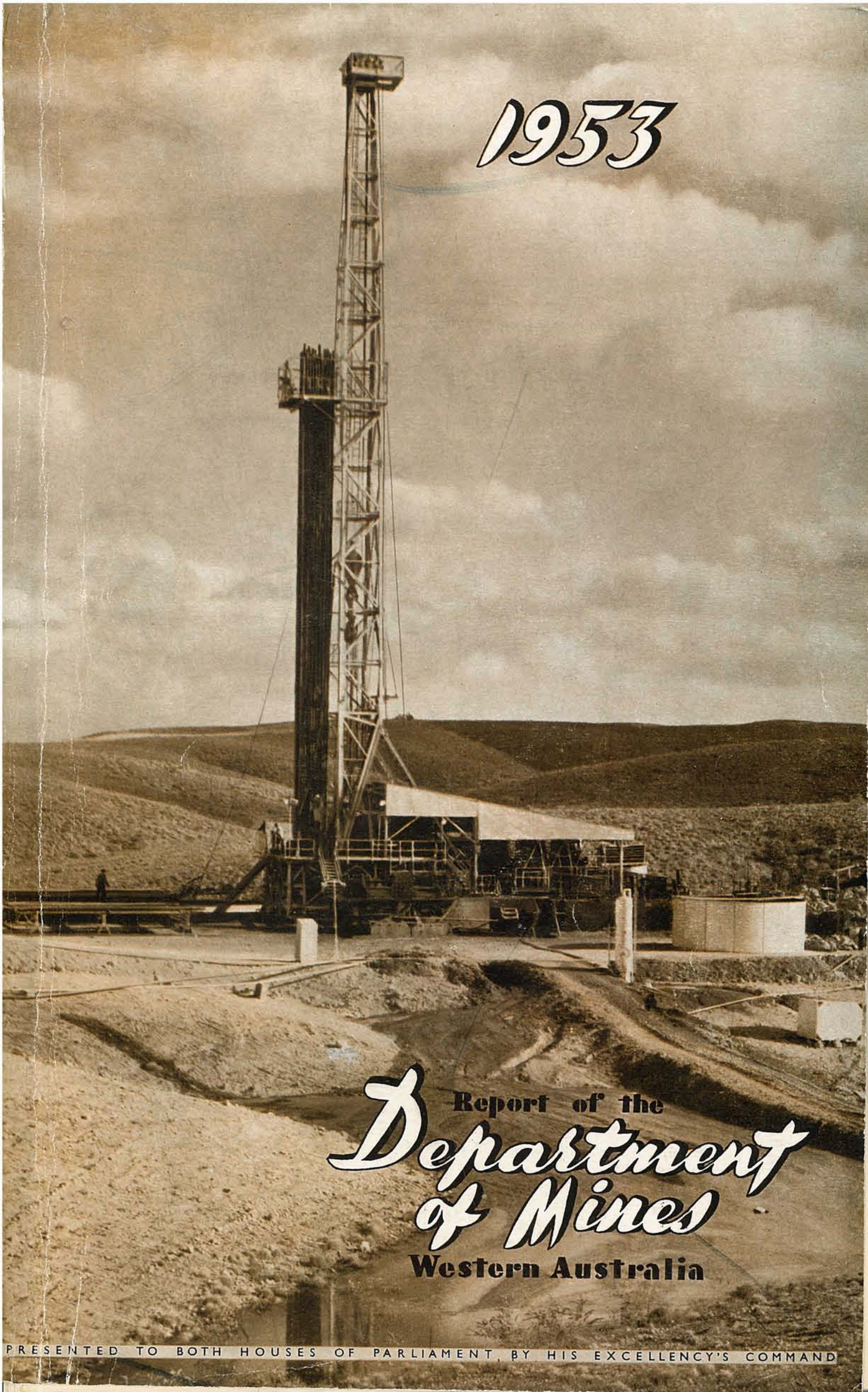

1953

Report of the Department of Mines

Western Australia

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

1955

WESTERN AUSTRALIA.

REPORT

of the

Department of Mines

FOR THE YEAR

1953

PERTH:
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ANNUAL REPORT OF THE DEPARTMENT OF MINES, WESTERN AUSTRALIA. 1953.

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STATE OF WESTERN AUSTRALIA.

Report of the Department of Mines of the State of Western Australia for the Year 1953.

To the Honourable Minister for Mines.

Sir,—I have the honour to submit the Annual Report of the Department of Mines of the State of Western Australia for the year 1953, 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.

Perth, 5th April, 1954.

Division I.

The Honourable Minister for Mines:

I have the honour to submit, for your information, a report on the Mining Industry for the year 1953.

The estimated value of the mineral output of the State for the year was £9,529,123 (calculating gold at £4 4s. 11.45d. per fine ounce), an increase in value of £1,149,809 compared with the preceding twelve months. The estimated value of the exchange premium paid to gold producers amounted to £A9,264,009, added to which, the overseas gold sales premium of £A535,330 received by the Gold Producers' Association Ltd. from sales of West Australian gold up to July, 1953, brought the gross value of all minerals to another new record of £A19,328,462, an increase of £A2,201,956 compared to the 1952 production which was the previous highest figure.

The estimated value of gold received at the Perth Branch of the Royal Mint and exported in gold-bearing material was £A12,763,762 but with the additional overseas gold sales premium mentioned above, totalled £A13,299,092 (and equalled 68.80 per cent. of all minerals). (See footnote to Table 1(a), Part 11).

Other minerals realised: Coal, £3,043,267; asbestos, £707,364; iron-ore (export), £682,162; pyrites, £489,985; lead ores and concentrates, £358,328; iron-ore (pig), £221,006; manganese, £150,991; silver, £89,401; tin, £63,129; talc, £30,932; gypsum, £30,178; chromite, £29,717; beryl, £22,223; cupreous ore (fertiliser), £21,004; tanto-columbite, £20,200; clays, £15,881; glauconite, £11,182; antimony, £10,313; felspar, £8,860; glass sand, £4,690; wolfram, £4,473; scheelite, £3,361; copper ore, £3,199; ochre, £2,887; barytes, £1,790; zinc (by product), £1,367; bentonite, £741; vermiculite, £348; graphite, £180; fuller's earth, £79; magnesite, £73; and zinc ore (fertiliser), £50.

Dividends paid by Mining Companies amounted to £1,432,852, an increase of £353,481 when compared with the previous year (see Table 6 part 11).

To the end of 1953, the total amount distributed by gold mining companies was £49,740,655.

To the same date the progressive value of the mineral production amounted to £278,619,483 of which gold accounted for £236,361,085 based on normal values; but the premium on the sale of gold during years 1920-1924, payments under the Gold Bounty Act, 1930, plus the additional premium from overseas sales distributed during 1952-1953 increase the total value of gold and mineral production by £113,771,020, making a gross progressive value of £A392,390,503.

GOLD.

The quantity of gold reported as being received at the Perth Branch of the Royal Mint (818,515.65 fine ounces), together with that contained in gold-bearing material exported for treatment (5,396.30 fine ounces), totalled 823,911.95 fine ounces and exceeded that of the previous year by 93,936.89 fine ounces (*vide* Table 1 (a) of Part 11).

