...	...	...	...	...	·70	4·24	316·00	261·12	...
Wilson's Patch ...	...	Voided leases	...	...	...	...	...	...	99·38	28,863·35	13,050·19	1·05
		Sundry claims	...	...	...	...	...	4·68	50·57	1,488·91	1,357·77	...
	From District generally :—											
	Sundry parcels treated at :											
	State Battery Reserve, Darlot		...	...	...	*100·01	...	...	...	10·00	*245·98	...
	Parks and Hunt's Cyanide Plant		...	...	...	...	...	...	...	...	*951·64	...
	Reefer Cyanide Plant		...	...	...	*159·21	...	...	...	20·00	*2,713·55	22·38
	Various Works		...	...	...	...	...	...	...	789·50	*20,984·71	123·15
	Reported by Banks and Gold Dealers		5·80	4·35	...	...	...	3,402·30	248·63	21·50	45·17	...
		Totals	**5·80**	**4·35**	**73,359·36**	**23,605·73**	**1,982·50**	**3,731·21**	**13,998·40**	**5,706,198·74**	**2,550,989·23**	**146,761·05**
MOUNT MARGARET DISTRICT.												
Burtville	2446T	Boomerang	...	...	126·00	986·14	...	...	...	380·00	3,000·14	21·54
	2476T	Happy Find	...	...	...	...	...	...	...	73·00	316·95	...
	2480T	Mocking Bird	...	...	...	...	...	...	...	24·50	66·89	...
	2138T	Nil Desperandum	...	...	6·00	5·47	...	...	5·30	1,385·12	3,033·99	...
	2412T	Sailor Prince	...	...	...	...	...	...	...	467·25	89·16	...
		Voided leases	...	...	...	...	...	2·29	413·80	68,523·68	104,615·47	275·27
		Sundry claims	...	...	...	...	...	2·65	208·27	7,165·91	5,332·85	...

Duketon	2483T	Mulga King	...	...	20·00	20·66	...	...	...	20·00	20·66	...
		Voided leases	...	...	...	...	...	5·35	3,216·10	31,857·42	22,484·49	...
		Sundry claims	...	...	23·60	32·87	...	...	528·26	2,271·00	2,068·89	29·76
Eagle's Nest ...	...	Voided leases	...	...	...	...	...	...	145·34	534·50	1,238·22	...
		Sundry claims	2·20	12·66	...	·92	...	14·09	472·38	943·00	317·00	...
	(2482T) ...	Marloo	...	...	...	107·66	...	...	...	...	116·63	...
	2141T	King of Creation G.Ms., Ltd.	...	...	...	...	...	...	...	6,358·00	1,288·92	11·00
		Prior to transfer to present holders	...	...	...	...	...	...	...	13,723·00	3,199·66	...
	2345T, etc. ...	Western Mining Corporation, Ltd. ...	...	...	...	...	...	...	...	106,009·00	75,816·25	4,316·81
		Prior to transfer to present holders	...	...	...	...	...	...	...	119·25	140·97	...
	2458T	Westralia	...	...	50·00	36·02	...	...	...	137·00	120·48	...
		Voided leases	...	...	...	...	...	10·07	393·41	29,693·15	20,119·23	...
		Sundry claims	...	...	5·00	29·40	...	1,181·65	148·23	5,424·59	3,691·47	...
Euro	...	Voided leases	...	...	...	...	...	...	65·14	91,821·50	37,678·25	...
		Sundry claims	...	...	...	...	...	4·87	73·04	1,270·25	785·52	...
Laverton	2216T	Beria Main Lode	...	...	...	85·35	...	...	...	6,550·35	1,482·62	...
	2408T, etc. ...	Gladiator Gold Mines, Ltd.	...	...	...	...	...	...	...	103,538·00	25,965·35	...
	2433T	Ida H. Extended	...	...	...	...	...	8·30	...	25·50	26·96	...
	2229T	Ida H.	...	...	...	...	...	...	...	531·50	469·46	...
	2229T (2230T)	Ida H. Leases	...	...	...	...	...	...	...	2,683·75	379·62	...
	2245T	Lancefield Extended West ...	...	...	...	...	...	...	...	472·00	786·46	...
	2478T	Lancefield North	...	...	...	...	...	...	...	17·25	88·96	...
		Voided leases	...	...	...	...	...	20·29	2,024·11	1,961,643·52	784,754·06	56,923·16
		Sundry claims	...	...	...	*13·85	...	210·18	1,475·35	16,683·75	8,945·23	...
Mt. Barnicoat ...	2254T	Ulalla	...	...	...	...	...	...	...	392·50	92·44	...
		Voided leases	...	...	...	...	...	...	23·08	1,376·25	558·94	...
		Sundry claims	...	...	...	...	...	...	·68	1,058·00	796·57	...
Mt. Shenton ...	...	Voided leases	...	...	...	...	...	...	...	15·00	26·65	...
		Sundry claims	...	...	...	...	...	...	...	279·25	209·67	...
	From District generally :—											
	Sundry Parcels treated at :											
	State Battery, Laverton		...	...	...	...	...	...	...	97·50	*7,211·05	15·64
	F. Harrington (L.T.T. 995H)		...	...	...	*3·65	...	...	...	...	*3·65	...
	D. Cable (L.T.T. 978H, 979H)		...	...	...	*306·40	...	...	...	...	*792·53	...
	G. E. Grey's Cyanide Works		...	...	...	*15·73	...	...	...	...	*5,521·62	...
	J. Shepherd (M.A. 23T)		...	...	...	*32·61	...	...	...	...	*37·01	...
	Various Works		...	...	...	...	...	...	...	159·50	*12,335·88	...
	Reported by Banks and Gold Dealers		1·07	·70	...	...	...	2,472·87	105·90	...	26·76	...
	Totals		**3·27**	**13·36**	**230·60**	**1,676·73**	...	**3,932·61**	**9,298·39**	**2,463,724·74**	**1,136,053·58**	**61,593·18**

North Coolgardie Goldfield.

MENZIES DISTRICT.

Comet Vale ...	5719Z	Coonega	...	...	8·00	5·21	...	...	...	8·00	5·21	...
	5476Z	Sand Queen-Gladsome Mines, N.L. ...	...	...	...	5·23	...	...	...	42,096·75	14,583·85	6·45
		Prior to transfer to present holders	...	...	...	...	...	...	...	75,754·50	59,007·25	1,505·65
		Voided leases	...	...	...	...	...	...	419·74	148,635·97	119,408·22	3,839·28
		Sundry claims	...	...	...	...	...	...	40·19	1,696·91	885·75	...

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

NORTH COOLGARDIE GOLDFIELD—*continued.*

MENZIES DISTRICT—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Goongarrie ...	...	Voided leases	...	...	...	...	...	·94	1,378·20	29,771·54	17,966·00	...
		Sundry claims	...	...	49·75	80·14	...	46·46	1,954·08	2,326·27	2,848·58	...
Menzies	5703z	Aspacia	...	18·46	...	...	...	...	18·46	970·50	876·11	5·24
	5543z	Black Swan	...	...	...	...	...	...	...	967·63	1,486·32	9·08
	5694z	Dark Horse	...	...	...	...	...	...	...	83·00	293·76	...
	5511z	First Hit Gold Mines (1934), Limited	...	...	5,850·00	4,315·00	...	...	...	61,025·20	43,748·13	6,608·73
		Prior to transfer to present holders	...	...	...	...	...	...	...	1,672·75	4,687·69	...
	5542z	Good Block Leases	...	...	...	...	...	...	7·32	1,425·00	1,759·23	...
	5549z	Lady Harriet	...	...	295·00	86·09	...	...	...	548·00	164·46	...
	5520z	Mignonette	...	...	...	...	...	...	...	168·50	209·47	...
	5697z	New Florence	...	...	62·50	30·29	...	...	6·56	972·50	358·63	...
	5663z	Springfield	...	...	...	...	...	...	...	132·00	47·98	...
	(5484z) ...	Warrior	...	...	185·00	52·60	...	...	...	2,932·00	1,375·68	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	285·96	132·77	...
	5671z	Woolgar Gold Mines, Ltd.	...	...	...	...	...	...	...	42·00	8·85	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	151·50	174·25	...
		Voided leases	...	...	...	...	...	45·42	1,095·38	927,968·54	722,129·79	13,581·15
		Sundry claims	...	...	7·00	7·85	...	49·50	590·32	30,700·94	23,646·18	776·49
Mt. Ida	5658z	Carida	...	...	...	...	...	...	...	277·95	361·69	...
	5668z	Federation	...	...	...	...	...	...	...	389·50	425·20	...
	5551z	Goldfields Australian Development Co., Ltd. (Mt. Ida Gold Mines, Limited)	...	...	...	...	...	...	...	24,519·50	12,090·94	808·89
		Prior to transfer to present holders	...	...	...	...	...	...	...	1,512·75	737·95	...
	5707z	Quin Hills	...	...	...	...	...	...	12·52	809·00	181·19	...
		Voided leases	...	...	...	...	...	...	79·69	67,254·72	71,711·06	106·63
		Sundry claims	...	113·54	10·00	8·71	...	48·14	315·27	15,561·91	7,898·78	·12
Twin Hills ...	...	Voided leases	...	...	...	...	...	...	...	552·30	568·87	...
		Sundry claims	...	...	...	...	...	...	...	97·80	86·69	...
		From District generally :—										
		Sundry Parcels treated at :										
		State Battery, Mt. Ida	...	...	...	...	...	...	...	1,866·25	*6,829·04	...
		Gold Tailings Limited Cyanide Plant	...	...	...	...	...	...	...	...	*345·87	5·84
		Lady Harriet Cyanide Plant	...	...	...	*162·89	...	...	...	279·50	*15,474·39	*30·00
		Menzies Consolidated Cyanide Plant	...	...	...	*100·39	...	...	...	...	*3,241·05	...
		B. W. Sanders' Cyanide Plant	...	...	...	...	...	...	...	...	*489·41	*575·81
		Various Works	...	...	...	...	...	...	...	2,512·30	*34,165·28	*1,877·50
		Reported by Banks and Gold Dealers	·59	...	...	...	...	1,422·75	382·80	35·00	7·72	...
		Totals	**·59**	**132·00**	**6,467·25**	**4,854·40**	**...**	**1,613·21**	**6,300·53**	**1,446,004·44**	**1,170,419·29**	**29,736·86**

ULARRING DISTRICT.

Davyhurst ...	1102U	Lights of Israel	...	...	...	6·57	...	...	...	1,075·00	176·42	...
	1016U	New Callion	...	...	...	...	...	...	...	5,293·30	2,002·37	119·67
		Voided leases	...	...	...	...	...	2·93	144·62	164,253·32	125,596·63	5,408·47
		Sundry claims	...	...	167·00	44·81	...	...	37·98	12,649·44	5,302·17	...
Morley's	1101U	Emerald	...	26·03	48·00	128·38	...	...	26·03	344·50	812·23	...
	1094U	First Hit	...	...	...	...	...	...	...	618·75	2,212·66	...
	1081U	Mabel Gertrude	...	...	...	...	...	...	...	348·00	426·55	...
	1089U	Paramount	...	...	...	...	...	...	...	660·50	901·33	...
	1078U	Rabbit	...	...	...	...	...	...	265·66	277·50	687·47	...
	1074U	Two Chinamen	...	...	...	...	...	...	3,409·54	784·50	2,881·45	...
		Voided leases	...	...	...	...	...	...	121·96	443·50	754·84	...
		Sundry claims	...	...	39·50	26·71	...	2·16	932·23	1,293·25	2,258·92	...
Mulline	1107U	Ajax West	...	...	...	...	...	...	1·37	282·75	547·89	...
	1069U	Riverina Gold Mines, Ltd.	...	...	...	...	...	...	...	32,058·00	11,662·42	...
		Voided leases	...	...	...	...	...	...	274·09	102,556·22	103,327·32	530·75
		Sundry claims	10·82	13·96	16·00	26·12	...	10·82	192·15	10,317·89	8,482·73	1·10
Mulwarrie ...	1113U	Oakley	...	...	...	...	...	...	...	151·00	191·83	...
		Voided leases	...	...	...	...	...	...	165·29	19,480·68	26,369·21	38·47
		Sundry claims	...	...	...	...	...	·80	282·29	2,981·33	2,574·59	...
Ularring	...	Voided leases	...	...	...	...	...	...	563·34	9,771·60	13,907·76	...
		Sundry claims	...	...	...	...	...	...	...	671·50	309·48	...
	From District generally :—											
	Sundry Parcels treated at :											
	State Battery, Mulline		...	...	...	...	...	...	...	639·99	*16,459·89	...
	State Battery, Mulwarrie		...	...	...	...	...	...	...	613·18	*6,564·16	...
	E. Rowe (M.A. 13)		...	...	...	·64	...	...	...	...	21·65	...
	H. J. Van Trip		...	...	18·00	5·02	...	...	...	18·00	5·02	...
	Waihi Cyanide Plant		...	...	...	*73·67	...	...	...	5·00	*333·81	...
	Waihi Golden Pole Cyanide Plant		...	...	...	...	...	...	...	...	*936·58	...
	Prior to Amalgamation		...	...	...	...	...	...	...	...	*5,032·24	...
	Various Works		...	...	...	...	...	...	15·82	215·15	*1,779·65	...
	Reported by Banks and Gold Dealers		1·90	...	...	...	...	103·05	63·08	100·00	22·67	...
	Totals		**12·72**	**39·99**	**288·50**	**311·92**	...	**119·76**	**6,495·45**	**367,903·85**	**342,541·94**	**6,098·46**

NIAGARA DISTRICT.

Desdemona ...	...	Voided leases	...	...	...	...	...	...	7·12	9,809·00	7,555·81	12·04
		Sundry claims	...	...	...	...	...	...	8·99	2,225·45	892·48	...
Kookynie	911G	Cosmopolitan South	...	...	...	...	...	...	...	600·00	293·91	...
		Voided leases	...	...	...	...	...	3·35	347·30	744,223·21	393,923·63	5,375·97
		Sundry claims	...	...	83·00	81·79	...	56·74	99·84	7,753·80	6,006·03	...
Niagara	913G	New Gladstone	...	...	...	...	...	...	...	639·00	269·99	...
		Voided leases	...	...	...	...	...	...	104·54	85,237·50	52,095·06	...
		Sundry claims	...	...	15·50	11·12	...	28·10	97·22	14,135·16	7,996·58	...
Tampa	902G	Grafter	...	...	...	...	...	...	...	192·00	20·30	...
		Voided leases	...	...	...	...	...	...	41·58	50,285·57	23,267·41	174·24
		Sundry claims	...	2·38	...	...	...	32·60	283·40	8,016·33	4,100·19	...

TABLE 1.—*Production of Gold and Silver from all sources, etc.*—continued.

NORTH COOLGARDIE GOLDFIELD—*continued.*

NIAGARA DISTRICT—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Niagara—*continued*												
		From District generally :—										
		Sundry parcels treated at :										
		Grafter Battery	...	...	...	...	...	...	...	...	*137·63	...
		P. J. Ward (Permit)	...	...	...	...	...	...	...	...	*10·08	...
		Various Works	...	...	...	...	...	...	...	1,220·50	*16,226·67	41·17
		Reported by Banks and Gold Dealers	...	...	...	...	...	1,583·86	823·66	...	63·53	...
		Totals	...	**2·38**	**98·50**	**92·91**	...	**1,704·65**	**1,813·65**	**924,337·52**	**512,859·30**	**5,603·42**

YERILLA DISTRICT.

Edjudina	1122R, etc. ...	Paget Gold Mines of Edjudina, Ltd. ...	...	...	...	...	...	...	...	841·50	187·51	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	738·75	559·80	...
		Voided leases	...	...	...	...	...	...	18·44	33,943·45	42,627·48	37·79
		Sundry claims	...	...	...	...	...	...	26·89	6,807·58	4,761·31	...
Patricia	...	Voided leases	...	...	...	...	...	...	...	4,158·50	5,396·40	25·40
		Sundry claims	...	...	...	...	...	...	...	35·00	17·76	...
Pinjin	...	Voided leases	...	...	...	...	...	...	48·34	17,463·30	10,742·77	...
		Sundry claims	...	...	...	...	...	...	154·86	5,623·59	3,466·70	...
Yarri	1211R	Margaret	...	...	...	...	...	...	...	590·00	131·18	...
	1126R, etc. ...	Porphyry (1939) G.M., Limited ...	...	...	...	...	...	...	...	66,648·00	9,855·05	261·86
	1126	Edjudina Gold Mining Co., N.L. ...	...	...	...	...	...	...	...	30,220·00	5,409·93	507·51
		Prior to transfer to present holders	...	...	...	...	...	...	...	124·50	38·89	...
		Voided leases	...	...	...	...	...	6·30	87·08	43,095·25	20,835·58	2·00
		Sundry claims	...	...	...	...	...	·87	5·93	13,669·80	5,208·23	...
Yerilla	...	Voided leases	...	...	...	...	...	...	3,107·25	16,161·93	12,733·54	13·93
		Sundry claims	...	1·46	...	...	...	19·30	34·30	2,695·58	1,538·19	...
Yilgangie	1221R	Golden Hill	...	...	...	...	...	...	...	120·00	66·13	...
	1176R	Western Mining Corporation, Ltd. ...	...	...	...	...	...	...	...	646·75	446·89	...
		Prior to transfer to present holders	...	...	...	...	...	...	·85	1,244·75	1,830·28	...
		Voided leases	...	...	...	...	...	...	9·94	1,342·75	949·08	...
		Sundry claims	...	...	...	...	...	121·67	90·48	2,841·30	1,666·56	...
		From District generally :—										
		Sundry parcels treated at :										
		State Battery, Yarri	...	...	...	*2·48	...	...	...	271·50	*7,496·64	3·50
		State Battery, Yerilla	...	...	...	...	...	...	...	...	*43·52	...