Similarly, the total gold yield for the year reported directly to the Department by the producers was 823,331.06 fine ounces, which constituted an increase of 95,863.22 fine ounces, in comparison with the pervious year's figures (*vide* Table 3 of Part 11).

The slight variation of the two totals mentioned above, is principally due to the fact that the gold reported as being received at the Mint and exported for treatment, is not all necessarily produced during the calendar year under review, a certain quantity being in the transitory stage from the producer at the end of the year. The former total is accepted as the official production of the State on account of its realised monetary value, whilst the latter is utilised mainly in tracing the gold back to its source, i.e. individual mine production to which a respective ore tonnage can be applied.

The calculated average value per ton of ore treated in the State as a whole decreased from 23.529 shillings per ton in 1952 to 22.065 shillings per ton in 1953, calculating gold at the old rate of £4 4s. 11.45d. per fine ounce, but the exchange premium rate, which remained unchanged throughout the year (264.70 per cent.) would more than treble this estimate. For the East Coolgardie Goldfield (which produced 58.9 per cent. of the State's yield of gold), the calculated average value of the ore treated decreased from 22.480 shillings to 22.456 shillings per ton. The estimates for Murchison (Big Bell Mines Ltd. and Hill 50 G.M. N.L.) Mt. Margaret (Sons of Gwalia Ltd.), Coolgardie (New Coolgardie G.Ms. N.L.), Dundas (Central Norseman Gold Corpn. N.L.), and Yilgarn (Great

Western Cons.), were 17.300s. (13.842s.); 23.315s. (25.979s.); 36.968s. (45.353s.); 40.287s. (42.027s.); and 11.735s. (15.756s.) respectively. Figures for 1952 being shown in parentheses.

The tonnage of ore reported to have been treated in 1953, viz. 3,169,875 tons, was 543,263 tons or 20 per cent more than the previous year and constituted 73.8 per cent. of the State record tonnage established in 1940.

The following tonnage increases were reported from the respective Goldfields—Kimberley 52, Ashburton 36, Peak Hill 18,937, Murchison 33,855, Mt. Margaret 14,670, North Coolgardie 2,932, East Coolgardie 115,318, Coolgardie 2,210 and Yilgarn 361,768; those fields showing a reduction in tonnage being Pilbara 2,394, West Pilbara 20, East Murchison 136, Yalgoo 196, Broad Arrow 302, North-East Coolgardie 278 and Dundas 3,190.

In the East Coolgardie Goldfield where output was up 115,300 tons or 6.7% more than the previous year, Lake View & Star Ltd. reported an increase of 47,400 tons, followed similarly by Great Boulder Pty. G.M's. Ltd. with 33,250, Gold Mines of Kalgoorlie (Aust.) Ltd. 19,630, South Kalgurli (Cons.) Ltd. 8,450, Boulder Perseverance Ltd. 4,400, and the Kalgoorlie Enterprise Mines Ltd. with 2,350 tons.

Anglo Westralian Mining Pty. Ltd, and Great Western Consolidated were solely responsible for the higher output of the Peak Hill and Yilgarn Goldfields respectively, while Sons of Gwalia Ltd. played a similar role in the Mount Margaret Goldfield.

Credit for the improvement in the Murchison figures went to Hill 50 G.M's. N.L. with an increase of 30,000 tons, whilst Big Bell Mines Ltd. exceeded their previous year's tonnage by 2,350.

Apart from slightly lower outputs in the Dundas by Central Norseman Gold Corporation and Pilbara by Blue Spec Mining Coy. N.L., the state of the industry in the remaining Goldfields appeared to be fairly static.

West Australian gold included in sales on open dollar markets by the Gold Producers' Association Ltd. between August 1952 and July 1953, totalled 684,726.16 fine ounces; the extra premium received therefrom, in excess of the Mint value, amounted to £A535,330, an average of 15.636 shillings per fine ounce. This amount was distributed to the producer members during January, April, July and November.

Although distribution of August to October sales proceeds had not been made before the close of the year, it was significant to note that the gross premium received by the Association had fallen to a few pence per ounce, and prospects of further relief to the industry from this source have considerably receded.

MINERALS.

Mineral activity was well maintained and the North Western fields in particular received considerable attention.

From these fields came Asbestos and Iron, Antimony, Beryl, Chrome, Copper, Lead, Manganese, Wolfram and Zinc. The more southern fields produced particularly Pyrite, Gypsum, Clays, Felspar and Talc, in addition to Lead, Tin and Copper.

The search for minerals is of course greatly governed by the State of the market. Prices have to be reasonably good and stable to permit of operators undertaking operations in areas like the North-West where production costs, freights, etc. are high.

Unfortunately with some minerals such as Lead, the prices fluctuate considerably, and producers are under the strain of insecurity all the time.

At the moment there appears to be an upward tendency in prices of minerals and metals and it is to be hoped that this is maintained.

Prospecting for Uranium continues, most operators being constantly on the alert for any signs of radio activity in the formations worked or examined.

At Dundas, concentrated work by way of trenching and drilling is being systematically carried on.

The recent finds in the Northern Territory and Eastern States have given added fillip to the search in Western Australia.

COAL.

At Collie, operations have steadily continued in the mechanisation of the older Collieries, development of new ones, and establishment of two new open-cuts.

With three active producing Companies in the field, and a large output, the emphasis is now likely to be on quality and economic production. The hectic post war scramble for Coal of any description has subsided and the marketing angle must now be closely watched by producers.

COMPARATIVE MINERAL STATISTICS.

	1952.	1953.	Variation.
Gold—			
Reported to Department :			
Ore (tons)	2,626,612	3,169,875	+ 543,263
Gold (fine ozs.)	727,468	823,331	+ 95,863
Average Grade (dwts. per ton)	5·539	5·195	— 0·344
Men Employed	6,394	6,359	— 35
Dividends (£A)	1,079,371	1,432,852	+ 353,481
Mint and Export :			
Gold (fine ozs.)	729,975	823,912	+ 93,937
Estimated Value (£A)	11,847,917	13,299,092	+ 1,451,175
Coal—			
Reported to Department :			
Tons	830,461	886,182	+ 55,721
Value (£A)	2,457,296	3,043,267	+ 585,971
Men Employed	1,281	1,463	+ 182
Other Minerals—			
Reported to Department :			
Value (£A)	2,281,293	2,986,103	+ 704,810
Men Employed	964	936	— 28
All Minerals—			
Value (£A)	17,126,506	*19,328,462	+ 2,201,956
Men Employed	8,639	8,758	+ 119

* New record (previous highest figure being for 1952).

PART II.—MINERALS.

TABLE 1.—*Quantity and Value of Minerals, other than Gold and Silver, produced during Years* 1952 *and* 1953.