Various Works	...	...	...	...	...	2·17	...	642·25	*6,049·24	...
Reported by Banks and Gold Dealers	·45	...	...	...	...	1,161·08	160·08	...	4·11	...
Totals	**·45**	**1·46**	...	**2·48**	...	**1,311·39**	**3,744·44**	**249,926·03**	**142,062·77**	**851·99**

Broad Arrow Goldfield.

Bardoc	2102w ...	Despatch	...	...	...	...	...	...	...	432·00	140·60	...
	2198w ...	Ellen Pearce	...	...	...	...	...	...	...	1,040·75	743·72	...
	2219w ...	Gippslander	...	...	...	...	...	...	...	26·00	26·76	...
	2199w ...	Zoroastrian	...	...	...	...	...	...	...	936·25	149·31	...
		Voided leases	...	...	...	...	...	...	2,335·41	82,272·09	54,441·19	203·60
		Sundry claims	...	...	...	...	...	54·95	1,193·45	14,157·28	7,365·78	...
Black Flag ...	2190w ...	Bell Bird	...	...	...	...	...	...	1·55	149·25	44·00	...
		Voided leases	...	...	...	...	...	27·81	404·35	48,058·54	28,105·53	...
		Sundry claims	...	...	...	...	...	712·92	250·76	7,205·71	4,513·31	...
Broad Arrow ...	2217w ...	Dreamer	...	51·70	23·00	43·28	...	...	74·34	54·00	81·21	...
	2039w ...	Golden Arrow	...	...	...	...	...	...	...	4,023·50	622·96	...
	1958w ...	Grace Darling	...	...	154·00	79·31	...	...	1·67	3,576·50	2,540·32	...
	2215w ...	Hagland's Hill	...	...	...	...	...	...	10·11	...	...	...
	2216w ...	Kimra	...	...	...	...	...	...	...	801·00	1,036·43	...
	2148w ...	Lady Betty	...	...	...	...	...	...	...	390·80	79·43	...
	2206w ...	Lady Betty Extended	...	...	...	...	...	...	...	155·00	37·48	...
	2218w ...	Lady Betty North	...	...	...	...	...	...	...	101·00	20·20	...
	2223w ...	North Bulletin	...	...	95·75	201·29	...	...	...	248·00	286·53	...
	1771w ...	North Duke	...	136·72	...	...	...	...	1,670·51	192·80	628·42	...
	1933w ...	Oversight Tava United	...	2·32	...	...	...	...	1,147·01	837·29	909·72	...
	2221w ...	Undersight	...	...	...	...	...	...	...	95·00	15·82	...
		Voided leases	...	...	...	...	...	70·32	7,405·47	139,084·35	111,384·10	20·23
		Sundry claims	...	...	10·25	16·00	...	1,005·82	2,605·65	29,980·39	15,543·18	·11
Canegrass ...	...	Voided leases	...	...	...	...	...	...	27·77	669·82	460·72	...
		Sundry claims	...	...	10·75	2·77	...	...	227·55	717·45	505·06	...
Carnage	...	Voided leases	...	...	...	...	...	176·04	659·31	2,402·00	2,170·67	...
		Sundry claims	...	...	...	...	...	...	6·61	1,774·58	861·61	...
Cashman's ...	...	Voided leases	...	...	...	...	...	67·51	813·76	8,172·15	7,090·91	...
		Sundry claims	...	...	...	...	...	...	39·55	997·27	313·75	...
Christmas Reef ...	2175w ...	New Mexico	...	...	...	...	...	...	...	281·50	515·35	...
	2211w ...	New Year's Gift	...	...	...	...	...	...	...	11·25	9·03	...
		Voided leases	...	...	...	...	...	...	29·68	783·52	207·21	...
		Sundry claims	...	...	...	...	...	...	307·15	2,683·39	2,525·73	...
Fenbark	2188w ...	Golden Penny	...	...	89·75	32·78	...	...	...	2,124·00	357·58	...
	2228w ...	New Fenbark	...	...	...	...	...	...	...	75·75	23·16	...
		Voided leases	...	...	...	...	...	...	4·42	3,291·50	1,955·85	...
		Sundry claims	...	...	...	...	...	...	51·96	2,525·52	935·75	...
Grant's Patch ...	2227w ...	Magpie	...	...	...	...	...	...	...	35·75	101·12	...
	1962w, etc. ...	Ora Banda Amalgamated Mines, N.L. ...	...	...	1,295·00	1,103·00	...	...	...	153,483·00	57,765·88	175·00
		Prior to transfer to present holders	...	...	...	...	...	...	...	12,424·50	9,540·07	...

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

BROAD ARROW GOLDFIELD—*continued.*

MINING CENTRE.	NUMBER OF LEASE.	REGISTERED NAME OF COMPANY OR LEASE.	TOTAL FOR 1944.					TOTAL PRODUCTION.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Grant's Patch—*continued*	2208w ...	Wentworth	...	...	...	...	...	...	...	453·25	110·69	...
		Voided leases	...	...	...	...	...	...	258·52	14,501·60	4,560·62	...
		Sundry claims	...	5·42	...	...	...	...	356·66	4,560·29	2,323·86	...
Ora Banda ...	1336w, etc. ...	Associated Northern Ora Banda, N.L.	...	...	...	...	...	...	...	2,727·50	406·53	4·87
		Prior to transfer to present holders	...	...	...	...	...	...	...	315,958·95	123,252·22	1,664·70
	2232w ...	Cave Hill North	...	...	12·00	36·56	...	...	...	12·00	36·56	...
	1943w, etc. ...	Ora Banda United Mines, Ltd. ...	...	...	...	...	...	...	...	2,182·25	74·80	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	76,612·22	14,630·93	...
		Voided leases	...	...	...	...	...	...	829·75	24,532·10	12,526·19	...
		Sundry claims	...	111·14	...	5·47	...	...	324·13	11,958·00	4,028·69	...
Paddington ...	2195w ...	Lockinvar Gold Mines, Ltd.	...	...	...	...	...	...	...	790·50	184·89	...
	2114w ...	Lone Oak	...	...	74·00	60·49	...	8·58	...	487·00	355·03	...
	2105w ...	Minnie Palmer	...	...	...	...	...	...	...	9,722·50	804·15	...
	2122w ...	Pakeha	...	...	...	...	...	...	...	1,901·90	633·49	...
		Voided leases	...	...	...	...	...	5,557·72	463·31	178,566·41	83,131·57	18·96
		Sundry claims	...	...	...	...	...	1,714·16	279·49	15,388·48	8,869·25	...
Riche's Find ...	...	Voided leases	...	...	...	...	...	...	7·01	7,357·09	5,283·87	71·36
		Sundry claims	...	...	...	...	...	...	212·26	1,460·55	1,660·28	·13
Siberia	...	Voided leases	...	...	...	...	...	1·07	2,581·31	28,854·47	31,364·62	...
		Sundry claims	...	...	...	...	...	289·06	1,178·64	20,010·29	12,337·78	...
Smithfield ...	2193w ...	King of the Hills	...	...	...	...	...	...	...	2,143·75	532·78	...
		Voided leases	...	...	...	...	...	...	... ...	2,091·96	590·34	...
		Sundry claims	...	...	...	...	...	...	123·37	2,393·09	910·21	...
	From Goldfield generally :—											
	Sundry Parcels treated at :											
	State Battery, Ora Banda		...	...	...	*445·31	...	...	...	128·05	*16,256·22	...
	Brearley's Cyanide Plant		...	...	...	...	...	...	...	...	*2,374·39	*1,227·68
	Golden Arrow Cyanide Plant		...	...	...	...	...	...	...	26·00	*2,617·13	...
	Minnie Palmer Cyanide Plant		...	...	...	*1·66	...	...	...	...	*2,748·02	...
	Various Works		...	...	...	...	...	2,275·66	1·24	16,896·02	*43,952·35	*1,875·77
	Reported by Banks and Gold Dealers		22·97	2·90	...	...	...	9,908·88	130·11	61·68	90·35	...
	Totals		**22·97**	**310·20**	**1,764·50**	**2,027·92**	...	**21,870·50**	**26,013·84**	**1,268,048·35**	**690,703·26**	**5,262·41**

North-East Coolgardie Goldfield.

KANOWNA DISTRICT.

Gindalbie	1540x	Lady Betty	...	...	...	...	...	...	301·95	197·00	432·46	...
		Voided leases	...	...	...	...	...	...	19·94	44,077·78	39,512·90	38·31
		Sundry claims	...	...	40·50	17·06	...	...	713·92	4,810·77	2,741·08	...
Gordon	1532x	Sirdar	...	...	374·00	318·22	455·82	...	79·84	4,452·25	3,173·46	517·61
		Voided leases	...	...	...	...	...	...	589·88	48,723·78	16,562·53	...
		Sundry claims	...	...	...	...	...	...	177·38	1,918·20	1,130·74	...
Kalpini	...	Voided leases	...	...	...	...	...	...	38·73	13,463·50	6,739·57	·07
		Sundry claims	...	...	...	...	...	24·70	252·83	1,437·00	1,010·42	...
Kanowna	1541x	Three of Diamonds	...	...	...	...	...	...	...	174·00	22·80	...
		Voided leases	...	...	...	...	...	24·94	4,511·34	684,818·35	380,125·24	2,482·24
		Sundry claims	...	1·97	62·75	30·70	...	100·03	2,125·34	23,666·02	11,022·81	1·50
Mulgarrie	...	Voided leases	...	...	...	...	...	...	1,216·63	6,902·26	4,197·98	...
		Sundry claims	...	...	...	...	...	...	16·78	1,261·75	631·40	...
Six Mile	...	Voided leases	...	...	...	...	...	...	1,603·72	559·00	767·72	...
		Sundry claims	...	...	70·75	10·28	...	...	54·14	739·25	225·56	...
	From District generally :—											
	Sundry Parcels treated at :											
	Maund's Cyanide Plant		...	...	...	*32·26	...	...	...	...	*32·26	...
	Peat's Cyanide Plant		...	...	...	*10·96	...	...	...	16·00	*278·66	...
	Various Works		...	...	...	...	...	330·42	867·52	158,919·05	152,894·97	...
	Reported by Banks and Gold Dealers		27·12	·64	...	...	...	105,919·44	35·68	·50	101·55	...
	Totals		**27·12**	**2·61**	**548·00**	**419·48**	**455·82**	**106,399·53**	**12,605·62**	**996,136·46**	**621,604·11**	**3,039·73**

KURNALPI DISTRICT.

ubilee	...	Voided leases	...	...	...	...	...	...	145·13	2,122·50	1,465·16	...
		Sundry claims	...	...	...	...	...	25·57	13·52	1,219·25	511·63	...
Kurnalpi	...	Voided leases	...	...	...	...	...	371·18	3,166·80	4,052·51	3,957·71	6·27
		Sundry claims	...	3·13	10·25	9·54	...	317·61	727·39	4,255·36	2,063·34	...
Mulgabbie ...	...	Voided leases	...	...	...	...	...	...	1,402·66	226·75	7,845·87	4·95
		Sundry claims	...	2·65	...	...	...	8·06	2,725·29	1,171·45	2,185·53	...
	From District generally :—											
	Sundry Parcels treated at :											
	Various Works		...	...	...	...	...	...	...	101·50	388·63	...
	Reported by Banks and Gold Dealers		·29	·21	...	...	...	12,097·37	68·59	...	2·35	...
	Totals		**·29**	**5·99**	**10·25**	**9·54**	...	**12,819·79**	**8,249·38**	**13,149·32**	**18,420·22**	**11·22**

East Coolgardie Goldfield.

EAST COOLGARDIE DISTRICT.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Binduli	6025E	Red Star	...	...	60·75	8·00	...	...	...	128·00	14·10	...
		Voided leases	...	...	...	...	...	...	...	803·10	385·19	...
		Sundry claims	...	...	9·50	6·08	...	...	13·01	4,592·77	1,591·65	...
Boorara	5486E	Olympian	...	...	...	...	...	...	...	1,306·00	738·90	...
		Voided leases	...	...	...	...	...	...	459·07	306,930·82	171,842·83	408·36
		Sundry claims	...	...	147·50	15·21	...	·49	145·56	2,764·34	1,406·17	...
Boulder	5862E	Albert Adventure	...	...	...	...	...	...	...	1,460·50	258·77	...
	5630E	Argennum	...	...	...	...	...	...	...	454·50	130·63	...
	5465E	Birthday Gift	...	...	...	...	...	...	...	5,244·89	1,366·30	...
	5690E	Boulder Perseverance, Limited ...	...	...	75,986·64	20,397·62	8,029·16	...	...	1,737,693·27	757,197·12	221,160·53
		Prior to transfer to present holders	...	...	...	...	...	...	...	3,306,942·88	1,841,159·00	203,821·43
	5964E	Croesus Extended	...	...	...	...	...	1·07	...	67·75	5·22	...
	5472E	Golden Key	...	...	...	...	...	18·27	19·72	415·00	158·96	...
	5692E, etc. ...	Gold Mines of Kalgoorlie, Ltd. ...	...	...	98,544·00	22,969·03	5,886·46	...	...	887,465·86	268,243·43	92,426·98
		Prior to transfer to present holders	...	...	...	...	...	...	545·23	527,790·53	568,643·05	4,844·50
	5696E, etc. ...	Great Boulder Proprietary G.Ms., Ltd.	...	...	248,313·00	64,878·24	33,436·29	...	1·53	7,461,174·97	4,627,571·45	765,153·39
	5845E	Happy Returns	...	...	...	...	...	...	...	186·50	45·78	...
	5345E, etc. ...	Kalgoorlie Enterprise Mines, Ltd. ...	...	...	37,349·41	9,490·48	817·72	...	...	397,696·19	123,794·98	12,129·21
		Prior to transfer to present holders	...	...	...	...	...	...	...	15,320·68	8,957·01	...
	5708E, etc. ...	Lake View & Star, Ltd.	...	...	278,171·00	90,989·60	17,221·58	...	...	6,499,818·30	2,221,898·54	157,509·76
		Prior to transfer to present holders	...	...	...	...	...	...	8·49	15,792,500·38	9,149,223·80	1,348,055·82
	5159E, etc. ...	Lake View South (G.M.K.), Ltd. ...	...	...	...	...	...	...	...	62,278·38	21,536·66	...
	5789E, etc	North Kalgurli (1912), Ltd.	...	...	91,444·14	27,442·50	10,823·97	...	111·55	1,515,245·24	546,259·17	148,568·64
	5806E, etc. ...	North Kalgurli (1912), Ltd., Croesus Pty. Group	...	...	...	...	...	...	51·20	90,159·00	19,261·22	...
	5891E	(New Croesus)	...	...	...	...	...	...	...	193·00	48·74	...
	5700E, etc. ...	Prior to transfer to present holders	...	...	...	...	...	43·99	...	4,018,436·01	2,815,911·21	97,625·03
	5429E, etc. ...	North Kalgoorlie United Mines, Ltd. ...	...	...	...	...	...	...	...	4,661·51	928·18	232·93
		Prior to transfer to present holders	...	...	...	...	...	...	...	131·74	76·74	...
	5539E	Oroya East	...	...	...	...	...	...	...	906·25	107·22	...
	5853E, etc. ...	Paringa Junction Leases	...	...	...	...	...	...	5·12	946·00	448·72	...
	5853E	(Paringa Junction)	...	...	...	...	...	...	...	123·75	17·77	...
	5854E	(Paringa Junction North) ...	...	...	...	...	...	...	...	60·50	10·64	...
	5855E	(Paringa Junction South) ...	...	...	...	...	...	...	...	1,473·25	228·42	...
	5456E	Paringa Mining and Exploration Co., Ltd.	...	...	67,295·00	15,446·11	517·25	...	...	551,867·06	136,948·79	9,201·25
	5556E	(Brown Hill Extended)	...	...	...	...	...	...	...	638·00	74·44	...
	5716E	(Two B's)	...	...	...	...	...	...	...	645·52	180·88	...
	5456E, etc. ...	Prior to transfer to present holders	...	...	...	...	...	...	...	52,670·76	23,503·73	...
	5808E, etc. ...	South Kalgurli Consolidated, Ltd. ...	...	...	56,685·38	15,602·59	2,715·04	...	...	2,344,935·55	943,700·76	19,840·55
		Prior to transfer to present holders	...	...	...	...	...	...	...	1,344,254·70	531,792·77	17,722·97