Description of Minerals.	1952.		1953.		Increase or Decrease for year, compared with 1952.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.	£A.	Tons.	£A.	Tons.	£A.
Antimony Ore and Concentrates	264·58	43,397	358·43	10,313	+ 93·85	— 33,084
Asbestos—						
Chrysotile	652·35	37,255	605·58	65,769	— 46·77	+ 28,514
Crocidolite	2,940·09	557,861	3,795·40	641,595	+ 855·31	+ 83,734
Barytes	9·00	50	211·87	1,790	+ 202·87	+ 1,740
Bentonite	586·00	2,036	217·70	741	— 368·30	— 1,295
Beryl Ore	85·29	14,562	124·62	22,223	+ 39·33	+ 7,661
Chromite	773·00	11,100	1,968·00	29,717	+ 1,195·00	+ 18,617
Clays—						
Cement Clay	15,310·10	5,664	13,619·90	5,266	— 1,690·20	— 398
Fire Clays :						
Kaolin Type	1,772·00	1,684	1,424·95	1,359	— 347·05	— 325
Kaolin and Other Type	7,836·00	7,836	7,393·00	7,393	— 443·00	— 443
White Clays :						
Ball Clay (Ceremic)	780·00	3,000	458·00	1,763	— 322·00	— 1,237
Kaolin (Filler Material)	267·75	1,303	20·00	100	— 247·75	— 1,203
Coal	830,461·20	2,457,296	886,182·20	3,073,073	+ 55,721·00	+ 615,777
Corundum	54·00	380	*Nil*	*Nil*	— 54·00	— 380
Copper Ore	15·51	1,188	50·29	3,199	+ 34·78	+ 2,011
Cupreous Ore (Fertiliser)	1,643·59	21,595	1,948·08	21,004	+ 304·49	— 591
Dolomite	555·25	2,423	*Nil*	*Nil*	— 555·25	— 2,423
Felspar	2,503·50	10,452	2,127·00	8,860	— 376·50	— 1,592
Fergusonite	·17	165	*Nil*	*Nil*	— ·17	— 165
Fuller's Earth	25·00	125	15·75	79	— 9·25	— 46
Glass Sand	7,669·12	5,629	6,905·74	4,690	— 763·38	— 939
Glauconite	230·00	7,305	319·50	11,182	+ 89·50	+ 3,877
Graphite	*Nil*	*Nil*	20·00	180	+ 20·00	+ 180
Gypsum	50,331·56	33,257	40,247·11	30,178	— 10,084·45	— 3,079
Iron Ore—						
For Pig	17,703·45	226,844	16,851·77	221,006	— 851·68	— 5,838
Exported	204,945·00	203,238	687,895·00	682,162	+ 482,950·00	+ 478,924
Lead .... Silver-Lead .... } Ore and concentrates Silver-Lead-Zinc	7,448·98	935,200	6,425·48	358,328	— 1,023·50	— 576,872
Magnesite	1,054·67	2,842	19·60	73	— 1,035·07	— 2,769
Manganese	5,044·80	35,634	16,324·00	150,991	+ 11,279·20	+ 115,357
Ochre—						
Red	296·55	3,252	286·67	2,742	— 9·88	— 510
Yellow	*Nil*	*Nil*	20·50	145	+ 20·50	+ 145
Pyrites	53,577·00	422,029	59,248·00	489,985	+ 5,671·00	+ 67,956
Talc	1,223·61	14,683	2,228·07	30,932	+ 1,004·46	+ 16,249
Tantalo/Columbite Ore and Concentrates	7·02	10,010	8·09	20,200	+ 1·07	+ 10,190
Tin	97·80	68,716	113·27	63,129	+ 15·47	— 5,587
Tungsten—						
Scheelite (lb.)	5,139·00	3,691	6,520·00	3,361	+ 1,381·00	— 330
Wolfram (lb.)	60,352·00	46,018	7,733·00	4,473	— 52,619·00	— 41,545
Vermiculite	62·00	744	29·00	348	— 33·00	— 396
*Zinc (Metallic)	*Nil*	*Nil*	114·16	1,376	+ 114·16	+ 1,376
Zinc Ore (Fertiliser)	*Nil*	*Nil*	10·00	50	+ 10·00	+ 50
Total	....	5,198,464	....	5,969,775	....	+ 771,311

TABLE 1 (a).—*Quantity and Value of Gold and Silver exported and minted during Years* 1952 *and* 1953.

	Fine ozs.	£A.	Fine ozs.	£A.	Fine ozs.	£A.
Gold (Exported and Minted)	729,975·06	†11,847,917	823,911·95	†13,299,092	+ 93,936·89	+ 1,451,175
Silver (Exported and Minted)	199,153·41	80,125	229,364·39	89,401	30,210·98	+ 9,276
Total	....	11,928,042	....	13,388,493	....	+ 1,460,451

* By-product from Silver-Lead-Zinc mining. † Including Overseas Gold Sales Premium of £A539,358 and £A535,330 for 1952 and 1953 respectively from Gold Producers Association, Ltd.

TABLE 2.—*Value and Percentage of Mineral Exports in relation to the Value of Total Exports from Western Australia.*

Year.	Total Exports. †	Mineral Exports (exclusive of Coal).	Percentage.
	£	£	
1902	9,051,358	7,530,319	83·20
1903	10,324,732	8,727,060	84·53
1904	10,271,489	8,625,676	83·98
1905	9,871,019	7,731,954	78·33
1906	9,832,679	7,570,305	76·99
1907	9,904,860	7,544,992	76·17
1908	9,518,020	7,151,317	75·13
1909	8,860,494	5,906,673	66·66
1910	8,299,781	4,795,654	57·78
1911	10,606,863	7,171,638	67·61
1912	8,941,008	5,462,499	61·09
1913	9,128,607	4,608,188	50·48
1914	8,406,182	3,970,182	47·23
1915	6,291,934	2,969,502	47·19
1916	10,878,153	6,842,621	62·92
1917	9,323,229	5,022,694	53·87
1918	6,931,834	2,102,923	30·34
1919	14,279,240	6,236,585	43·67
1920	15,149,323	3,096,849	20·44
1921	10,331,405	1,373,810	13·30
1922	11,848,025	2,875,402	24·27
1923	11,999,500	3,259,476	27·16
1924	13,808,910	1,424,319	13·24
1925	13,642,852	173,126	1·27
1926	14,668,184	1,597,698	10·89
1927	15,805,120	472,041	2·99
1928	16,911,932	996,099	5·88
1929	16,660,742	1,802,709	10·82
1930	19,016,639	6,370,396	33·49
1931	14,266,650	4,333,421	30·37
1932	16,771,465	5,657,870	33·74
1933	18,098,214	5,328,869	29·44
1934	16,784,705	5,759,324	34·31
1935	17,611,547	5,698,721	32·36
1936	19,564,716	7,130,381	36·45
1937	21,594,942	9,026,313	41·80
1938	24,220,864	10,417,458	43·01
1939	23,244,509	11,969,562	51·49
1940	25,800,562	12,480,721	48·37
1941	24,536,777	12,411,316	50·58
1942	20,681,284	8,476,622	40·99
1943	18,014,340	6,539,295	36·30
1944	19,453,001	(a) 1,282,867	6·59
1945	20,170,624	(b) 205,587	1·02
1946	26,342,125	(b) 211,890	0·80
1947	42,389,125	(c) 4,162,892	9.82
1948	57,779,996	(b) 342,646	0·59
1949	58,197,775	(b) 465,124	0·80
1950	78,804,864	(b) 531,245	0·67
1951	115,880,457	(*d*) 7,479,601	6·45
1952	101,620,138	(*c*) 7,952,834	7·82
1953	106,678,014	(*e*)13,239,076	12·41
Total since 1902	1,219,070,808	274,516,342	22·52

Exclusive of Arsenic prior to 1935. † Including Ship's Stores. (*a*) Approximately 25 per cent. of gold production for year exported. (*b*) No gold bullion exported. (*c*) Approximately 50 per cent. of gold production for year exported. (*d*) Approximately 66 per cent. of gold production for year exported. (*e*) Approximately 86 per cent. of gold production for year exported.