	5466E	South Star	...	...	...	*44·00	...	...	233·46	4,237·43	1,494·78	...
		Prior to transfer to present holders	...	...	...	...	...	...	5·22	1,835·75	748·78	...
		Voided leases	...	...	...	...	...	109·90	11,998·25	621,233·84	472,550·60	6·83
		Sundry claims	...	...	...	...	...	24·58	201·30	11,402·99	4,229·63	...
Cutter's Luck ...	...	Voided leases	...	...	...	...	...	...	20·83	12·25	9·13	...
		Sundry claims	...	...	14·75	7·40	...	7·67	383·14	692·65	308·18	...
Feysville	...	Voided leases	...	...	...	...	...	...	110·93	561·30	394·24	...
		Sundry claims	...	3·20	...	...	...	...	199·00	1,096·35	618·03	...
Hampton Plains ...	P.P.L. 9 ...	Celebration Gold Mine Co., N.L. ...	...	...	...	...	...	...	...	61,399·75	15,206·00	...
	P.P.L. 1 ...	Consolidated Gold Areas, N.L. ...	...	...	...	27·44	...	...	...	140,098·73	37,014·48	5,835·85
	P.P.L. 86 ...	Golden Hope, N.L.	...	...	...	...	...	...	...	5,964·00	2,006·14	...
	P.P.L. 192 ...	Golden Hope North	...	...	...	...	...	...	...	353·00	201·02	...
	P.P.L. 12 ...	Junction Extended	...	...	...	...	...	...	...	2,296·25	358·67	...
	P.P.L. 252, 289	Mount Martin	...	...	...	*72·15	...	...	...	14,953·75	5,715·22	...
	P.P.L. 279 ...	Mutooroo	...	...	...	...	...	...	...	6,151·88	1,087·26	...
	P.P.L. 277 ...	New Hope	...	...	215·75	47·87	...	...	17·23	54,209·30	10,174·96	...
	P.P.L. 81 ...	Villers Brettaneaux	...	...	...	...	...	...	...	3,562·02	1,435·55	...
		Voided leases	...	...	...	...	...	4,565·62	203·94	49,092·69	20,871·27	69·60
		Sundry claims	...	...	27·75	24·81	...	2·68	70·85	46,300·91	8,470·77	...
Kalgoorlie ...	5735E	Bonnie Lass	...	...	...	...	...	...	...	250·50	74·67	...
	5449E, etc. ...	Broken Hill Proprietary Co., Ltd. ...	...	...	...	...	...	...	3·99	272,314·01	113,598·98	1,843·28
		Prior to transfer to present holders	...	...	...	...	...	...	...	1,027·75	166·81	...
	5531E	Cassidy's Hill	...	...	...	...	...	...	·79	243·50	*135·04	...
	6030E	Churchill	...	...	...	...	...	...	...	54·75	6·71	...
	6046E	Colleen Bawn	...	...	142·25	38·30	...	...	...	142·25	38·30	...
	5867E	Concord	...	...	...	...	...	...	8·64	169·25	65·54	...
	5839E	Coronation	...	...	...	...	...	...	...	40·00	9·03	...
	5913E	Devon Consols	...	9·42	...	...	...	...	82·47	844·21	356·72	...
	5924E	Federal	...	...	...	...	...	...	...	36·25	4·51	...
	5510E	Golden Dream	...	...	...	...	...	...	...	530·74	149·77	...
	5737E	Golden Mile Channel	...	...	...	...	...	...	·97	2,534·50	199·41	...
	6020E	Golden Mile North	...	...	18·75	3·35	...	...	...	106·25	23·77	...
	6019E	Golden Seam	...	...	...	...	...	...	...	201·00	161·16	...
	5904E	Great Patience	...	1·07	71·25	15·41	...	...	1·07	204·75	62·02	...
	5519E	Hannan's Enterprise	...	...	...	...	...	...	...	362·00	79·80	...
	5878E	Lady May	...	...	448·00	218·23	...	...	...	1,919·00	505·23	...
	5549E	Maritana Hill	...	...	...	...	...	...	...	381·50	42·12	...
	4547E, etc. ...	Mount Charlotte (Kalgoorlie) Gold Mines, Ltd.	...	...	...	...	...	...	...	1,234·00	252·17	...
		Prior to transfer to present holders	...	...	...	...	...	...	5·72	48,292·60	13,930·79	...
	5437E	North End Extended	...	119·50	57·05	63·53	...	...	873·47	283·35	452·34	...
	5852E	Pedestal	...	...	...	...	...	...	...	1,608·75	444·93	...
	5468E	Phar Lap	...	...	33·25	14·14	...	...	...	437·00	338·35	...
	5415E	Return	...	...	...	...	...	...	5·64	3,670·50	638·42	...
	5934E	Sceptre	...	...	...	...	...	...	...	28·00	4·63	...
	6024E	Trident	...	...	...	...	...	...	...	58·75	36·67	...
		Voided leases	...	...	...	...	...	242·48	9,558·67	963,254·45	397,399·16	44,017·12
		Sundry claims	...	...	20·25	2·84	...	232·41	1,053·03	58,930·29	22,886·34	...
Wombola	5688E	Caledonian	...	...	...	...	...	...	...	3,191·50	2,561·70	...
	5497E	Daisy	...	...	482·50	140·61	...	...	...	3,916·25	3,492·45	...
	6032E	Dry Mount	...	...	39·00	53·78	...	...	...	39·00	53·78	...
	5872E	Everly	...	...	10·00	18·25	...	...	...	44·00	43·38	...
	5962E	G.D.M.	...	...	7·50	76·86	...	...	68·71	47·00	179·45	...
	5689E	Haoma	...	...	862·00	533·18	...	...	...	5,947·00	4,318·52	...

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

EAST COOLGARDIE GOLDFIELD—*continued.*

EAST COOLGARDIE DISTRICT—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Wombola—*continued*	5500E	Happy-Go-Lucky	...	...	...	...	...	...	...	2,075·25	1,675·85	...
	6043E	Launa Doone	...	...	62·50	34·51	...	...	...	62·50	34·51	...
	5961E	Loganberry	...	...	...	...	...	...	...	288·25	101·02	...
	5829E	Lurgan	...	...	...	...	...	...	·69	854·75	476·59	...
	5798E	Maranoa	...	...	12·50	8·53	...	...	32·17	2,045·50	1,046·78	...
	5493E, etc. ...	New Milano, N.L.	...	...	...	...	...	...	·25	17,030·75	10,548·97	479·00
	5493E	(Milano)	...	...	...	...	...	...	...	4,012·75	11,676·72	...
	5616E	(Leslie)	...	...	...	...	...	...	...	602·00	939·10	...
	5967E	North Caledonian	...	...	...	...	...	...	...	10·75	4·16	...
	5850E	Pauline	...	...	...	...	...	...	...	237·00	287·95	...
	4766E	Pericles Gold Mines, Ltd.	...	...	...	...	...	...	358·11	4,728·03	19,305·86	...
	6022E	Proprietary	...	...	154·00	113·64	...	...	...	357·25	388·02	...
	6018E	Reggio	...	...	20·50	19·48	...	...	·43	68·00	30·43	...
	5866E	Rosemary	...	...	...	...	...	...	...	32·50	67·19	...
	5925E	Tangney	...	...	...	...	...	...	...	12·00	4·46	...
	5795E	Transvaal	...	...	...	...	...	...	...	504·75	102·14	...
	5525E	Xmas Flat	...	...	...	...	...	...	...	330·25	264·74	...
		Voided leases	...	...	...	...	...	...	2,003·68	19,037·31	18,386·22	...
		Sundry claims	...	299·43	88·00	76·68	...	...	698·05	20,277·93	12,683·27	...
	From District generally :—											
	Sundry claims		...	...	...	...	...	11,014·57	465·61	5,440·46	2,541·10	...
	Sundry parcels treated at :											
	State Battery, Kalgoorlie		...	...	8·00	280·18	...	...	...	287·45	*19,874·88	...
	Cavalier Treatment Works		...	...	...	...	...	...	...	10·50	*31·43	...
	Prior to transfer to present holders		...	...	...	...	...	...	...	...	*1,538·16	1,507·65
	B. O. Bagworth's Treatment Works		...	...	18·75	11·29	...	...	...	18·75	11·29	...
	Bowden Bros. Cyanide Works		...	...	...	...	...	...	...	...	*286·50	...
	Golden Horseshoe (New), Ltd.		...	...	...	*9,183·47	*12,993·44	...	...	...	*248,875·05	207,179·65
	S. Irwin's and W. J. Heydon's Treatment Works		...	...	...	...	...	...	...	...	*64·05	...
	Pericles Cyanide Plant		...	...	...	*355·73	...	...	...	...	*1,924·95	...
	Polkinghorne's Cyanide Plant		...	...	...	...	...	...	...	...	*149·38	...
	J. F. Poynton (M.A. 1)		...	...	...	...	...	...	...	9·50	6·06	...
	Various Works		...	...	...	...	...	384·36	64·70	41,096·27	*263,842·67	12,606·81
	Reported by Banks and Gold Dealers		37·55	7·81	...	349·39	...	16,542·07	9,707·56	355·63	2,703·35	...
	Totals		**37·55**	**440·43**	**956,820·62**	**279,080·51**	**92,440·91**	**33,190·16**	**39,799·05**	**49457969·02**	**26551149·17**	**3,372,247·14**

BULONG DISTRICT.

Balagundi ...	...	Voided leases	...	...	...	...	...	...	2,408·98	1,110·68	1,473·73	12·92
		Sundry claims	...	...	11·50	9·47	...	3·51	280·53	668·26	465·64	...
Bulong	1311Y	Blue Quartz	...	...	...	...	...	...	...	571·50	159·49	...
	1315Y	Lady Gwen	...	...	242·00	49·22	...	...	...	304·00	71·02	...

	1308Y	Southern Cross	...	...	...	...	...	...	1·30	1,144·75	161·40	...
		Voided leases	...	...	...	...	...	107·54	8,490·35	104,142·55	85,090·08	...
		Sundry claims	...	10·75	94·25	17·10	...	1,655·86	1,592·19	14,593·23	17,393·45	...
Majestic	...	Voided leases	...	...	...	...	...	19·45	63·91	1,317·94	647·62	...
		Sundry claims	...	...	5·00	4·30	...	42·88	150·67	1,899·05	940·62	...
Morelands ...	...	Sundry claims	...	...	...	...	...	...	·13	183·00	58·51	...
Mount Monger ...	...	Voided leases	...	...	...	...	...	...	2,771·39	1,437·85	1,256·10	...
		Sundry claims	...	...	...	...	...	215·60	...	379·05	308·48	...
Randalls	...	Voided leases	...	...	...	...	...	...	60·04	33,099·85	11,089·30	...
		Sundry claims	...	...	...	...	...	20·70	8·11	4,691·56	1,188·34	...
Taurus	...	Voided leases	...	...	...	...	...	2·06	3·70	1,765·10	909·84	...
		Sundry claims	...	...	...	...	...	112·69	51·88	2,597·35	1,036·33	...
Trans Find ...	P.P.L. 308A ...	Dawn of Hope	...	...	...	...	...	...	2·87	792·25	286·93	...
		Voided leases	...	...	...	...	...	...	...	983·92	865·71	...
		Sundry claims	...	...	...	...	...	...	5·93	699·25	312·08	...
	From District generally :—											
	Sundry parcels treated at :											
	Various Works		...	...	...	...	...	...	...	6,102·15	6,675·38	...
	Reported by Banks and Gold Dealers		9·71	·71	...	...	...	25,193·43	70·15	·01	28·44	...
		Totals	**9·71**	**11·46**	**352·75**	**80·09**	...	**27,373·72**	**15,962·13**	**178,483·30**	**130,418·49**	**12·92**

Coolgardie Goldfield.

COOLGARDIE DISTRICT.

Bonnievale ...	5596	Jenny Wren	...	...	...	...	...	...	141·17	575·00	603·32	4·17
	4600	Melva's Maie	...	...	...	·23	...	...	...	1,461·65	3,128·75	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	614·50	1,099·21	11·63
	5321	Westralia Extended	...	...	...	...	...	...	...	164·50	37·54	...
		Voided leases	...	...	...	...	...	...	25·00	352,443·84	188,746·25	...
		Sundry claims	...	...	...	...	...	...	158·69	5,928·93	4,485·38	...
Bullabulling ...	...	Voided leases	...	...	...	...	...	...	...	776·81	668·19	...
		Sundry claims	...	...	...	...	...	5·21	15·98	1,308·26	558·48	...
Burbanks	5605	Burbanks Deeps	...	...	...	...	...	...	...	103·00	53·46	...
	5443	New Gift	...	...	...	...	...	...	2·00	601·00	206·10	...
	5250	Vice Regal	...	...	...	...	...	...	1·91	3,966·00	1,250·21	...
		Voided leases	...	...	...	...	...	14·90	372·17	415,584·71	304,569·63	521·06
		Sundry claims	...	1·43	86·00	33·31	...	55·05	463·21	13,910·10	8,381·27	...
Cave Rocks ...	5645	Goldcoin	...	...	...	...	...	...	...	242·75	39·30	...
	5665	Nornadeen	...	...	46·75	7·82	...	...	...	260·75	76·45	...
		Voided leases	...	...	...	...	...	...	...	2,302·05	588·18	...
		Sundry claims	...	...	...	...	...	...	50·00	3,415·65	785·28	...
Coolgardie ...	5679	Ada	...	...	260·00	30·68	...	...	...	382·00	48·35	...
	5637	Caledonia	...	...	...	...	...	...	7·30	1,471·50	225·75	...
	5297, etc. ...	Consolidated G.Ms. of Coolgardie, Ltd.	...	...	20,745·00	2,267·31	124·61	...	...	281,670·70	50,465·04	4,804·72
		Prior to transfer to present holders	...	...	...	...	...	...	4·55	1,946·35	547·45	3·22

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

COOLGARDIE GOLDFIELD—*continued.*

COOLGARDIE DISTRICT—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Coolgardie—*continued*	5653	Gleesons	...	...	...	...	...	...	...	1,925·00	922·37	...
	5680	Greenhills	...	...	...	...	...	...	...	16·00	8·48	...
	5638	Grey's Hill	...	...	...	...	...	...	...	129·00	87·50	...
	5577	Iron Duke	...	...	...	...	...	...	...	826·00	589·23	...
	5598	King Solomon	...	...	21·50	2·30	...	2·69	...	615·00	92·66	...
	5643	Lloyd George South	...	...	...	...	...	...	...	...	10·25	...
	5622	Lucky Hit	...	...	43·00	23·52	...	...	...	635·50	252·76	...
	5239, etc. ...	Phoenix Gold Mines, Limited	...	...	28,507·00	8,060·57	...	...	...	140,484·00	39,861·13	2·54
		Prior to transfer to present holders	...	...	...	...	...	...	2·74	167·56	237·80	...
		Voided leases	...	...	...	...	...	1,299·02	4,665·92	570,910·43	326,346·17	·96
		Sundry claims	...	6·53	153·50	69·98	...	203·33	2,673·45	63,418·28	23,446·98	...
Eundynie	5624	Eundynie	...	...	...	...	...	...	...	54·00	71·56	...
		Voided leases	...	...	...	...	...	·92	16·09	31,697·20	16,423·28	1·75
		Sundry claims	...	...	...	...	...	...	10·18	630·19	311·52	...
Gibralter	5217	Lloyd George	...	...	252·00	122·66	...	...	18·69	6,484·88	3,614·24	...
		Voided leases	...	...	...	...	...	...	15·28	31,849·75	16,424·07	...
		Sundry claims	...	...	...	...	...	1·39	50·76	2,823·20	1,259·75	...
Gnarlbine ...	...	Voided leases	...	...	...	...	...	...	13·95	2,731·75	1,341·60	...
		Sundry claims	...	...	...	...	...	...	4·90	1,186·10	504·18	...
Hampton Plains	P.P.L. 330 ...	Barbara	...	...	402·50	403·37	...	...	...	402·50	403·37	...
	P.P.L. 119 ...	Golden Eagle	...	...	...	...	...	...	7·63	2,807·59	2,548·42	...
	P.P.L. 319 ...	Lady May	...	...	792·50	504·74	...	...	...	812·50	529·49	...
	P.P.L. 315 ...	Malvern Star	...	...	...	...	...	...	...	16·00	10·14	...
	P.P.L. 316 ...	Surprise G.M.	...	...	268·50	69·35	...	...	...	5,497·50	2,851·04	...
		Voided leases	...	...	...	...	...	...	403·05	8,588·25	7,820·86	...
		Sundry claims	1·63	...	21·00	18·91	...	1·63	132·06	1,738·25	799·38	...
Higginsville ...	5647	Fair Play	...	...	1,613·00	304·78	...	...	...	6,689·00	1,365·65	...
	5662	Sons of Erin	...	...	...	...	...	...	...	68·05	139·85	...
	5293	Two Boys	...	...	100·00	152·62	...	...	...	7,348·00	3,694·90	...
	5666	War Time	...	...	20·00	18·38	...	...	26·28	40·00	61·97	...
		Voided leases	...	...	...	...	...	...	347·65	37,829·55	17,159·23	159·44
		Sundry claims	...	...	...	...	...	...	149·47	3,594·73	1,907·79	...
Larkinville ...	...	Voided leases	...	...	...	...	...	22·77	46·48	2,098·91	3,198·09	...
		Sundry claims	...	...	39·25	328·76	...	...	147·20	440·03	1,025·77	...
Logan's	5324, etc. ...	Spargo's Reward G.M. (1935), N.L. ...	...	...	...	...	...	...	...	105,397·50	26,318·11	...
	5681	Twenty Grand	...	...	17·50	42·76	...	...	...	17·50	42·76	...
		Voided leases	...	...	...	...	...	...	...	1,182·31	531·33	...
		Sundry claims	...	...	21·50	15·23	...	...	128·95	1,539·10	843·44	...