Comparative Statistical Diagrams

showing:

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

and the

GOLD PRODUCTION OF AUSTRALASIA FOR THE YEAR 1953

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

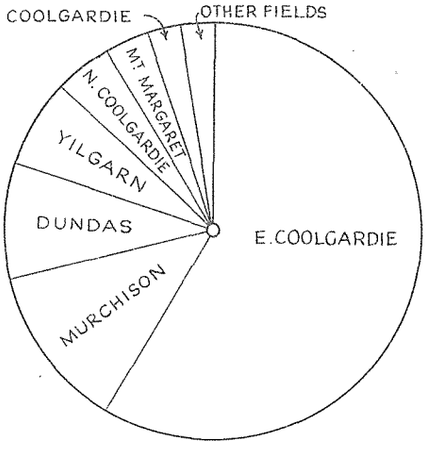


Fig. 2 Gold produced from various Goldfields as given by the Export and Mint Returns

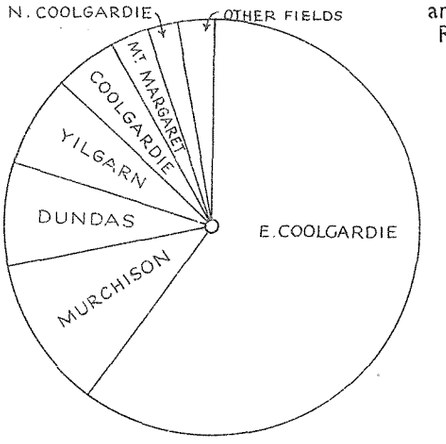


Fig. 3 Value of Gold and other Minerals

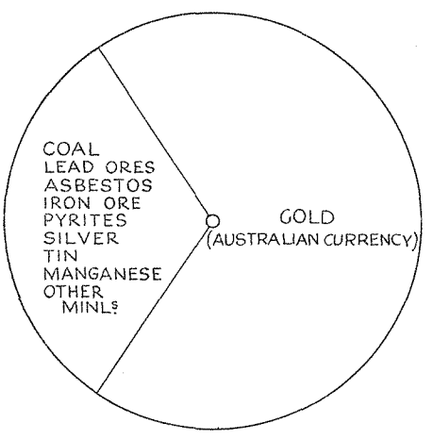


Fig. 4 Value of Minerals other than Gold

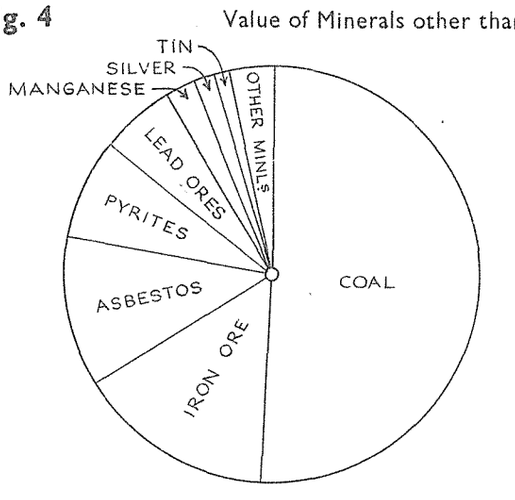


Fig. 5 Areas of land leased for Goldmining on various Goldfields

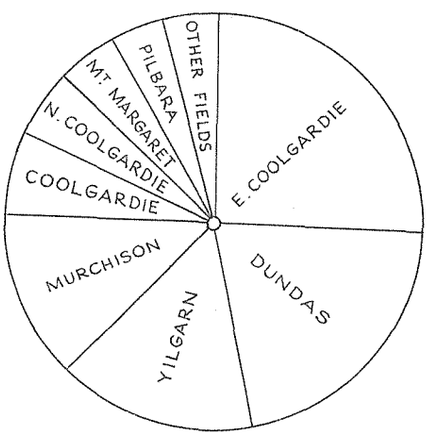


Fig. 6 Output of Gold in the States of Australia and the Dominion of New Zealand

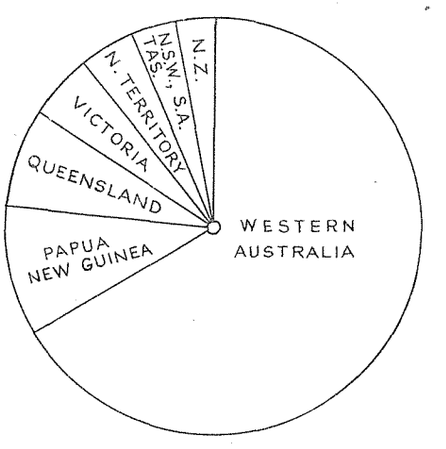
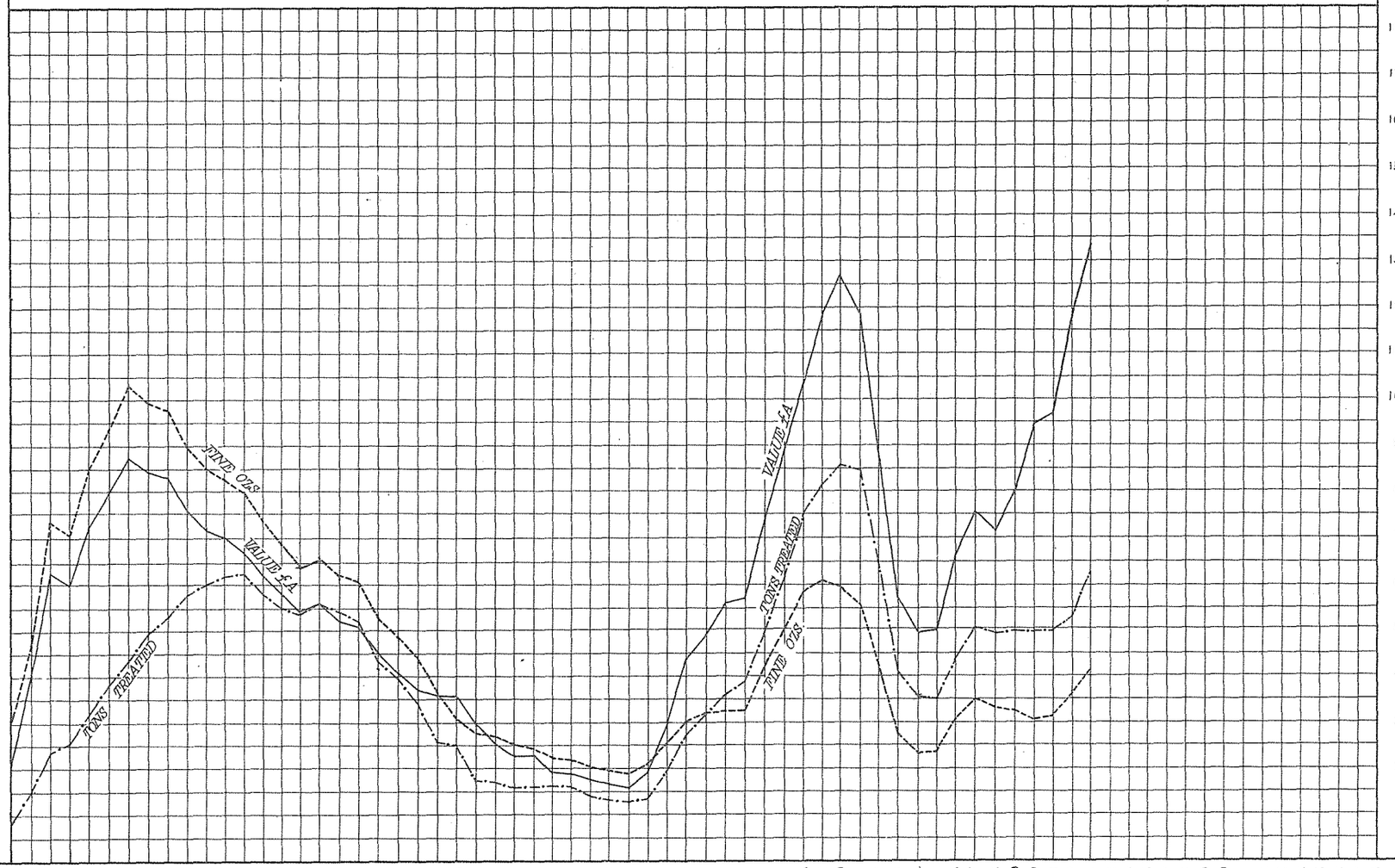