Londonderry ...	...	Voided leases	...	...	...	...	...	...	93·13	29,817·35	20,886·19	...
		Sundry claims	...	...	...	...	...	16·68	38·72	2,995·67	2,406·90	22·42
Mungari	...	Voided leases	...	...	...	...	...	...	17·71	735·00	331·78	...
		Sundry claims	...	...	...	...	...	1·77	151·34	1,104·44	433·74	...
Paris	5311, 5500 ...	Lister's G.M.	...	...	1,142·00	620·97	...	...	...	10,833·00	5,955·16	...
	5514	(Paris)	...	...	...	...	...	...	...	696·00	337·87	3·24
	5500	(Paris Central)	...	...	...	...	...	...	...	113·00	24·16	...
		Voided leases	...	...	...	...	...	...	4·30	463·00	209·47	...
		Sundry claims	...	...	...	...	...	...	...	2,037·25	501·81	...
Red Hill	...	Voided leases	...	...	...	...	...	14·87	1,551·81	40,797·40	31,070·65	...
		Sundry claims	...	...	...	...	...	15·29	90·11	1,306·52	704·47	...
Ryan's Find ...	...	Voided leases	...	...	...	...	...	...	...	54·16	151·69	...
		Sundry claims	...	...	...	...	...	...	·44	101·69	228·66	...
St. Ive's	5682	Alice May	...	...	20·00	5·81	...	...	...	20·00	5·81	...
	(5617), 5628, 5629	Ive's Reward leases	...	...	...	...	...	...	...	1,617·00	450·47	...
		Voided leases	...	...	...	...	...	61·90	146·87	37,600·46	15,603·59	...
		Sundry claims	...	...	...	...	...	211·25	944·85	4,078·56	1,441·72	...
Wannaway ...	...	Voided leases	...	...	...	...	...	...	19·10	1,813·35	1,047·89	...
		Sundry claims	...	...	...	...	...	...	175·11	1,101·42	1,150·43	...
Widgiemooltha ...	5451	Host Group	...	...	...	...	...	...	...	1,601·00	434·38	...
	5658	Iron Knob	...	...	...	...	...	...	6·02	145·00	52·19	...
		Voided leases	...	...	...	...	...	9·42	1,108·92	20,362·70	11,292·64	·17
		Sundry claims	...	...	25·50	30·11	...	46·49	415·81	15,171·21	6,536·40	...
	From District generally :—											
	Sundry parcels treated at :											
	State Battery, Coolgardie	...	...	...	*988·37	...	...	...	...	771·01	*30,950·26	*9·65
	Australian Machinery and Investment Company's Cyanide Plant	...	...	...	...	...	...	...	...	...	*2,905·79	*86·31
	Frank's Cyanide Plant	...	...	...	...	...	...	...	...	...	*1,343·17	...
	Imperial Cyanide Plant	...	...	...	...	...	...	...	...	26·00	*340·76	...
	Lister's Cyanide Plant	...	...	...	...	...	...	...	...	...	*269·23	...
	Paris Central Cyanide Plant	...	...	...	...	...	...	...	...	...	*77·64	...
	Parry's Cyanide Plant	...	...	...	...	...	...	...	...	...	*1,356·32	...
	Widgiemooltha Cyanide Plant	...	...	...	...	...	...	...	...	...	*1,165·31	...
	Various Works	...	...	...	...	...	...	7·75	...	3,871·61	*25,133·42	*223·06
	Reported by Banks and Gold Dealers	25·70	...	...	...	...	14,641·24	715·02	48·25	64·91	...
	Totals	**27·33**	**7·96**	**54,598·00**	**14,122·54**	**124·61**	**16,633·57**	**15,581·97**	**2,311,103·21**	**1,234,485·59**	**5,854·34**

KUNANALLING DISTRICT.

Carbine	970s	Carbine	...	...	...	...	...	...	...	13,820·00	7,047·96	...
	970s, etc. ...	Carbine leases	...	...	...	...	...	...	687·98	51,991·86	39,862·25	...
		Voided leases	...	...	...	...	...	...	...	20,116·00	5,470·81	...
		Sundry claims	...	...	...	...	...	136·08	93·96	5,851·53	1,946·07	...
Chadwin	1014s	Magdala	...	...	...	...	...	...	...	285·50	116·84	...
	1020s	Question Mark	...	...	124·00	169·59	...	...	...	407·00	563·46	...

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

COOLGARDIE GOLDFIELD—*continued.*

KUNUNALLING DISTRICT—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Chadwin—*continued.*		Voided leases	...	...	...	...	...	...	...	3,578·55	3,691·68	2·50
		Sundry claims	...	1·15	45·00	16·91	...	14·28	54·97	4,450·55	2,464·71	...
Dunnsville ...	...	Voided leases	...	...	...	...	...	...	828·58	17,489·60	8,642·30	...
		Sundry claims	...	...	15·50	19·24	...	2·82	1,020·90	2,316·31	1,716·25	...
Jourdie Hills ...	...	Voided leases	...	...	...	...	...	...	18·00	28,009·74	19,401·09	28·45
		Sundry claims	...	...	...	...	...	1·86	49·81	1,648·75	811·80	1·05
Kintore	...	Voided leases	...	...	...	...	...	18·70	169·33	54,044·64	39,197·31	677·88
		Sundry claims	...	7·77	16·25	6·74	...	111·91	102·70	2,792·38	1,999·27	...
Kunanalling ...	987s	Premier	...	...	410·00	213·95	...	·23	...	3,841·00	1,958·75	...
	919s, 987s ...	(Eureka Leases)	...	...	...	...	...	...	...	7,172·50	6,288·07	12·78
	988s	Premier North	...	...	...	...	...	...	...	410·00	288·08	...
		Voided leases	...	...	...	...	...	85·90	1,734·92	117,678·66	91,323·50	27·99
		Sundry claims	...	...	...	...	...	216·53	808·12	12,710·32	8,863·66	...
Kundana	...	Voided leases	...	...	...	...	...	...	...	465·00	68·12	...
		Sundry claims	...	...	...	...	...	...	...	305·25	34·63	...
		From District generally :—										
		Sundry Parcels treated at :										
		Goldfields Australian Development Treatment Works	...	...	...	*121·19	...	...	...	...	*484·82	...
		Various Works	...	...	...	...	...	42·23	...	1,782·26	*5,061·33	...
		Reported by Banks and Gold Dealers	5·87	...	...	...	...	856·16	17·93	...	5·85	·49
		Totals	**5·87**	**8·92**	**610·75**	**547·62**	...	**1,486·70**	**5,587·20**	**351,167·40**	**247,308·61**	**751·14**

Yilgarn Goldfield.

Blackbornes ...	...	Voided leases	...	...	...	...	...	...	...	1,282·50	341·37	...
		Sundry claims	...	...	...	...	...	...	...	340·50	74·59	...
Bullfinch	4020	Birthday	...	...	...	...	...	...	·95	8·00	60·05	...
	4042	Birthday South	...	...	...	...	...	...	1·03	15·00	50·50	...
	3345, etc. ...	Copperhead	...	...	...	...	...	...	...	7,427·32	2,076·32	...
	3378	Copperhead Deeps	...	...	...	...	...	...	...	13,554·65	4,102·83	...
	3337, 3458 ...	Easter Gift Leases	...	...	...	...	...	...	...	1,597·00	472·43	...
		Prior to transfer to present holders	...	...	...	...	...	...	48·03	3,594·26	1,169·82	...

	3400, etc. ...	Frances May	...	...	...	...	...	...	7·74	8,683·55	3,341·69	...
	3397	Goldfinch	...	...	...	...	...	...	6·73	6,456·03	2,634·10	...
	4009	Reynold's Find	...	...	...	...	...	...	...	241·00	114·95	...
	3350	Rising Sun	...	...	...	...	...	...	2·30	37,059·53	10,837·80	...
		Voided leases	...	...	...	...	...	...	10·14	489,929·07	185,333·68	27,958·41
		Sundry claims	...	...	...	...	...	8·47	37·04	7,284·75	3,949·16	...
Corinthian ...	3398, 3425 ...	Corinthian Leases	...	...	...	...	...	...	...	3,081·83	1,770·09	...
	3398... ...	(Corinthian)	...	...	...	...	...	...	...	7,383·75	2,543·16	...
	3425	(Corinthian North)	...	...	...	...	...	...	...	3,951·00	1,934·78	...
	3415	Deliverance	...	...	...	...	...	...	...	3,019·40	3,173·07	...
		Voided leases	...	...	...	...	...	...	...	135,095·00	30,011·76	...
		Sundry claims	...	...	...	...	...	...	·68	1,022·35	557·63	...
Eenuin	4067	Lone Pine	...	...	...	...	...	...	...	106·75	29·41	...
	4060	Star of Eenuin	...	...	80·00	53·45	...	...	2·33	390·25	279·33	...
	3893	Trump	...	...	10·00	4·66	...	...	...	10·00	4·66	...
	3936, etc. ...	Yellowdine Gold Areas, N.L.	...	...	...	...	...	...	...	7,341·50	7,605·06	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	281·00	418·04	...
		Voided leases	...	...	...	...	...	...	176·13	1,349·56	1,557·76	...
		Sundry claims	...	...	...	...	...	·60	73·97	2,291·60	1,602·46	...
Evanston	3895	Blue Peter	...	...	...	...	...	...	...	1,288·00	285·84	...
	3868	Evanston	...	...	...	1,334·85	...	...	...	48,125·30	25,848·30	10·14
	3870	Evanston East	...	...	...	...	...	...	...	34·00	13·59	...
	3869	Evanston North	...	...	...	...	...	...	...	1,598·76	1,079·93	...
	3888	Goldies	...	...	...	...	...	...	...	200·00	43·15	...
	3997	Gravel Pit	...	...	...	...	...	...	79·27	238·80	160·25	...
		Voided leases	...	...	...	...	...	...	...	649·00	230·70	...
		Sundry claims	...	...	...	...	...	4·98	...	503·35	133·66	...
Forrestonia ...	...	Voided leases	...	...	...	...	...	...	...	1,185·00	298·15	...
		Sundry claims	...	...	...	...	...	...	...	372·00	141·78	...
Golden Valley ...	3575	Great Bingin	...	...	...	...	...	...	...	16,771·00	10,248·61	...
	3573	(Marie's Find)	...	...	...	...	...	...	...	742·00	353·15	...
	3822	(Queen Marie)	...	...	...	...	...	...	...	180·50	164·83	...
	3248	Radio Deeps	...	...	72·00	18·38	...	...	...	5,532·58	6,270·53	...
	2994, etc. ...	Radio Leases	...	...	695·00	821·88	...	...	2·70	16,729·30	37,967·02	7·43
	3993	Stumpy Doodle	...	...	348·00	133·76	1·55	...	·58	2,280·00	824·22	8·99
		Voided leases	...	...	...	...	...	...	35·76	10,802·84	10,584·40	2·00
		Sundry claims	...	...	...	...	...	4·58	57·83	6,076·77	4,511·84	1·02
Greenmount ...	...	Voided leases	...	...	...	...	...	45·99	21·62	125,022·64	31,575·09	944·50
		Sundry claims	...	...	...	...	...	·46	4·27	2,856·58	779·67	...
Holleton	37PP	Brittania	...	...	...	...	...	...	...	278·00	423·91	...
	3923	Holleton East	...	...	320·00	44·38	...	...	...	4,244·00	425·21	2·74
		Voided leases	...	...	...	...	...	...	9·33	39,808·75	12,554·58	31·79
		Sundry claims	...	...	...	...	...	...	3·75	3,464·05	923·78	·20
Hopes Hill ...	3414	Pilot	...	...	...	...	...	...	...	19,446·12	2,948·68	...
	4033	Queen Elizabeth	...	...	...	...	...	...	...	113·00	46·22	...
		Voided leases	...	...	...	...	...	...	74·78	132,361·55	36,369·69	1·00
		Sundry claims	...	...	...	...	...	18·67	33·36	4,151·02	1,301·77	...
Kennyville ...	3875	Victoria	...	...	...	...	...	...	...	3,592·00	841·55	·63
		Voided leases	...	...	...	...	...	...	18·76	55,581·63	21,520·61	·59
		Sundry claims	...	...	...	...	...	...	5·06	8,237·50	2,137·54	...

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

Dundas Goldfield.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Buldania	...	Voided leases	...	...	...	...	...	...	3·02	846·05	708·99	...
		Sundry claims	...	...	...	...	...	...	36·53	1,281·02	837·20	·12
Dundas	...	Voided leases	...	...	...	...	...	1·88	28·02	6,103·48	2,545·38	155·02
		Sundry claims	...	...	...	...	...	·76	413·85	1,761·75	1,019·19	17·81
Norseman ...	1596	Abbotshall	...	...	84·75	78·67	6·65	...	...	2,447·20	1,051·81	751·65
	1656	Black Cat	...	...	25·50	46·26	3·95	...	...	25·50	46·26	3·95
	1382, etc. ...	Blue Bird Gold Mines, N.L.	...	...	...	...	...	...	1,663·32	10,927·00	24,299·51	1,617·21
		Prior to transfer to present holders	...	...	...	...	...	...	...	864·25	1,277·32	...
	1468	Bronzewing	...	...	924·25	422·15	40·20	...	33·89	1,550·50	1,201·03	70·06
	1617	Caesar	...	...	...	...	...	...	...	54·00	42·72	...
	1319, etc. ...	Central Norseman Gold Corporation, N.L.	...	...	71,521·00	29,674·84	18,680·57	...	...	686,111·20	256,868·79	249,903·60
	1386	(Valkyrie South Extended) ...	...	...	...	...	...	...	...	15·25	5·68	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	19,487·58	14,657·87	2,305·45
	1452	Cumberland Central	...	...	...	...	...	...	...	265·25	72·77	·19
	1462	Cumberland Central West ...	...	...	...	...	...	...	...	118·00	36·75	...
	1619	Dunkerque	...	...	37·75	16·39	1·35	...	...	240·75	234·59	4·39
	1637	Ellen Terry	...	...	146·50	202·80	23·57	...	...	425·75	650·30	60·84
	1421	Empress Gold Mines, N.L. ...	...	...	...	...	...	...	...	567·50	516·08	54·61
	1653	Houghton	...	9·00	...	...	·57	...	9·00	35·00	27·56	3·90
	1364	Lady Mary	...	...	...	...	...	...	...	99·00	15·45	...
	1490, etc. ...	Norseman Associated G.Ms., N.L. ...	...	...	...	...	...	...	...	17,917·00	3,216·75	4,981·00
		Prior to transfer to present holders	...	...	...	...	...	...	...	83·25	23·47	...
	1371, etc. ...	Norseman Developments, N.L. ...	...	...	...	...	...	...	...	38,102·00	7,532·50	12,586·00
		Prior to transfer to present holders	...	...	...	...	...	...	...	40·50	9·68	...
	1315, etc. ...	Norseman Gold Mines, N.L.	...	...	38,980·00	6,837·00	15,682·00	...	...	875,562·00	228,828·95	333,533·54
		Prior to transfer to present holders	...	...	...	...	...	...	...	2,656·75	669·38	...
	1588	O.K.	...	...	...	...	...	...	...	288·00	133·72	2·37
	1661	O.K. South	...	...	38·00	23·40	1·96	...	...	38·00	23·40	1·96
	1422	Onkaparinga	...	...	88·50	105·86	12·74	...	...	397·75	800·43	79·54
	1468, 1422 ...	Bronzewing and Onkaparinga (prior to cancellation of amalgamation)	...	...	...	...	...	...	...	843·00	1,396·98	3·62
	1660	Second Front	...	...	24·00	5·78	·33	...	...	24·00	5·78	·33
	1530	Second Try	...	...	625·00	302·57	42·01	...	4·37	816·75	373·77	50·81
	1657	Trump	...	...	174·25	79·75	8·34	...	...	174·25	79·75	8·34
	1624	Valhalla	...	...	11·00	8·33	·54	...	...	215·50	176·68	7·60
		Voided leases	...	...	...	...	...	9·31	10,551·37	891,402·47	585,967·60	36,638·93
		Sundry claims	...	...	283·50	196·82	16·91	1,041·31	3,377·55	43,824·41	21,085·11	148·21
Peninsula	1616	Day Dawn	...	...	...	...	...	...	...	364·75	414·21	3·60
	1597	Peninsula North	...	...	...	...	...	...	...	191·75	231·07	7·54
		Voided leases	...	...	...	...	...	...	24·29	8,817·14	5,373·87	...
		Sundry claims	...	...	...	...	...	...	...	203·00	108·18	·97
	From Goldfield generally :—											
	Sundry Parcels treated at :											
	State Battery, Norseman		...	...	...	...	...	...	...	405·39	*24,094·06	*1,023·65
	Princess Royal Cyanide Plant		...	...	...	*115·12	*73·73	...	...	...	*1,949·04	*1,571·78

TABLE I.—*Production of Gold and Silver from all sources, etc.*—continued.