DIAGRAM OF GOLD OUTPUT

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



TONS TREATED	FINE OUNCES	VALUE £A
9,000,000	3,600,000	18,000,000
	3,400,000	17,000,000
8,000,000	3,200,000	16,000,000
	3,000,000	15,000,000
7,000,000	2,800,000	14,000,000
	2,600,000	13,000,000
6,000,000	2,400,000	12,000,000
	2,200,000	11,000,000
5,000,000	2,000,000	10,000,000
	1,800,000	9,000,000
4,000,000	1,600,000	8,000,000
	1,400,000	7,000,000
3,000,000	1,200,000	6,000,000
	1,000,000	5,000,000
2,000,000	800,000	4,000,000
	600,000	3,000,000
1,000,000	400,000	2,000,000
	200,000	1,000,000

YEAR

1897 1898 1899 1900 1901 1902 1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 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 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961 1962 1963 1964 1965 1966 1967 1968

VALUE £A	FINE OUNCES	TONS TREATED
18,000,000	3,600,000	9,000,000
17,000,000	3,400,000	
16,000,000	3,200,000	8,000,000
15,000,000	3,000,000	
14,000,000	2,800,000	7,000,000
13,000,000	2,600,000	
12,000,000	2,400,000	6,000,000
11,000,000	2,200,000	
10,000,000	2,000,000	5,000,000
9,000,000	1,800,000	
8,000,000	1,600,000	4,000,000
7,000,000	1,400,000	
6,000,000	1,200,000	3,000,000
5,000,000	1,000,000	
4,000,000	800,000	2,000,000
3,000,000	600,000	
2,000,000	400,000	1,000,000
1,000,000	200,000	

YEAR

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.).	
	1952.	1953.	1952.	1953.	1952.	1953.
	Fine ozs.	Fine ozs.	%	%	Shillings.	Shillings.
1. Kimberley	391	238	·054	·029	....	....
2. West Kimberley	....	....	....	....	....	....
3. Pilbara	12,938	7,974	1·779	·968	96·695	75·500
4. West Pilbara	15	4	·002	·001	65·110	....
5. Ashburton	18	84	·002	·010	243·872	165·542
6. Gascoyne	....	....	....	....	....	....
7. Peak Hill	5,603	9,013	·770	1·095	15·758	13·800
8. East Murchison	1,350	1,199	·186	·146	237·960	294·455
9. Murchison	75,319	101,030	10·354	12·271	13·842	17·300
10. Yalgoo	454	423	·062	·051	72·076	106·321
11. Mt. Margaret	27,982	29,140	3·846	3·539	25·979	23·315
12. North Coolgardie	34,830	36,459	4·788	4·428	52·845	52·565
13. Broad Arrow	3,225	2,550	·443	·310	61·544	48·088
14. North East Coolgardie	950	384	·131	·047	69·030	36·611
15. East Coolgardie	454,932	484,949	62·536	58·901	22·480	22·456
16. Coolgardie	22,867	19,601	3·143	2·380	45·353	36·968
17. Yilgarn	7,480	55,630	1·028	6·757	15·756	11·753
18. Dundas	78,914	74,135	10·848	9·004	42·027	40·287
19. Phillips River	189	479	·026	·058	....	....
20. Outside Proclaimed Goldfields	11	39	·002	·005	....	....
Totals and Averages	727,468	823,331	100·000	100·000	23·529	22·066

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

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

TABLE 4.

Average Quantities of Gold Ore raised and treated, and Gold produced therefrom, per man employed on the several Goldfields of the State, during 1952 *and* 1953.

Goldfield.	1952.				1953.			
	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 underground.	Per man employed above and underground.	Per man employed underground.	Per man employed above and underground.	Per man employed underground.	Per man employed above and underground.	Per man employed underground.	Per man employed above and underground.
	Tons.	Tons.	Fine ozs.	Fine ozs.	Tons.	Tons.	Fine ozs.	Fine ozs.
1. Kimberley	....	....	....	78·11	....	10·50	....	5·25
2. West Kimberley	....	....	....	....	....	....	....	....
3. Pilbara	155·70	63·85	177·22	76·68	157·42	56·79	133·91	48·31
4. West Pilbara	20·00	6·66	15·33	5·11	....	....	....	....
5. Ashburton	....	....	....	....	21·50	10·75	41·58	20·79
6. Gascoyne	....	....	....	....	....	....	....	....
7. Peak Hill	3,322·81	514·80	509·35	78·91	5,044·40	924·80	819·32	150·21
8. East Murchison	37·07	9·64	103·85	27·00	31·45	9·35	108·41	32·23
9. Murchison	1,566·97	746·78	255·31	123·29	1,545·52	767·97	313·38	155·72
10. Yalgoo	59·44	24·31	50·43	20·63	37·44	16·92	45·64	20·54
11. Mt. Margaret	598·07	258·49	182·89	79·04	573·92	288·52	157·18	79·02
12. North Coolgardie	368·36	177·75	229·14	110·57	390·22	184·71	240·59	113·88
13. Broad Arrow	60·09	28·61	40·31	19·20	112·63	41·71	62·85	23·28
14. North-East Coolgardie	53·16	22·49	43·19	18·27	55·70	20·25	23·58	8·57
15. East Coolgardie	977·39	501·38	258·63	132·67	1,095·91	550·75	289·68	145·58
16. Coolgardie	231·53	135·54	123·60	72·36	234·60	132·87	101·83	57·67
17. Yilgarn	268·85	97·88	49·86	18·15	1,914·74	802·58	264·90	111·03
18. Dundas	712·13	411·13	352·29	203·38	651·37	381·29	308·90	180·81
19. Phillips River	....	....	94·52	15·75	....	....	239·62	59·90
20. Outside Proclaimed Goldfields	....	....	....	....	....	....	....	....
Total Averages	839·44	410·79	232·49	113·77	1,015·66	498·48	263·37	129·26

TABLE 5.