YILGARN GOLDFIELD—*continued.*

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1944.					Total Production.				
			Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Silver.
			Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.
Koolyanobbing ...	...	Voided leases	...	...	...	...	...	...	...	1,707·05	884·28	...
		Sundry claims	...	...	...	...	...	·26	...	580·00	225·46	...
Marvel Loch ...	4046	Banker	...	...	...	...	...	...	...	50·00	19·67	...
	3987, etc. ...	Burbidge Gold Mines, N.L.	...	...	...	...	...	...	...	72,785·00	7,404·15	...
	3987	(Grand National)	...	...	...	...	...	...	...	19,739·00	2,647·30	...
	4003	Christmas Gift	...	...	...	...	...	...	1·40	90·00	46·58	...
	3957	Comet	...	...	...	...	...	...	...	1,067·00	639·66	6·85
	13PP	Cricket	...	...	...	...	...	...	...	1,616·00	921·75	...
	3966	Donovan's Find	...	...	80·00	8·76	...	...	...	200·05	56·02	...
	3942, 3943 ...	Edward's Reward Leases ...	...	...	1,280·00	620·59	...	...	...	17,787·50	9,171·60	...
	3942	(Edwards Reward)	...	...	...	...	...	...	...	2,080·00	2,016·32	...
	3943	(Sunshine)	...	...	...	...	...	...	...	3,866·00	2,384·79	...
	4034	Firelight	...	...	...	...	...	...	...	645·00	117·54	...
	3724	Francis Firness	...	...	...	...	...	...	...	8,012·00	3,731·76	...
	3941	Geelong	...	...	10·00	1·23	...	...	1·95	413·50	73·37	...
	3683	Golden Cube	...	...	117·00	47·45	...	...	20·27	1,310·00	653·54	...
	4074	Greenbird	...	...	40·00	93·82	...	...	...	40·00	93·82	...
	3718	Kurrajong	...	...	...	...	...	...	...	9,106·00	3,231·11	...
	4047	Lennenberg"s Reward	...	...	...	...	...	...	...	341·00	32·40	...
	3431, etc. ...	Lenodo Leases	...	...	...	2·99	...	...	...	5,006·00	1,042·92	·36
		Prior to transfer to present holders	...	...	...	...	...	...	...	1,056·00	177·67	...
	3914	May	...	...	...	...	...	...	...	145·00	45·86	...
	3459	May Queen	...	...	...	...	...	...	...	3,738·00	6,922·23	...
	4073	Mountain King	...	...	17·00	8·75	...	...	...	17·00	8·75	...
	3970	Mountain Queen	...	...	20·00	110·66	...	...	...	496·00	364·90	...
	3390, etc. ...	N.G.M., Ltd.	...	...	...	...	...	...	...	4,067·50	351·36	·50
		Prior to transfer to present holders	...	...	...	...	...	...	...	2,675·00	459·60	...
	4068	Try Again	...	...	250·00	142·15	...	...	...	390·00	175·28	...
	4035	Undaunted	...	...	...	...	...	...	...	742·00	92·19	...
	4006	Union Jack	...	...	...	...	...	...	...	907·00	177·74	1·04
		Voided leases	...	...	...	...	...	...	385·60	626,945·16	176,930·88	2,464·70
		Sundry claims	...	1·45	79·00	23·01	...	11·35	215·63	33,204·84	12,833·49	...
Mt. Jackson ...	3449	Die Hardy	...	...	...	...	...	...	...	365·50	343·86	...
	3859	Great Unknown	...	...	...	...	...	...	14·71	708·50	650·97	...
	3418	Clamp's Central	...	...	...	...	...	...	...	1,232·50	665·35	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	7,224·00	6,457·63	6·34
		Voided leases	...	...	...	...	...	...	164·60	44,202·28	30,726·43	2,307·43
		Sundry claims	...	...	30·00	10·04	...	6·44	52·87	9,841·85	4,463·45	70·74
Mt. Palmer ...	3544, etc. ...	Yellowdine Gold Development, Ltd. ...	...	...	3,756·00	1,996·94	...	...	...	304,234·50	155,374·82	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	1,564·65	2,540·71	...

	3400, etc. ...	Frances May	...	...	...	...	...	...	7·74	8,683·55	3,341·69	...
	3397	Goldfinch	...	...	...	...	...	...	6·73	6,456·03	2,634·10	...
	4009	Reynold's Find	...	...	...	...	...	...	...	241·00	114·95	...
	3350	Rising Sun	...	...	...	...	...	...	2·30	37,059·53	10,837·80	...
		Voided leases	...	...	...	...	...	...	10·14	489,929·07	185,333·68	27,958·41
		Sundry claims	...	...	...	...	...	8·47	37·04	7,284·75	3,949·16	...
Corinthian ...	3398, 3425 ...	Corinthian Leases	...	...	...	...	...	...	...	3,081·83	1,770·09	...
	3398... ...	(Corinthian)	...	...	...	...	...	...	...	7,383·75	2,543·16	...
	3425	(Corinthian North)	...	...	...	...	...	...	...	3,951·00	1,934·78	...
	3415	Deliverance	...	...	...	...	...	...	...	3,019·40	3,173·07	...
		Voided leases	...	...	...	...	...	...	...	135,095·00	30,011·76	...
		Sundry claims	...	...	...	...	...	...	·68	1,022·35	557·63	...
Eenuin	4067	Lone Pine	...	...	...	...	...	...	...	106·75	29·41	...
	4060	Star of Eenuin	...	...	80·00	53·45	...	...	2·33	390·25	279·33	...
	3893	Trump	...	...	10·00	4·66	...	...	...	10·00	4·66	...
	3936, etc. ...	Yellowdine Gold Areas, N.L.	...	...	...	...	...	...	...	7,341·50	7,605·06	...
		Prior to transfer to present holders	...	...	...	...	...	...	...	281·00	418·04	...
		Voided leases	...	...	...	...	...	...	176·13	1,349·56	1,557·76	...
		Sundry claims	...	...	...	...	...	·60	73·97	2,291·60	1,602·46	...
Evanston	3895	Blue Peter	...	...	...	...	...	...	...	1,288·00	285·84	...
	3868	Evanston	...	...	...	1,334·85	...	...	...	48,125·30	25,848·30	10·14
	3870	Evanston East	...	...	...	...	...	...	...	34·00	13·59	...
	3869	Evanston North	...	...	...	...	...	...	...	1,598·76	1,079·93	...
	3888	Goldies	...	...	...	...	...	...	...	200·00	43·15	...
	3997	Gravel Pit	...	...	...	...	...	...	79·27	238·80	160·25	...
		Voided leases	...	...	...	...	...	...	...	649·00	230·70	...
		Sundry claims	...	...	...	...	...	4·98	...	503·35	133·66	...
Forrestonia ...	...	Voided leases	...	...	...	...	...	...	...	1,185·00	298·15	...
		Sundry claims	...	...	...	...	...	...	...	372·00	141·78	...
Golden Valley ...	3575	Great Bingin	...	...	...	...	...	...	...	16,771·00	10,248·61	...
	3573	(Marie's Find)	...	...	...	...	...	...	...	742·00	353·15	...
	3822	(Queen Marie)	...	...	...	...	...	...	...	180·50	164·83	...
	3248	Radio Deeps	...	...	72·00	18·38	...	...	...	5,532·58	6,270·53	...
	2994, etc. ...	Radio Leases	...	...	695·00	821·88	...	...	2·70	16,729·30	37,967·02	7·43
	3993	Stumpy Doodle	...	...	348·00	133·76	1·55	...	·58	2,280·00	824·22	8·99
		Voided leases	...	...	...	...	...	...	35·76	10,802·84	10,584·40	2·00
		Sundry claims	...	...	...	...	...	4·58	57·83	6,076·77	4,511·84	1·02
Greenmount ...	...	Voided leases	...	...	...	...	...	45·99	21·62	125,022·64	31,575·09	944·50
		Sundry claims	...	...	...	...	...	·46	4·27	2,856·58	779·67	...
Holleton	37PP	Brittania	...	...	...	...	...	...	...	278·00	423·91	...
	3923	Holleton East	...	...	320·00	44·38	...	...	...	4,244·00	425·21	2·74
		Voided leases	...	...	...	...	...	...	9·33	39,808·75	12,554·58	31·79
		Sundry claims	...	...	...	...	...	...	3·75	3,464·05	923·78	·20
Hopes Hill ...	3414	Pilot	...	...	...	...	...	...	...	19,446·12	2,948·68	...
	4033	Queen Elizabeth	...	...	...	...	...	...	...	113·00	46·22	...
		Voided leases	...	...	...	...	...	...	74·78	132,361·55	36,369·69	1·00
		Sundry claims	...	...	...	...	...	18·67	33·36	4,151·02	1,301·77	...
Kennyville ...	3875	Victoria	...	...	...	...	...	...	...	3,592·00	841·55	·63
		Voided leases	...	...	...	...	...	...	18·76	55,581·63	21,520·61	·59
		Sundry claims	...	...	...	...	...	...	5·06	8,237·50	2,137·54	...

		Various Works	...	...	...	...	...	...	54·52	483·14	*12,857·24	*844·36
		Reported by Banks and Gold Dealers	...	...	...	...	...	1,180·87	41·03	47·50	18·62	·43
		Totals	...	9·00	112,964·00	38,115·74	34,595·42	2,234·13	16,240·76	2,616,124·33	1,201,485·49	646,443·38

Phillips River Goldfield.

Hatter's Hill ...	...	Voided leases	...	...	...	...	...	...	4·38	1,499·55	1,182·75	...
		Sundry claims	...	...	6·00	4·60	...	74·91	21·69	5,225·60	2,720·90	26·09
Kundip	249, etc. ...	Beryl Gold Mines, Ltd.	...	...	...	...	...	...	...	2,365·00	2,330·52	197·78
	261	Gem Restored	...	...	...	...	...	...	...	68·00	10·29	...
		Voided leases	...	...	...	...	...	113·28	556·17	82,109·58	58,196·98	3,811·03
		Sundry claims	...	...	...	...	...	90·27	72·84	6,404·18	1,939·25	54·65
Mt. Desmond ...	...	Voided leases	...	...	...	...	...	...	1·40	9·00	3,905·46	6,891·59
		Sundry claims	...	...	...	...	...	...	...	...	32·81	51·01
Ravensthorpe ...	...	Voided leases	...	...	...	...	...	...	141·80	24,723·55	26,070·94	4,384·07
		Sundry claims	...	...	...	...	...	163·96	7·68	7,251·57	3,194·41	41·12
West River ...	...	Voided leases	...	...	...	...	...	...	...	...	10·34	31·06
		Sundry claims	...	...	...	3·31	...	...	...	...	6·60	3·44
	From Goldfield generally :—											
	Sundry parcels treated at :											
	Cordingup Cyanide Plant	...	...	...	...	...	...	...	...	...	*909·37	4·36
	Floater Cyanide Plant	...	...	...	...	...	...	...	...	12·00	*242·50	...
	Daw and Toleman's Cyanide Plant	...	...	...	4·84	...	...	...	...	...	*342·19	...
	J. T. Hunt's Smelter Reserve	...	...	...	2·54	2·80	...	...	...	...	2·54	2·80
	Kundip Cyanide Plant	...	...	...	...	...	...	...	...	15·00	*15·25	...
	Various Works	...	...	...	...	...	...	...	...	...	*1,925·45	493·66
	Reported by Banks and Gold Dealers	...	·67	...	...	...	164·69	12·14	...	...	...
	Totals	...	**·67**	**6·00**	**15·29**	**2·80**	**607·11**	**818·10**	**129,683·03**	**103,038·55**	**15,992·66**

Outside Proclaimed Goldfield.

Burracoppin ...	...	Voided leases	...	...	...	...	...	...	...	710·85	706·38	...
		Sundry claims	...	...	...	...	...	...	...	372·75	213·97	...
Donnybrook ...	...	Voided leases	...	...	...	...	...	23·24	...	1,613·30	816·23	...
		Sundry claims	...	...	...	...	...	44·01	42·29	119·50	15·71	15·18
Jimperding ...	45PP	Hillsdale	...	...	...	...	...	...	...	1,261·75	298·05	...
Roebourne ...	68H, 70H ...	Corderoy Mines, Ltd.	...	...	...	...	...	...	...	1,954·50	451·44	10·79
		Voided leases	...	...	...	...	...	177·74	93·21	19,975·11	22,105·90	1,258·16
		Sundry claims	...	...	...	...	...	46·39	88·97	1,074·35	845·13	99·11
	Reported by Banks and Gold Dealers	...	...	...	...	...	6,063·75	170·45	103·50	228·32	...
	From State generally :—											
	Sundry parcels treated at :											
	Fremantle Smelter, Ltd.	...	...	...	...	...	...	...	...	...	1,879·08	1,109·06
	Various Works	...	...	...	...	...	...	...	...	27·00	7,233·06	30,417·57
	Sundry Specimens	...	...	...	...	...	4·24	56·85	...	...	...
	Voided leases and sundry claims	...	...	...	...	...	245·45	14·13	201·60	43·58	...
	Reported by Banks and Gold Dealers	1·15	8·33	...	...	...	980·55	829·51	...	240·14	59·99
	Totals	**1·15**	**8·33**	...	...	...	**7,585·37**	**1,295·41**	**27,414·21**	**35,076·99**	**32,969·86**

TABLE II.

PRODUCTION OF GOLD AND SILVER FROM ALL SOURCES, SHOWING IN FINE OUNCES THE OUTPUT, AS REPORTED TO THE MINES DEPARTMENT DURING THE YEAR 1944.

Goldfield.	District.	DISTRICT.						GOLDFIELD.					
		Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Total Gold.	Silver.	Alluvial.	Dollied and Specimens.	Ore treated.	Gold therefrom.	Total Gold.	Silver.
		Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lbs.).	Fine ozs.	Fine ozs.	Fine ozs.
Kimberley	... ...							199·20	...	...	...	199·20	...
Pilbara	Marble Bar ...	·60	9·62	14,793·90	14,046·24	14,056·46	...	61·31	48·14	15,629·90	14,592·20	14,701·65	...
	Nullagine ...	60·71	38·52	836·00	545·96	645·19	...						
Ashburton	... ...	...	...	...	...	...	...	17·50	...	...	...	17·50	...
Gascoyne	... ...	...	...	...	...	...	...	...	...	...	...	...	...
Peak Hill	... ...	...	...	...	...	...	...	12·72	108·78	206·50	443·74	565·24	...
East Murchison ...	Lawlers ...	·36	...	19,364·00	4,889·75	4,890·11	...	4·11	239·86	489,038·25	58,498·84	58,742·81	...
	Wiluna ...	3·75	3·29	468,760·50	51,978·15	51,985·19	...						
	Black Range ...	...	236·57	913·75	1,630·94	1,867·51	...						
Murchison	Cue	513·76	117·88	2,032·25	1,091·32	1,722·96	2·48	568·93	135·16	40,489·25	17,563·16	18,267·25	183·98
	Meekatharra ...	41·31	·78	1,957·50	2,137·23	2,179·32	...						
	Day Dawn ...	...	...	1,632·00	2,833·02	2,833·02	...						
	Mt. Magnet ...	13·86	16·50	34,867·50	11,501·59	11,531·95	181·50						
Yalgoo	... ...	...	...	...	...	...	...	4·68	...	1,749·11	921·61	926·29	86·78
Mt. Margaret ...	Mt. Morgans ...	33·82	18·13	1,529·75	2,181·67	2,233·62	...	42·89	35·84	75,119·71	27,464·13	27,542·86	1,982·50
	Mt. Malcolm ...	5·80	4·35	73,359·36	23,605·73	23,615·88	1,982·50						
	Mt. Margaret...	3·27	13·36	230·60	1,676·73	1,693·36	...						
North Coolgardie ...	Menzies ...	·59	132·00	6,467·25	4,854·40	4,986·99	...	13·76	175·83	6,854·25	5,261·71	5,451·30	...
	Ularring ...	12·72	39·99	288·50	311·92	364·63	...						
	Niagara ...	...	2·38	98·50	92·91	95·29	...						
	Yerilla ...	·45	1·46	...	2·48	4·39	...						
Broad Arrow ...	... ...	...	...	...	...	...	...	22·97	310·20	1,764·50	2,027·92	2,361·09	...
N.E. Coolgardie ...	Kanowna ...	27·12	2·61	548·00	419·48	449·21	455·82	27·41	8·60	558·25	429·02	465·03	455·82
	Kurnalpi ...	·29	5·99	10·25	9·54	15·82	...						
East Coolgardie ...	East Coolgardie	37·55	440·43	956,820·62	279,080·51	279,558·49	92,440·91	47·26	451·89	957,173·37	279,160·60	279,659·75	92,440·91
	Bulong ...	9·71	11·46	352·75	80·09	101·26	...						
Coolgardie	Coolgardie ...	27·33	7·96	54,598·00	14,122·54	14,157·83	124·61	33·20	16·88	55,208·75	14,670·16	14,720·24	124·61
	Kunanalling ...	5·87	8·92	610·75	547·62	562·41	...						
Yilgarn	... ...	...	...	...	...	...	...	...	1·45	20,366·65	10,816·39	10,817·84	291·22
Dundas	... ...	...	...	...	...	...	...	...	9·00	112,964·00	38,115·74	38,124·74	34,595·42
Phillips River ...	... ...	...	...	...	...	...	...	...	·67	6·00	15·29	15·96	2·80
Outside Proclaimed Goldfields ...		...	...	...	...	...	...	1·15	8·33	...	...	9·48	...
		...	...	...	...	...	...	**1,057·09**	**1,550·63**	**1,777,128·49**	**469,980·51**	**472,588·23**	**130,164·04**

TABLE III.

RETURN SHOWING TOTAL PRODUCTION REPORTED TO THE MINES DEPARTMENT, AND RESPECTIVE DISTRICTS AND GOLDFIELDS FROM WHENCE DERIVED, TO 31ST DECEMBER, 1944.

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	... ...	...	...	...	...	...	...	7,825·20	142·43	22,453·15	17,036·31	25,003·94	93·00
Pilbara	Marble Bar ...	14,697·34	4,410·08	261,075·62	275,313·86	294,421·28	755·05	24,284·99	5,051·54	333,713·31	365,054·54	394,391·07	783·72
	Nullagine ...	9,587·65	641·46	72,637·69	89,740·68	99,969·79	28·67						
Ashburton	... ...	...	...	...	...	...	...	9,238·48	406·39	5,684·25	2,398·70	12,043·57	8,183·68
Gascoyne	... ...	...	...	...	...	...	...	677·52	41·57	387·00	517·29	1,236·38	...
Peak Hill	... ...	...	...	...	...	...	...	3,374·41	5,107·11	609,260·68	291,235·47	299,716·99	2,311·33
East Murchison ...	Lawlers ...	6,856·05	2,277·48	1,920,106·26	798,652·07	807,785·60	26,279·64	8,695·78	21,650·63	11,987,062·57	3,507,947·83	3,538,294·24	51,663·06
	Wiluna ...	222·36	1,239·11	8,348,194·34	1,766,207·46	1,767,668·93	2,889·42						
	Black Range ...	1,617·37	18,134·04	1,718,761·97	943,088·30	962,839·71	22,494·00						
Murchison	Cue	4,931·92	7,687·69	3,371,736·89	912,956·86	925,576·47	118,589·05	24,614·60	56,474·46	8,957,057·76	4,149,960·16	4,231,049·22	295,179·73
	Meekatharra ...	14,228·03	17,426·57	2,223,855·49	1,265,520·00	1,297,174·60	5,042·27						
	Day Dawn ...	2,989·08	11,066·29	2,014,498·28	1,331,335·84	1,345,391·21	169,210·44						
	Mt. Magnet ...	2,465·57	20,293·91	1,346,967·10	640,147·46	662,906·94	2,337·97						
Yalgoo	... ...	...	...	...	...	...	...	1,740·94	2,923·09	429,049·21	255,540·76	260,204·79	1,497·00
Mt. Margaret ...	Mt. Morgans ...	3,301·03	9,262·04	1,196,659·36	694,647·66	707,210·73	5,781·64	10,964·85	32,558·83	9,366,582·84	4,381,690·47	4,425,214·15	214,135·87
	Mt. Malcolm ...	3,731·21	13,998·40	5,706,198·74	2,550,989·23	2,568,718·84	146,761·05						
	Mt. Margaret...	3,932·61	9,298·39	2,463,724·74	1,136,053·58	1,149,284·58	61,593·18						
North Coolgardie ...	Menzies ...	1,613·21	6,300·53	1,446,004·44	1,170,419·29	1,178,333·03	29,736·86	4,749·01	18,354·07	2,988,171·84	2,167,883·30	2,190,986·38	42,290·73
	Ularring ...	119·76	6,495·45	367,903·85	342,541·94	349,157·15	6,098·46						
	Niagara ...	1,704·65	1,813·65	924,337·52	512,859·30	516,377·60	5,603·42						
	Yerilla ...	1,311·39	3,744·44	249,926·03	142,062·77	147,118·60	851·99						
Broad Arrow ...	... ...	...	...	...	...	...	...	21,870·50	26,013·84	1,268,048·35	690,703·26	738,587·60	5,262·41
N.E. Coolgardie ...	Kanowna ...	106,399·53	12,605·62	996,136·46	621,604·11	740,609·26	3,039·73	119,219·32	20,855·00	1,009,285·78	640,024·33	780,098·65	3,050·95
	Kurnalpi ...	12,819·79	8,249·38	13,149·32	18,420·22	39,489·39	11·22						
East Coolgardie ...	East Coolgardie	33,190·16	39,799·05	49,457,969·02	26,551,149·17	26,624,138·38	3,372,247·14	60,563·88	55,761·18	49,636,452·32	26,681,567·66	26,797,892·72	3,372,260·06
	Bulong ...	27,373·72	15,962·13	178,483·30	130,418·49	173,754·34	12·92						
Coolgardie	Coolgardie ...	16,633·57	15,581·97	2,311,103·21	1,234,485·59	1,266,701·13	5,854·34	18,120·27	21,169·17	2,662,270·61	1,481,794·20	1,521,083·64	6,605·48
	Kunanalling ...	1,486·70	5,587·20	351,167·40	247,308·61	254,382·51	751·14						
Yilgarn	... ...	...	...	...	...	...	...	2,179·74	2,828·57	3,563,997·46	1,636,044·32	1,641,052·63	38,324·85
Dundas	... ...	...	...	...	...	...	...	2,234·13	16,240·76	2,616,124·33	1,201,485·49	1,219,960·38	646,443·38
Phillips River ...	... ...	...	...	...	...	...	...	607·11	818·10	129,683·03	103,038·55	104,463·76	15,992·66
Outside Proclaimed Goldfields ...		...	...	...	...	...	...	7,585·37	1,295·41	27,414·21	35,076·99	43,957·77	32,969·86
		...	...	...	...	...	...	**328,546·10**	**287,692·15**	**95,612,698·70**	**47,608,999·63**	**48,225,237·88**	**4,737,047·77**

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, 1944; 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 1941	22,422·06	11,689·42	34,111·48	147,356·01	259,976·84	407,332·85
1941	....	806·73	806·73	128·64	20,330·75	20,459·39
1942	....	605·88	605·88	127·94	15,747·25	15,875·19
1943	....	249·60	249·60		16,222·38	16,222·38
1944	....	154·00	154·00	234·60	12,871·67	13,106·27
Total	22,422·06	13,505·63	35,927·69	147,847·19	325,148·89	472,996·08
	(*a*) WEST PILBARA.			ASHBURTON.		
Prior to 1941	4,351·11	26,760·61	31,111·72	4,104·96	5,112·45	9,217·41
1941	....	....	....	....	551·08	551·08
1942	....	....	....	....	95·42	95·42
1943	....	....	....	....	33·57	33·57
1944	....	....	....	....	69·21	69·21
Total	4,351·11	26,760·61	31,111·72	4,104·96	5,861·73	9,966·69
	(*b*) GASCOYNE.			(*c*) PEAK HILL.		
Prior to 1941	304·55	1,061·25	1,365·80	41,102·76	200,627·23	241,729·99
1941	....	2·64	2·64	....	1,332·11	1,332·11
1942	....	....	....	....	253·82	253·82
1943	....	....	....	....	388·52	388·52
1944	....	....	....	....	446·42	446·42
Total	304·55	1,063·89	1,368·44	41,102·76	203,048·10	244,150·86
	EAST MURCHISON.			MURCHISON.		
Prior to 1941	245,377·25	2,600,276·81	2,845,654·06	1,570,967·62	2,701,462·26	4,272,429·88
1941	2,864·92	108,328·38	111,193·30	1,324·84	103,960·74	105,285·58
1942	3,850·32	82,262·14	86,112·46	853·58	85,325·67	86,179·25
1943	3,025·25	63,725·90	66,751·15	568·11	25,431·99	26,000·10
1944	23·76	44,926·42	44,950·18	1·18	16,304·32	16,305·50
Total	255,141·50	2,899,519·65	3,154,661·15	1,573,715·33	2,932,484·98	4,506,200·31
	(*d*) YALGOO.			(*e*) MT. MARGARET.		
Prior to 1941	13,505·95	180,030·30	193,536·25	677,220·07	3,467,093·63	4,144,313·70
1941	37·98	4,864·43	4,902·41	12,357·47	52,765·11	65,122·58
1942	6·80	2,981·14	2,987·94	1,867·53	41,497·11	43,364·64
1943	22·42	1,272·93	1,295·35	411·87	24,666·82	25,078·69
1944	....	1,042·47	1,042·47	297·57	23,414·33	23,711·90
Total	13,573·15	190,191·27	203,764·42	692,154·51	3,609,437·00	4,301,591·51
	(*f*) NORTH COOLGARDIE.			(*g*) BROAD ARROW.		
Prior to 1941	262,987·28	1,921,517·78	2,184,505·06	122,301·32	375,090·00	497,391·32
1941	74·33	24,708·48	24,782·81	22·91	16,164·60	16,187·51
1942	12·82	19,339·58	19,352·40	69·14	8,950·04	9,019·18
1943	97·63	8,220·58	8,318·21	46·24	7,318·34	7,364·58
1944	3·08	5,937·46	5,940·54	8·56	2,398·22	2,406·78
Total	263,175·14	1,979,723·88	2,242,899·02	122,448·17	409,921·20	532,369·37
	(*f*) NORTH-EAST COOLGARDIE.			(*f*) EAST COOLGARDIE.		
Prior to 1941	235,806·62	454,062·55	689,869·17	6,965,688·08	19,707,011·21	26,672,699·29
1941	5·38	1,102·87	1,108·25	47,377·28	524,307·42	571,684·70
1942	19·42	494·60	514·02	7,246·74	443,509·94	450,756·68
1943	6·03	395·36	401·39	828·72	316,369·51	317,198·23
1944	38·71	492·21	530·92	488·24	293,919·88	294,408·12
Total	235,876·16	456,547·59	692,423·75	7,021,629·06	21,285,117·96	28,306,747·02
	(*h*) COOLGARDIE.			YILGARN.		
Prior to 1941	662,485·68	1,050,818·24	1,713,303·92	216,929·54	1,373,370·22	1,590,299·76
1941	87·60	45,060·80	45,148·40	495·43	54,327·48	54,822·91
1942	58·32	32,199·57	32,257·89	929·82	30,765·37	31,695·19
1943	172·36	16,897·52	17,069·88	600·83	14,505·05	15,105·88
1944	48·59	14,022·60	14,071·19	87·90	9,287·35	9,375·25
Total	662,852·55	1,158,998·73	1,821,851·28	219,043·52	1,482,255·47	1,701,208·99
	(*i*) DUNDAS.			(*j*) PHILLIPS RIVER.		
Prior to 1941	168,377·05	929,280·43	1,097,657·48	40,569·02	58,910·70	99,479·72
1941	437·48	80,771·37	81,208·85	2·14	2,453·97	2,456·11
1942	74·13	66,630·78	66,704·91	23·50	964·46	987·96
1943	40·35	44,115·34	44,155·69	1·88	80·80	82·68
1944	376·43	38,559·52	38,935·95	5·85	106·99	112·84
Total	169,305·44	1,159,357·44	1,328,662·88	40,602·39	62,516·92	103,119·31
	¶ DONNYBROOK.			OUTSIDE PROCLAIMED GOLDFIELDS.		
Prior to 1941	282·21	557·53	839·74	19,368·36	32,841·25	52,209·61
1941	....	....	....	709·54	1,553·00	2,262·54
1942	....	....	....	536·42	881·20	1,417·62
1943	....	....	....	586·65	172·87	759·52
1944	....	....	....	210·52	486·69	697·21
Total	282·21	557·53	839·74	21,411·49	35,935·01	57,346·50

(*a*) Prior to 1st May, 1898, included with Pilbara, and abolished 12th July, 1929. (*b*) Prior to March, 1899, included with Ashburton. (*c*) From 1st August, 1897. (*d*) Prior to 1st April, 1897, included with Murchison. (*e*) From 1st August, 1897. (*f*) Prior to 1st May, 1896, included with Coolgardie. (*g*) From 1st September, 1897. (*h*) Declared 5th April, 1894, to which date included with Yilgarn. (*i*) Prior to 1893, included with Yilgarn. (*j*) Prior to 1902, included in Outside Proclaimed Goldfields. ¶ Abolished 4th March, 1908.

TABLE V.

TOTAL OUTPUT OF GOLD BULLION, CONCENTRATES, ETC., ENTERED FOR EXPORT AND RECEIVED AT THE PERTH BRANCH OF THE ROYAL MINT.

FROM 1st JANUARY, 1886.