Output of Gold from the several States of Australia, the Northern Territory, Papua, and Mandated Territory of New Guinea, and the Dominion of New Zealand, during 1953.

State.	Output of Gold.	Value.*	Percentage of Total.	
			Output of Commonwealth.	Output of Australasia.
	Fine ozs.	£	%	%
Western Australia	823,912	3,499,753	68·839	66·684
Victoria	63,917	271,502	5·340	5·173
New South Wales	26,461	112,399	2·211	2·142
Queensland	91,887	390,311	7·677	7·437
Tasmania	16,988	72,160	1·419	1·375
South Australia	443	1,881	0·037	0·036
Territory of Papua and New Guinea	120,848	513,329	10·097	9·781
Northern Territory	52,423	222,678	4·380	4·243
New Zealand	38,656	164,200	....	3·129
	1,235,535	5,084,013	100·000	100·000

* Par Value (£4 4s. 11·45d. per fine ounce.)

TABLE 6.

Dividends, etc., paid by Western Australian Mining Companies during 1953, *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.	
		1953.	Grand Total to end of 1953.
		£	£
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.	168,750	465,626
	Various Companies	....	2,764,945
Mt. Margaret	Sons of Gwalia, Ltd.	....	2,075,050
	Various Companies	....	958,286
North Coolgardie	do. do.	....	712,551
Broad Arrow	do. do.	....	92,500
North-East Coolgardie	do. do.	....	129,493
East Coolgardie	Boulder Perseverance, Ltd.	28,102	(*a*) 2,684,756
	Golden Horseshoe (New), Ltd.	11,458	(*b*) 4,101,670
	Gold Mines of Kalgoorlie, Ltd.	96,055	1,067,166
	Great Boulder Proprietary G.M's., Ltd.	187,500	7,621,900
	Kalgoorlie Enterprise Mines, Ltd.	....	287,375
	Lake View and Star, Ltd.	393,750	(*c*) 6,480,166
	North Kalgurli (1912), Ltd.	120,312	1,763,436
	South Kalgurli Consolidated, Ltd.	15,625	1,234,098
	Various Companies	....	11,101,894
Coolgardie	New Coolgardie G.M., N.L.	21,300	21,300
	Various Companies	....	388,700
Yilgarn	do. do.	....	(*d*) 1,205,556
Dundas	Central Norseman Gold Corporation, N.L.	390,000	1,657,500
	Various Companies	....	786,162
	Totals	1,432,852	49,740,655

(*a*) Also £45,091 in bonuses and profit-sharing notes in years 1935–36. (*b*) Also £55,000 Capital returned in year 1932 and £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 £67,725 Capital returned in 1948 by Edna May (W.A.) Amalgamated, N.L.

TABLE 7.

Quantity and Value of Minerals, other than Gold and Silver, reported to the Mines Department during 1953.

Goldfield, District or Mineral Field.	1953.		Increase or Decrease as compared with 1952.	
	Quantity.	Value.	Quantity.	Value.
	Tons.	£A.	Tons.	£A.
ANTIMONY ORE AND CONCENTRATES—				
Pilbara (Nullagine)	358·43	10,313	+ 93·85	— 33,084
ASBESTOS (Chrysotile)—				
Pilbara	341·69	7,087	+ 148·97	+ 4,003
West Pilbara	263·89	58,682	— 195·74	+ 24,511
ASBESTOS (Crocidolite)—				
West Pilbara	3,795·40	641,595	+ 855·31	+ 83,734
BARYTES				
Murchison	....	....	— 9·00	— 50
North-East Coolgardie	42·22	380	+ 42·22	+ 380
Outside Proclaimed Goldfield	169·65	1,410	+ 169·65	+ 1,410
BENTONITE—				
Outside Proclaimed Goldfield	217·70	741	— 368·30	— 1,295
BERYL ORE—				
Pilbara	104·49	18,649	+ 34·80	+ 7,108
Yalgoo	8·00	1,390	+ 8·00	+ 1,390
Coolgardie	10·06	1,782	— 3·97	— 955
Outside Proclaimed Goldfield	2·07	402	+ ·50	+ 118
CHROMITE—				
Peak Hill	1,968·00	29,717	+ 1,195·00	+ 18,617
CLAY (Cement Clay)—				
Outside Proclaimed Goldfield	13,619·90	5,266	— 1,690·20	— 398
CLAY (Fire Clays)—				
Outside Proclaimed Goldfield	8,817·95	8,752	— 790·05	— 768
CLAY (White Clay)—				
Murchison	....	....	— 41·75	— 207
Outside Proclaimed Goldfield	478·00	1,863	— 528·00	— 2,233
COAL—				
Collie	886,182·20	3,073,073	+ 55,721·00	+ 615,777
COPPER ORE AND CONCENTRATES—				
Pilbara	32·93	2,424	+ 17·42	+ 1,330
West Pilbara	13·32	674	+ 13·32	+ 674
Phillips River (Copper Precipitates)	....	....	....	— 94
Outside Proclaimed Goldfield	4·04	101	+ 4·04	+ 101
CORUNDUM—				
East Murchison (Lawlers)	....	....	— 54·00	— 380
CUPREOUS ORE (Fertiliser)—				
Pilbara	....	....	— 91·71	— 637
West Pilbara	672·22	6,851	— 237·97	— 82
Ashburton	9·79	114	+ 8·04	+ 83
Peak Hill	163·30	1,140	— 65·74	— 5,940
East Murchison	892·10	10,043	+ 552·05	+ 4,547
Murchison	25·54	461	+ 25·54	+ 461
Mt. Margaret	9·50	73	+ 2·65	— 17
Broad Arrow	22·00	368	+ 22·00	+ 368
East Coolgardie	29·00	100	+ 29·00	+ 100
Dundas	12·69	117	+ 12·69	+ 117
Phillips River	72·00	1,406	+ 8·00	+ 84
Outside Proclaimed Goldfield	39·94	331	+ 39·94	+ 331
DOLOMITE—				
Murchison (Mt. Magnet)	....	....	— 555·25	— 2,423
FELSPAR—				
Coolgardie	2,079·50	8,682	— 424·00	— 1,770
Outside Proclaimed Goldfield	47·50	178	+ 47·50	+ 178
FERGUSONITE—				
Pilbara (Marble Bar)	....	....	— ·17	— 165
FULLERS EARTH—				
Outside Proclaimed Goldfield	15·75	79	— 9·25	— 46
GLASS SAND—				
Outside Proclaimed Goldfield	6,905·74	4,690	— 763·38	— 939