Year.	Export.	Mint.	Total.	Estimated Value.
	fine ozs.	fine ozs.	fine ozs.	£A.
1886	270·17	...	270·17	1,147
1887	4,359·37	...	4,359·37	18,518
1888	3,124·82	...	3,124·82	13,273
1889	13,859·52	...	13,859·52	58,871
1890	20,402·42	...	20,402·42	86,664
1891	27,116·14	...	27,116·14	115,182
1892	53,271·65	...	53,271·65	226,284
1893	99,202·50	...	99,202·50	421,385
1894	185,298·73	...	185,298·73	787,099
1895	207,110·20	...	207,110·20	879,749
1896	251,618·69	...	251,618·69	1,068,808
1897	603,846·44	...	603,846·44	2,564,977
1898	939,489·49	...	939,489·49	3,990,697
1899	1,283,360·25	187,244·41	1,470,604·66	6,246,732
1900	894,387·27	519,923·59	1,414,310·86	6,007,610
1901	923,686·96	779,729·56	1,703,416·52	7,235,654
1902	707,039·75	1,163,997·60	1,871,037·35	7,947,661
1903	833,685·78	1,231,115·62	2,064,801·40	8,770,719
1904	810,616·04	1,172,614·03	1,983,230·07	8,424,226
1905	655,089·88	1,300,226·00	1,955,315·88	8,305,654
1906	562,250·59	1,232,296·01	1,794,546·60	7,622,749
1907	431,803·14	1,265,750·45	1,697,553·59	7,210,750
1908	356,353·96	1,291,557·17	1,647,911·13	6,999,881
1909	386,370·58	1,208,898·83	1,595,269·41	6,776,274
1910	233,970·34	1,236,661·68	1,470,632·02	6,246,848
1911	160,422·28	1,210,445·24	1,370,867·52	5,823,075
1912	83,577·12	1,199,080·87	1,282,657·99	5,448,385
1913	86,255·13	1,227,788·15	1,314,043·28	5,581,701
1914	51,454·65	1,181,522·17	1,232,976·82	5,237,352
1915	17,340·47	1,192,771·23	1,210,111·70	5,140,228
1916	26,742·17	1,034,655·87	1,061,398·04	4,508,532
1917	9,022·49	961,294·67	970,317·16	4,121,646
1918	15,644·12	860,867·03	876,511·15	3,723,183
1919	6,445·89	727,619·90	734,065·79	3,618,509
1920	5,261·13	612,581·00	617,842·13	3,598,931
1921	7,170·74	546,559·92	553,730·66	2,942,526
1922	5,320·16	532,926·12	538,246·28	2,525,812
1923	5,933·82	498,577·59	504,511·41	2,232,186
1924	2,585·20	482,449·78	485,034·98	2,255,927
1925	3,910·59	437,341·56	441,252·15	1,874,320
1926	3,188·22	434,154·98	437,343·20	1,857,715
1927	3,359·10	404,993·41	408,352·51	1,734,572
1928	3,339·30	390,069·19	393,408·49	1,671,093
1929	3,037·12	374,138·96	377,176·08	1,602,142
1930	1,753·09	415,765·00	417,518·09	1,864,442
1931	1,726·66	508,845·36	510,572·02	2,998,137
1932	3,887·07	601,674·33	605,561·40	4,403,642
1933	2,446·97	634,760·40	637,207·37	4,886,254
1934	3,520·40	647,817·95	651,338·35	5,558,873
1935	9,868·71	639,180·38	649,049·09	5,702,149
1936	55,024·58	791,183·21	846,207·79	7,373,539
1937	71,646·91	928,999·84	1,000,646·75	8,743,755
1938	113,620·06	1,054,171·13	1,167,791·19	10,363,023
1939	98,739·88	1,115,497·76	1,214,237·64	11,842,964
1940	71,680·47	1,119,801·08	1,191,481·55	12,696,503
1941	65,925·94	1,043,391·96	1,109,317·90	11,851,445
1942	15,676·48	832,503·97	848,180·45	8,865,495
1943	6,408·34	540,067·08	546,475·42	5,710,668
1944	1,824·99	464,439·76	466,264·75	4.899 997
Total	11,511,344·93	38,237,951·80	49,749,296·73	271,286,134

	1943.	1944.
	£	£
Estimated total par value of above production	209,340,969	211,321,534
Premiums received on sales of gold during 1920–1924 and 1930–1944 (approximate)	57,045,168	59,964,600
Estimated Total	£A266,386,137	£A271,286,134
Gross estimated value of gold won (including £161,448, bonus paid under the Commonwealth Bounty Act, 1930)	£A266,547,585	£A271,447,582

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 1944, AND PREVIOUS YEARS.

Period.	ALUNITE (POTASH).						ARSENIC.*	
	Yilgarn Goldfield.		State Generally.		Total.		East Murchison Goldfield (Wiluna District).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1941	....	....	*32·30	195	*32·30	195	22,930·70	412,753
1941	....	....	....	....	....	....	3,378·00	70,938
1942	....	....	....	....	....	....	2,727·00	57,267
1943	....	....	....	....	....	....	2,283·00	47,943
1944	943·20	14,229	....	....	943·20	14,229	2,304·00	48,384
Total	**943·20**	**14,229**	***32·30**	**195**	....	**14,424**	**33,622·70**	**637,285**

* Untreated.

* By-product from Wiluna G.Ms., Ltd.

Period.	ANTIMONY.							
	East Murchison Goldfield.		Pilbara Goldfield.		State Generally.		Total.	
	Quantity.†	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1941	1,529·77	26,469	3·13	39	11·58	491	1,544·48	26,999
1941	307·61	12,484	1·10	55	....	....	308·71	12,539
1942	*2,370·00	64,539	*19·42	505	....	....	2,389·42	65,044
1943	*1,471·00	52,602	*4·94	311	....	....	1,475·94	52,913
1944	*12·00	1,230	*3·60	252	....	....	15·60	1,482
Total	**5,690·38**	**157,324**	**32·19**	**1,162**	**11·58**	**491**	**5,734·15**	**158,977**

* Concentrates. † By-product from Moonlight Wiluna and Wiluna G.Ms.

Period.	ASBESTOS.							
	Ashburton Goldfield.		Pilbara Goldfield.		State Generally.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1941	10·00	959	1,645·00	73,104	*1,246·00	29,625	*2,900·71	*103,688
1941	....	....	5·00	175	56·27	2,791	61·27	2,968
1942	....	....	....	....	119·03	5,788	119·03	5,788
1943	....	....	12·25	456	230·83	12,519	243·08	12,975
1944	....	....	2·00	200	306·53	10,655	308·53	10,856
Total	**10·00**	**959**	**1,664·25**	**73,935**	**1,958·66**	**61,378**	**3,632·62**	**136,275**

* Includes 5 tons valued at £20 from East Coolgardie Goldfield.

Period.	BERYL.									
	Pilbara Goldfield.		Murchison Goldfield.		Coolgardie Goldfield.		State Generally.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1941	....	....	....	....	....	....	9·00	76	9·00	76
1941	....	....	....	....	....	....	·55	7	·55	7
1942	....	....	....	....	....	....	....	....	....	....
1943	476·75	13,560	....	....	....	....	38·81	1,204	515·56	14,764
1944	302·11	9,055	21·53	659	28·71	861	37·80	1,381	390·15	11,956
Total	**778·86**	**22,615**	**21·53**	**659**	**28·71**	**861**	**26·16**	**2,668**	**915·26**	**26,803**

TABLE VI.—*Minerals other than Gold*—continued.

Period.	Bentonite.		Bismuth Concentrates.		Clays.					
	State Generally.		State Generally.		Collie Mineral Field.		State Generally.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity	Value.	Quantity.	Value.
	tons.	£	lbs.	£	tons.	£	tons.	£	tons.	£
Prior to 1941	....	....	3,398·40	1,029	1,051·00	738	3,900·00	2,512	4,951·00	3,250
1941	....	....	....	....	....	....	1,399·55	894	1,399·55	894
1942	15·70	33	....	....	....	....	797·50	449	797·50	449
1943	159·03	337	560·00	137	....	....	2,111·75	1,387	2,111·75	1,387
1944	290·90	660	1,466·00	482	....	....	1,615·50	1,726	1,615·50	1,726
Total	**465·63**	**1,030**	**5,424·40**	**1,648**	**1,051·00**	**738**	**9,824·30**	**6,968**	**10,875·30**	**7,706**

Period.	Coal.		Copper Ore.									
	Collie Coalfield.		West Kimberley Goldfield.		Pilbara Goldfield.				West Pilbara Goldfield.		Ashburton Goldfield.	
					Marble Bar District.		Nullagine District.					
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1941	14,974,254·30	9,870,045	109·00	1,709	33·00	386	14·00	480	82,745·00	748,482	352·00	6,431
1941	556,573·72	389,278	....	....	....	....	....	....	....	....	....	....
1942	581,175·81	461,495	....	....	....	....	....	....	....	....	....	....
1943	531,546·38	489,721	....	....	....	....	....	....	....	....	....	....
1944	558,322·11	583,076	....	....	....	....	....	....	....	....	....	....
Total	**17,201,872·32**	**11,793,615**	**109·00**	**1,709**	**33·00**	**386**	**14·00**	**480**	**82,745·00**	**748,482**	**352·00**	**6,431**

Period.	Copper Ore—*continued.*											
	Peak Hill Goldfield.		East Murchison Goldfield. (Lawlers District).		Murchison Goldfield.		Yalgoo Goldfield.		Northampton Mineral Field.		Yandanooka Mineral Field.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1941	1,030·00	32,364	238·00	4,364	1,024·00	11,236	39·00	413	24,026·00	119,497	172·00	1,889
1941	....	....	....	....	....	....	....	....	....	....	....	....
1942	13·25	268	9·43	152	....	....	....	....	....	....	....	....
1943	....	....	·40	33	....	....	....	....	....	....	....	....
1944	....	....	26·80	183	18·00	54	....	....	....	....	....	....
Total	**1,043·25**	**32,632**	**274·63**	**4,732**	**1,042·00**	**11,290**	**39·00**	**413**	**24,026·00**	**119,497**	**172·00**	**1,889**

Period.	Copper Ore—*continued.*									
	Mt. Margaret Goldfield.		North Coolgardie Goldfield. (Menzies District).		East Coolgardie Goldfield (East Coolgardie District).		Phillips River Goldfield.		Yilgarn Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1941	47,861·00	230,846	6·00	51	51·00	330	95,743·00	588,359	....	....
1941	....	....	....	....	....	*49	6·10	105	....	....
1942	....	....	....	....	....	....	9·40	241	16·00	77
1943	....	....	....	....	....	....	....	....	....	....
1944	....	....	....	....	....	....	†1·21	*130	....	....
Total	**47,861·00**	**230,846**	**6·00**	**51**	**†51·00**	**379**	**95,759·71**	**588,835**	**16·00**	**77**

* Metallic value. † Incomplete.

Period.	Copper Ore—*continued.*				Diatomaceous Earth.		Dolomite.		Diamonds.		Emeralds.	
	State Generally.		Total.		State Generally.		Murchison Goldfield. (Mt. Magnet District).		Pilbara Goldfield. (Nullagine District).		Murchison Goldfield. (Cue District).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	carats.	£	carats (cut and rough).	£
Prior to 1941	22·00	410	253,465·00	1,747,247	....	....	....	....	....	24	18,373·00	1,609
1941	....	....	6·10	154	....	....	....	....	....	....	....	....
1942	....	....	48·08	738	....	....	....	....	....	....	....	....
1943	....	....	·40	33	40·00	640	....	....	....	....	....	....
1944	....	....	46·01	367	....	....	158·51	795	....	....	....	....
Total	**22·00**	**410**	**253,565·59**	**1,748,539**	**40·00**	**640**	**158·51**	**795**	....	**24**	**18,373·00**	**1,609**

TABLE VI.—*Minerals other than Gold*—continued.

Period.	EMERY.		FELSPAR.						GLASS SAND.	
	State Generally.		Coolgardie Goldfield.		State Generally.		Total.		State Generally.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1941	....	....	20,869·25	41,637	298·00	596	21,167·25	42,233	30·00	33
1941	....	....	3,990·00	11,970	117·00	220	4,107·00	12,190	22·00	25
1942	13·00	130	3,240·50	9,712	11·00	22	3,251·50	9,734	111·00	141
1943	....	....	2,289·00	6,867	24·50	57	2,313·50	6,924	340·30	304
1944	....	....	1,881·00	10,376	77·50	155	1,958·50	10,531	157·50	204
Total	**13·00**	**130**	**32,269·75**	**80,562**	**528·00**	**1,050**	**32,797·75**	**81,612**	**660·30**	**707**

Period.	GADOLINITE.		GLAUCONITE.		GRAPHITE.		LEAD ORE.			
	Pilbara Goldfield. (Marble Bar District).		State Generally.		State Generally.		Northampton Mineral Field.		State Generally.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1941	1·00	112	1,992·00	13,783	1·10	12	416,714·89	1,280,207	107·00	1,529
1941	....	....	155·50	3,888	....	....	....	....	....	....
1942	....	....	260·00	6,500	6·00	30	....	....	....	....
1943	....	....	98·00	2,450	11·00	55	1,250·00	1,100	....	....
1944	....	....	144·00	3,600	....	....	....	....	....	....
Total	**1·00**	**112**	**2,649·50**	**30,221**	**18·10**	**97**	**417,964·89**	**1,281,307**	**107·00**	**1,529**

Period.	LEAD ORE—*continued.*		LIMESTONE.							
	Total.		Murchison Goldfield (Cue District.).		Yilgarn Goldfield.		State Generally.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons	£	tons.	£	tons.	£
Prior to 1941	416,821·89	1,281,736	298·00	772	2,548·00	1,607	90,859·00	15,911	93,705·00	18,290
1941	....	....	....	....	....	....	....	....	....	....
1942	....	....	....	....	....	....	....	....	....	....
1943	1,250·00	1,100	....	....	....	....	....	....	....	....
1944	....	....	....	....	....	....	....	....	....	....
Total	**418,071·89**	**1,282,836**	**298·00**	**772**	**2,548·00**	**1,607**	**90,859·00**	**15,911**	**93,705·00**	**18,290**

Period.	GYPSUM.						IRON ORE.	
	Yilgarn Goldfield.		State Generally.		Total.		State Generally.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1941	11,389·69	10,810	92,228·00	110,719	103,546·69	121,529	....	....
1941	132·00	159	9,381·00	10,086	9,513·00	10,245	....	....
1942	....	....	2,877·55	3,136	2,877·55	3,136	150·00	225
1943	....	....	935·30	880	935·30	880	84·35	128
1944	....	....	3,604·45	3,722	3,604·45	3,722	....	....
Total	**11,521·69**	**10,969**	**109,026·30**	**128,543**	**120,476·99**	**139,512**	**234·35**	**353**

Period.	MAGNESITE.						MANGANESE.		PHOSPHATIC GUANO.	
	East Coolgardie Goldfield (Bulong District).		Coolgardie Goldfield.		Total.		Peak Hill Goldfield.		State Generally.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1941	824·40	1,053	267·00	242	1,091·41	1,295	77·00	436	39·23	273
1941	100·00	87	....	....	100·00	87	....	....	20·50	41
1942	....	....	25·00	100	25·00	100	....	....	....	....
1943	....	....	....	....	....	....	....	....	42·00	21
1944	....	....	....	....	....	....	....	....	2,215·00	12,183
Total	**924·40**	**1,140**	**292·00**	**342**	**1,216·41**	**1,482**	**77·00**	**436**	**2,316·73**	**12,518**

TABLE VI.—*Minerals other than Gold*—continued.

Period.	Ironstone.								Mica.	
	West Pilbara Goldfield.		East Coolgardie Goldfield (East Coolgardie District).		State Generally.		Total.		State Generally.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	lbs.	£
Prior to 1941	100·00	300	450·00	247	57,280·00	36,148	57,830·00	36,695	*2,852·00	507
1941	....	....	....	....	....	....	....	....	†6,160·00	25
1942	....	....	....	....	....	....	....	....	389·00	115
1943	....	....	....	....	....	....	....	....	13,907·75	715
1944	....	....	....	....	....	....	....	....	8,367·50	1,279
Total	100·00	300	450·00	247	57,280·00	36,148	57,830·00	36,695	31,676·25	2,641

* Includes 1,708 lbs. Crude Mica. † Crude Mica.

Period.	Pyrites.		Red Oxide.									
	Dundas Goldfield.		Pilbara Goldfield. (Nullagine District).		East Coolgardie Goldfield.		Murchison Goldfield (Cue District).		State Generally.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons	£	tons.	£	tons.	£	tons	£	tons.	£	tons.	£
Prior to 1941	....	....	380·40	3,782	....	....	....	....	26·00	78	406·40	3,860
1941	....	....	287·00	2,870	....	....	....	....	....	....	287·00	2,870
1942	368·00	607	....	....	....	....	....	....	143·00	1,360	143·00	1,360
1943	10,189·00	19,078	....	....	15·35	46	....	....	382·00	3,820	397·00	3,866
1944	23,702·00	68,340	....	....	20·00	80	74·00	563	851·00	7,064	945·00	7,707
Total	34,259·00	88,025	667·40	6,652	35·35	126	74·00	563	1,402·00	12,322	2,178·75	19,663

Period.	Silver Lead Ore.						Soapstone.					
	Pilbara Goldfield (Marble Bar District).		Ashburton Goldfield.		Total.		Greenbushes Mineral Field.		State Generally.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1941	195·00	3,658	2,974·00	35,796	3,169·00	39,454	....	....	....	....	....	....
1941	....	....	....	....	....	....	....	....	....	....	....	....
1942	....	....	....	....	....	....	255·00	950	10·00	25	265·00	975
1943	....	....	....	....	....	....	....	....	....	....	....	....
1944	....	....	....	....	....	....	262·00	828	....	....	262·00	828
Total	195·00	3,658	2,974·00	35,796	3,169·00	39,454	517·00	1,778	10·00	25	527·00	1,803

Period.	Talc.		Vermiculite.							
	East Coolgardie Goldfield.		East Coolgardie Goldfield. (Bulong District).		Yilgarn Goldfield.		State Generally.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1941	....	....	95·40	677	....	....	44·00	330	139·40	1,007
1941	....	....	....	....	....	....	160·35	962	160·35	962
1942	38·00	57	....	....	....	....	178·40	1,070	178·40	1,070
1943	72·55	170	....	....	20·00	60	342·80	2,057	362·80	2,117
1944	....	....	....	....	....	....	123·00	738	123·00	738
Total	110·55	227	95·40	677	20·00	60	848·55	5,157	963·95	5,894

Period.	Tin.											
	Kimberley Goldfield.				Pilbara Goldfield (Marble Bar District).				East Murchison Goldfield.			
	Quantity.			Value.	Quantity.			Value.	Quantity.			Value.
	Lode.	Stream.	Total.		Lode.	Stream.	Total.		Lode.	Stream.	Total.	
	tons.	tons.	tons.	£	tons.	tons.	tons.	£	tons.	tons.	tons.	£
Prior to 1941	....	....	....	....	372·62	5,523·82	5,896·44	545,723	....	....	....	....
1941	....	....	....	....	....	5·86	5·86	1,105	....	....	....	....
1942	....	....	....	....	....	10·70	10·70	2,265	....	....	....	....
1943	....	·60	·60	143	....	4·60	4·60	1,022	·14	....	·14	53
1944	....	....	....	....	9·87	....	9·87	2,175	....	....	....	....
Total	....	·60	·60	143	382·49	5,544·98	5,927·47	552,290	·14	....	·14	53

TABLE VI.—*Minerals other than Gold*—continued.

Period.	TIN—*continued.* Greenbushes Mineral Field. Quantity. Lode.	Stream.	Total.	Value.	Total. Quantity. Lode.	Stream.	Total.	Value.	TANTALITE. Pilbara Goldfield (Marble Bar District). Quantity. Lode.	Stream.	Total.	Value.
	tons.	tons.	tons.	£	tons.	tons.	tons.	£	tons.	tons.	tons.	£
Prior to 1941	473·18	10,833·63	6·81	991,602	840·70	16,356·82	*17,202·99	*1,537,746	84·31	160·67	244·98	113,955
1941	4·13	·95	5·08	769	4·13	6·81	10·94	1,874	....	....	....	....
1942	9·26	3·45	12·71	2,369	9·26	14·15	23·41	4,634	·68	....	·68	314
1943	5·69	·18	5·87	1,097	5·83	5·38	11·21	2,315	·87	....	·87	779
1944	·90	....	·90	176	10·77	....	10·77	2,351	10·20	....	10·20	12,916
Total	**488·06**	**10,837·58**	**11,325·64**	**996,013**	**870·69**	**16,383·16**	**17,259·32**	**1,548,920**	**96·06**	**160·67**	**236·72**	**127,964**

Period.	TANTALITE—*continued.* Greenbushes Mineral Field. Quantity. Lode.	Stream.	Total.	Value.	Total. Quantity. Lode.	Stream.	Total.	Value.	TIN-TANTALUM. Greenbushes Mineral Field. Quantity.	Value. (Tin content only)
	tons.	tons.	tons.	£	tons.	tons.	tons.	£	tons.	£
Prior to 1941	....	3·94	3·94	2,009	*86·81	164·61	251·42	*118,304	....	....
1941	....	....	....	....	....	....	....	....	....	....
1942	....	·17	·17	157	·68	·17	·85	471	....	....
1943	8·78	1·95	10·73	11,054	9·65	1·95	11·60	†11,833	....	....
1944	....	....	....	....	10·20	....	10·20	†12,916	20·16	2,045
Total	**8·78**	**6·06**	**14·84**	**13,120**	**107·34**	**166·73**	**274·07**	†143,524	**20·16**	**2,045**

* Includes 2·50 tons valued at £2,340 from Coolgardie Goldfield. † Incomplete.

Period.	WOLFRAM. Broad Arrow Goldfield. Quantity.	Value.	Yalgoo Goldfield. Quantity.	Value.	State Generally. Quantity.	Value.	Total. Quantity.	Value.	SCHEELITE. Murchison Goldfield. Quantity.	Value.	Yalgoo Goldfield. Quantity.	Value.
	units.	£	units.	£	units.	£	units.	£	units.	£	units.	£
Prior to 1941	....	....	....	....	*601	1,506	*601	1,506	....	....	....	....
1941	....	....	....	....	....	....	....	....	....	....	....	....
1942	16	88	*1	*8	....	....	*17	*96	....	....	....	....
1943	....	....	*14	*80	....	....	*14	*80	....	....	194	1,050
1944	....	....	....	....	....	....	....	....	11	59	....	....
Total	**16**	**88**	**15**	**88**	**601**	**1,506**	**632**	**1,682**	**11**	**59**	**194**	**1,050**

* Incomplete.

Period.	SCHEELITE—*continued.* Broad Arrow Goldfield. Quantity.	Value.	Coolgardie Goldfield (Coolgardie District). Quantity.	Value.	North Coolgardie Goldfield (Menzies District). Quantity.	Value.	Yilgarn Goldfield. Quantity.	Value.	Dundas Goldfield. Quantity.	Value.	Total. Quantity.	Value.
	units.	£	units.	£	units.	£	units.	£	units.	£	units.	£
Prior to 1941	70	175	689	2,115	388	970	....	....	4	10	1,151	3,270
1941	....	....	34	101	....	....	....	....	....	....	34	101
1942	....	....	58	321	10	36	....	....	....	....	68	357
1943	....	....	281	1,540	7	24	8	41	2	9	492	2,664
1944	....	....	16	90	....	....	3,873	21,271	....	....	3,900	21,420
Total	**70**	**175**	**1,078**	**4,167**	**405**	**1,030**	**3,881**	**21,312**	**6**	**19**	**5,645**	**27,812**

TABLE VII.

Quantity and Value of Minerals, other than Gold and Silver, reported during year, 1944.

Number of Lease, Claim, or Area.	Goldfield.	Registered Name of Company or Lease.	Quantity.		Value.
		ALUNITE.			
			tons.	Potash tons.	£A.
M.Ls. 41 and 43 (Yil) ...	Yilgarn ...	State (W.A.) Alunite Industries ...	19,236·00	943·20	14,228·50
		ANTIMONY.			
G.M.L. 231L	Pilbara ...	Blue Spec Mines, N.L.	...	3·60	251·95
G.M.L. 10J	East Murchison	Moonlight Wiluna G.Ms., Ltd. ...	46·00	12·00	1,230·00
			...	15·60	1,481·95
		ARSENIC.			
G.M.L. 667J	East Murchison	Wiluna G.Ms., Ltd.	2,304·00	...	48,384·00
		ASBESTOS—(Anthophyllite).			
Private Property (Bindi Bindi)	State generally	Associated Engineer's Corp'n., Ltd. ...	23·00	...	225·65
		ASBESTOS—(Chrysotile).			
M.C. 165	Pilbara ...	W. P. King & Sons	2·00	...	200·00
M.C. 263H (Nunnyerri) ...	State generally	King & Stein	10·04	...	455·55
		ASBESTOS—(Crocidolite).			
M.C. 269H (Yampire Gorge)	State generally	Australian Blue Asbestos, Ltd. ...	217·25	...	7,447·00
M.Cs. 177H, 248H, 249H (Hamersley Range)	State generally	I. Walters	24·00	...	1,050·00
M.C. 221H (Hamersley Range)	State generally	West Australian Blue Asbestos Fibres Co. Ltd.	32·24	...	1,477·00
			308·53	...	10,855·20
		BENTONITE.			
M.Cs. 258H, 282H (Marchagee)	State generally	W. G. Fennell	290·90	...	659·53
		BERYL.			
M.Cs. 106, 107, 109 (Wodgina)	Pilbara ...	Commonwealth Govt. Project 83 ...	245·14	...	6,883·50
Crown Lands	Pilbara ...	... ...	2·68	...	92·00
P.A. 2104 (Wodgina) ...	Pilbara ...	G. Lamont	46·68	...	1,784·90
P.A. 2096 (Wodgina) ...	Pilbara ...	A. E. Rogers	3·32	...	128·30
P.A. 3071 (Poona) ...	Murchison ...	A. S. Giles	15·50	...	465·00
P.A. 3073 (Poona) ...	Murchison ...	G. Rule	6·03	...	194·00
M.L. 80, etc. (Londonderry)	Coolgardie ...	Australian Glass Manufacturers Pty. ...	28·71	...	861·30
M.C. 111H (Balingup) ...	State generally	V. C. Oma	·10	...	2·00
M.C. 291H (Yinnietharra)	State generally	A. B. Thompson	11·51	...	447·65
P.A. 815H (Yinnietharra)	State generally	G. H. Burt	14·91	...	526·50
M.C. 291H (Yinnietharra)	State generally	Commonwealth Govt. Project 58 ...	2·50	...	83·50
	State generally	F. A. Moss	8·78	...	321·00
P.A. 2116	State generally	G. Hooley	4·29	...	165·85
			390·15	...	11,955·50
		BISMUTH.			
			Ore tons.	Metal lbs.	
M.C. 173H (Yinnietharra)	State generally	F. A. Moss	52·00	1,466·00	482·00
		CLAYS.			
			tons.		
M.Cs. 130H, 150H, 179H, 286H, 304H (Clackline)	State generally	Clackline Firebrick Co.	1,359·50	...	689·85
M.C. 247H (Mt. Kokeby)	State generally	J. B. Linton	124·00	...	620·00
M.Cs. 294H, 295H (Marchagee)	State generally	E. E. Rendle	132·00	...	416·00
			1,615·50	...	1,725·85

TABLE VII—*continued.*

Quantity and Value of Minerals, other than Gold and Silver, reported during year 1944.

Number of Lease, Claim, or Area.	Goldfield.	Registered Name of Company or Lease.	Quantity.		Value.
		COAL.	tons.		£A.
M.Ls. 314, etc.	Collie Mineral Field	Griffin Coal Mining Co. Ltd.	78,481·90	...	74,706·10
		Wyvern Colliery	9,670·30	...	9,224·10
M.Ls. 85, etc.	Collie Mineral Field	Amalgamated Collieries of W.A.—			
		Cardiff Mine	76,095·16	...	79,573·93
		Co-operative Mine	76,687·27	...	84,009·16
		Proprietary Mine	143,159·06	...	155,354·28
		Stockton Mine	107,449·22	...	114,681·48
		Stockton Open Cut	66,779·20	...	65,526·53
			558,322·11	...	583,075·58
		COPPER ORE.	Ore tons.	Metal tons.	
P.A. 1323 (Lawlers) ...	East Murchison	V. E. Carter	7·30	·66	31·00
P.A. 1895B (Barrambie)	East Murchison	C. H. Krug	19·50	2·00	117·00
G.M.L. 667 (Wiluna) ...	East Murchison	Wiluna G.Ms., Ltd.	...	·35	35·00
P.A. 2986N (Yaloginda)	Murchison ...	E. Walsh and A. Ricci	18·00	1·28	54·18
L.T.T. 977H (Ravensthorpe)	Phillips River	J. T. Hunt	1·21	·34	34·20
P.A. 689 (Ravensthorpe)	Phillips River	Belli & Warnes	...	·96	96·00
			46·01	5·59	367·38
		DOLOMITE.			
M.L. 10M, 11M (Mt. Magnet)	Murchison ...	Atkinson & Giles	27·45	...	137·00
P.A. 3003M (Mt. Magnet)	Murchison ...	Atkinson & Giles	131·06	...	657·50
			158·51	...	794·50
		FELSPAR.			
M.L. 80, etc. (Londonderry)	Coolgardie ...	Australian Glass Manufacturers Co. Ltd.	1,881·00	...	10,375·50
M.C. 111H (Balingup) ...	State generally	V. C. Oma	77·50	...	155·00
			1,958·50	...	10,530·50
		GLASS SAND.			
P.A. 820H (East Wanneroo)	State generally	R. J. Leach	5·50	...	5·50
M.Cs. 161H, 162H, 285H (East Wanneroo)	State generally	W. M. Leach	152·00	...	198·65
			157·50	...	204·15
		GLAUCONITE.	Greensand tons.	Glauconite tons.	
Private Property (Gin Gin)	State generally	G. E. Brook	720·00	144·00	3,600·00
		GYPSUM.			
M.Cs. 33H, etc. (Woolundra)	State generally	Ajax Plaster Co. Ltd.	293·00	...	336·95
M.Cs. 110H, etc. (Baandee)	State generally	Perth Modelling Works	1,248·45	...	1,261·50
M.Cs. 293H (Woolundra)...	State generally	P. Ripper	918·00	...	1,255·70
M.Cs. 280H (Lake Brown)	State generally	G. R. Saunders (Jr.)	1,145·00	...	868·00
			3,604·45	...	3,722·15
		MICA.	lbs.		
Project 58 (Yinnietharra)	State generally	Commonwealth Government	8,367·50	...	1,279·35
		PHOSPHATIC GUANO.	tons.		
Lands Department ...	State generally	British Phosphate Commissioners ...	2,215·00	...	12,182·50

TABLE VII.—*continued.*

Quantity and Value of Minerals, other than Gold and Silver, reported during year 1944.

Number of Lease, Claim, or Area.	Goldfield.	Registered Name of Company or Lease.	Quantity.		Value.
		PYRITES.	Pyritic Ore. tons.	Pyrites. tons.	£A.
G.M.Ls. 1460, 1481, 1502 (Norseman)	Dundas ...	Norseman G.Ms., N.L.	43,748·00	23,702·00	68,340·00
		RED OCHRE.		tons.	
P.A. 3051 (Cue)	Murchison ...	J. E. Cassidy and W. Gregory ...	...	30·00	255·00
P.A. 3050 (Cue)	Murchison ...	J. C. Zadow	...	44·00	308·00
M.C. 8E (Mt. Monger) ...	East Coolgardie	E. E. Rendle	...	20·00	80·00
P.A. 825H (Ophthalmia Range)	State generally	W. Howard	...	93·00	1,066·00
M.L. 370H (Ophthalmia Range)	State generally	Smith & Dodds	...	758·00	5,998·00
			...	945·00	7,707·00
		SOAPSTONE.			
M.C. 46 (Bridgetown) ...	Greenbushes Mineral Field	E. S. Mabey	...	262·00	828·00
		TANTALITE.			
P.A. 2096 (Kangan Station)	Pilbara ...	A. E. Rogers	17·00	·04	70·00
Project 83 (Pilbara) ...	Pilbara ...	Commonwealth Government	...	8·21	12,781·42
			...	1·61	not yet known
Crown Land	Pilbara ...	... ...	...	·07	65·00
			...	·27	not yet known
		TIN.			
D.C. 16 (Moolyella) ...	Pilbara ...	R. Brompton-Byrns	1·00	1·00	225·00
M.Ls. 313, 362 (Tabba Tabba)	Pilbara ...	Crawford Bros.	...	·55	100·00
Marble Bar	Pilbara ...	Sundry claims	...	8·32	1,850·00
M.C. 4 (Greenbushes) ...	Pilbara ...	Freeman & Collett	...	·90	176·35
			...	10·77	2,351·35
		TIN AND TANTALUM.			
M.C. 9 (Greenbushes) ...	Greenbushes	Freeman & Collett	...	4·11	474·70
M.C. 40 (Greenbushes) ...	Greenbushes	Freeman & Collett	...	·99	114·10
M.C. 40 (Greenbushes) ...	Greenbushes	Freeman & Collett	...	5·17	not yet known
M.C. 1 (Greenbushes) ...	Greenbushes	Tantalite Ltd.	...	4·63	739·05
M.C. 4 (Greenbushes) ...	Greenbushes	Vulcan	...	·50	...
M.C. 1 (Greenbushes) ...	Greenbushes	Tantalite Ltd. (Mixed SNO_3)	...	2·21	267·45
D.Cs. 97 and 99 (Greenbushes)	Greenbushes	J. M. & J. B. Joice	1,600·00	2·55	450·00
			...	20·16	2,045·30

TUNGSTEN ORES—SCHEELITE.

Number of Lease, Claim, or Area.	Goldfield.	Registered Name of Company or Lease.	Quantity.				Value.
			Ore tons.	Sheelite tons.	WO_3 tons.	Units.	£A.
M.C. 25 (Callie Spring)	Murchison ...	F. A. Moss	...	·16	·11	11	59·00
G.M.L. 5668 (Higginsville)	Coolgardie ...	M. J. Mahoney	3·00	·25	·16	16	90·00
T.L. 132 (Westonia) ...	Yilgarn ...	Edna May (W.A.) Amalgamated G.Ms., N.L.	32,177·00	59·43	38·74	3,873	21,270·64
			32,180·00	59·84	39·01	3,900	21,419·64

VERMICULITE.

Number of Lease, Claim, or Area.	Goldfield.	Registered Name of Company or Lease.	Quantity.	Value.
			tons.	£A.
M.C. 187H (Young River)	State generally	G. Halbert	... 123·00	738·00

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