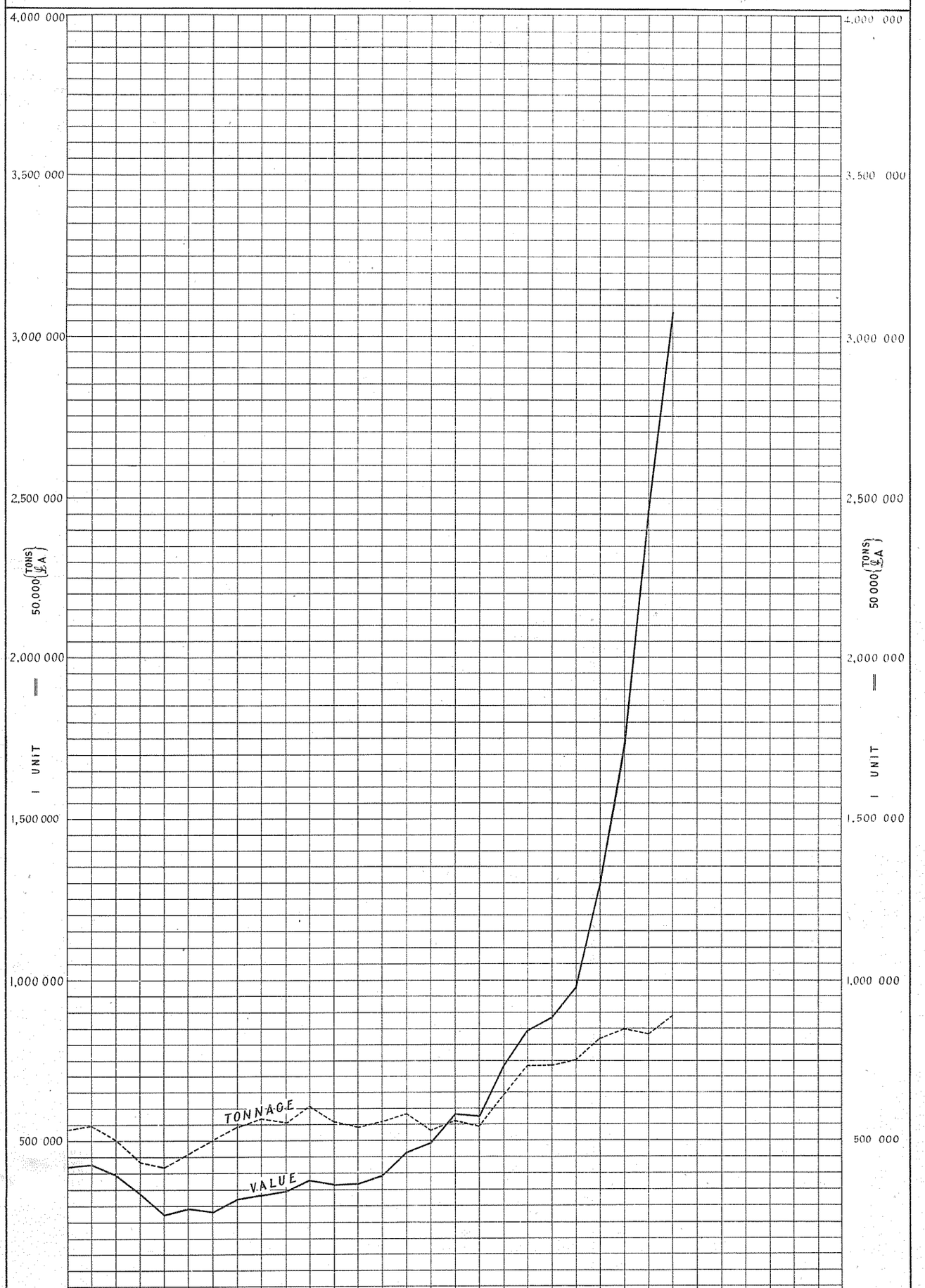
TABLE 7—*continued.*

Quantity and Value of Minerals, other than Gold and Silver, reported to the Mines Department during 1953—*continued.*

Goldfield, District or Mineral Field.	1953.		Increase or Decrease as compared with 1952.	
	Quantity.	Value.	Quantity.	Value.
GLAUCONITE (Recovered)	Tons.	£A.	Tons.	£A.
Outside Proclaimed Goldfield	319·50	11,182	+ 89·50	+ 3,877
GRAPHITE—				
Outside Proclaimed Goldfield	20·00	180	+ 20·00	+ 180
GYPSUM—				
Yilgarn	25,216·00	19,041	— 8,838·00	— 2,651
Dundas	12·00	6	— 9·00	— 47
Outside Proclaimed Goldfield	15,019·11	11,131	— 1,237·45	— 381
IRON ORE (for Pig Iron)				
Yilgarn	13,175·88	185,670	+ 180·98	+ 6,265
Outside Proclaimed Goldfield	3,675·89	35,336	— 1,032·66	— 12,103
IRON ORE (Exported)—				
West Kimberley	687,895·00	682,162	+482,950·00	+ 478,924
LEAD ORE AND CONCENTRATES—				
Northampton	4,776·11	284,524	— 923·28	— 498,662
Kimberley	....	....	— 2·73	— 291
Pilbara	....	....	— 420·30	— 36,827
West Pilbara	....	....	— 30·79	— 3,176
Ashburton	....	....	— 979·20	— 96,977
West Kimberley	....	....	— 316·57	— 14,743
SILVER-LEAD ORE AND CONCENTRATES—				
Pilbara	393·77	20,975	+ 393·77	+ 20,975
West Pilbara	3·29	28	+ 3·29	+ 28
Ashburton	713·28	40,195	+ 713·28	+ 40,195
SILVER-LEAD-ZINC ORE AND CONCENTRATES—				
West Kimberley	444·61	7,118	+ 444·61	+ 7,118
Pilbara	94·42	5,488	+ 94·42	+ 5,488
MAGNESITE—				
Coolgardie	19·60	73	— 1,035·07	— 2,769
MANGANESE—				
Peak Hill	16,324·00	150,991	+11,279·20	+ 115,357
OCHRE (Red)—				
Kimberley	20·61	330	+ 20·61	+ 330
Murchison	266·06	2,412	— 30·49	— 840
OCHRE (Yellow)—				
East Collgardie	20·50	145	+ 20·50	+ 145
PYRITES ORE AND CONCENTRATES—				
Dundas	59,248·00	489,985	+ 5,671·00	+ 67,956
TALC—				
East Coolgardie	108·70	487	+ 40·45	+ 214
Outside Proclaimed Goldfield	2,119·37	30,445	+ 964·01	+ 16,035
TANTALO/COLUMBITE ORE AND CONCENTRATES—	lbs.		lbs.	
Greenbushes	6,917·00	7,252	— 1,209·00	+ 1,196
Pilbara	6,469·00	8,560	+ 3,398·00	+ 7,005
Coolgardie	2,454·00	2,960	— 2,069·00	+ 561
Outside Proclaimed Goldfield	1,797·00	1,038	+ 1,797·00	+ 1,038
TANTALO/COLUMBITE ORE AND CONCENTRATES (Microlite)—				
Phillips River	487·00	390	+ 487·00	+ 390
TIN—				
Greenbushes	41·41	23,311	+ 5·53	— 651
Kimberley	....	....	— ·06	— 42
West Kimberley	....	....	— ·15	— 120
Pilbara	70·97	39,386	+ 11·12	— 3,919
West Pilbara	·59	310	— 1·27	— 977
East Murchison	·30	122	+ ·30	+ 122
TUNGSTEN (Scheelite)—	lbs.		lbs.	
East Murchison	....	....	— 141·00	— 52
Yalgoo	65·00	43	+ 65·00	+ 43
Mt. Margaret	1,758·00	842	— 1,153·00	— 1,413
North Coolgardie	2,931·00	1,571	+ 2,931·00	+ 1,571
Coolgardie	1,665·00	867	— 422·00	— 517
Yilgarn	101·00	38	+ 101·00	+ 38

GRAPH OF COAL OUTPUT

Showing Quantities and Values as reported to Mines Dept.



YEAR	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	YEAR
VALUE £A	420145	426706	394768	336178	270630	289806	278704	318013	365075	331565	340444	375083	362811	364500	389278	461495	489721	583075	572896	730104	840249	880236	972745	1287749	1716788	2457296	3073073								VALUE £A
TONS	528420	544719	501425	432400	415719	458399	500343	537188	565075	553510	604793	557535	539427	566574	581176	531546	558372	543363	642287	730506	737938	750594	814351	848475	830461	886182								TONS

GRAPH OF TREND IN COAL OUTPUT

Showing Comparison of Annual Tonnages and Percentages
between Deep and Open Cut Mining

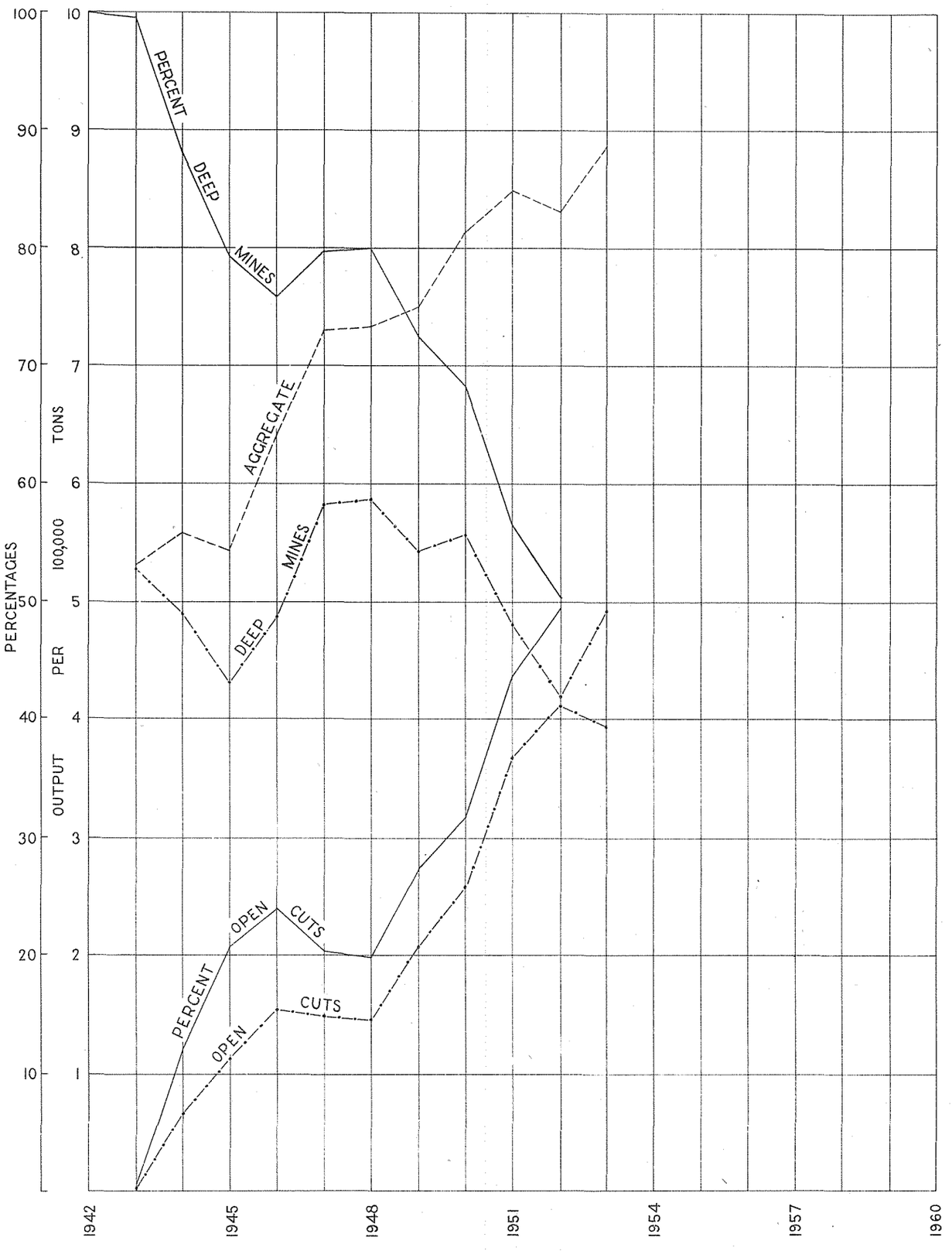


TABLE 7—*continued.*

Quantity and Value of Minerals, other than Gold and Silver, reported to the Mines Department during 1953—*continued.*

Goldfield, District or Mineral Field.	1953.		Increase or Decrease or compared with 1952.	
	Quantity.	Value.	Quantity.	Value.
TUNGSTEN (Wolfram)—	Tons.	£A	Tons.	£A.
Pilbara	....	....	—46,883·00	— 37,686
Murchison	6,731·00	3,861	— 5,446·00	— 3,676
Yalgoo	1,002·00	612	— 290·00	— 183
VERMICULITE—				
Outside Proclaimed Goldfield	29·00	348	— 33·00	— 396
ZINC (metallic)—				
West Kimberley	109·78	1,376	+ 109·78	+ 1,376
Pilbara	4·38	*nil*	+ 4·38	*nil*
ZINC ORE (Fertiliser)—				
Pilbara	10·00	50	+ 10·00	+ 50

TABLE 8.

Total Coal output from Collie Coalfield during 1952 *and* 1953, *estimated Value thereof, Number of Men employed, and Output per Man as reported Monthly.*

Year.	Total. Output.	Estimated Value.	Men Employed.			Output per Man Employed.		
			Above ground.	Under ground.	Above and under ground.	Above ground.	Under ground.	Above and under ground.
	Tons.	£A.	No.	No.	No.	Tons.	Tons.	Tons.
Deep Mining—								
1952	419,117	1,291,968	309	717	1,026	1,356	584	408
1953	493,035	1,730,919	355	816	1,171	1,389	604	421
Open Cut Mining—								
1952	411,344	1,165,328	255	....	255	1,613	....	1,613
1953	393,147	1,342,154	292	....	292	1,346	....	1,346
Totals—								
1952	830,461	2,457,296	564	717	1,281	1,472	1,158	648
1953	886,182	3,073,073	647	816	1,463	1,370	1,086	606

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

TABLE 9.

Total Number and Acreage of Lease, Mineral Claims and Prospecting Areas held for Mining on the 31*st December,* 1952 *and* 1953.

Leases and Other Holdings.	1952.		1953.	
	No.	Acreage.	No.	Acreage.
Gold Mining Leases on Crown Lands	1,451	27,617	**1,335**	**24,860**
Gold Mining Leases on Private Property	25	600	**25**	**594**
Mineral Leases on Crown Lands	251	43,294	**253**	**43,155**
Mineral Leases on Private Property	21	2,079	**19**	**2,069**
Mineral Claims	244	19,638	**342**	**23,318**
Prospecting Areas	*513	12,565	*537	**9,285**
Totals	2,305	105,793	**2,511**	**103,281**

* Includes 68 Prospecting Areas for Minerals of a total of 1,522 acres.
† Includes 97 Prospecting Areas for Minerals of a total of 5,297 acres.

PART IV.—MEN EMPLOYED.

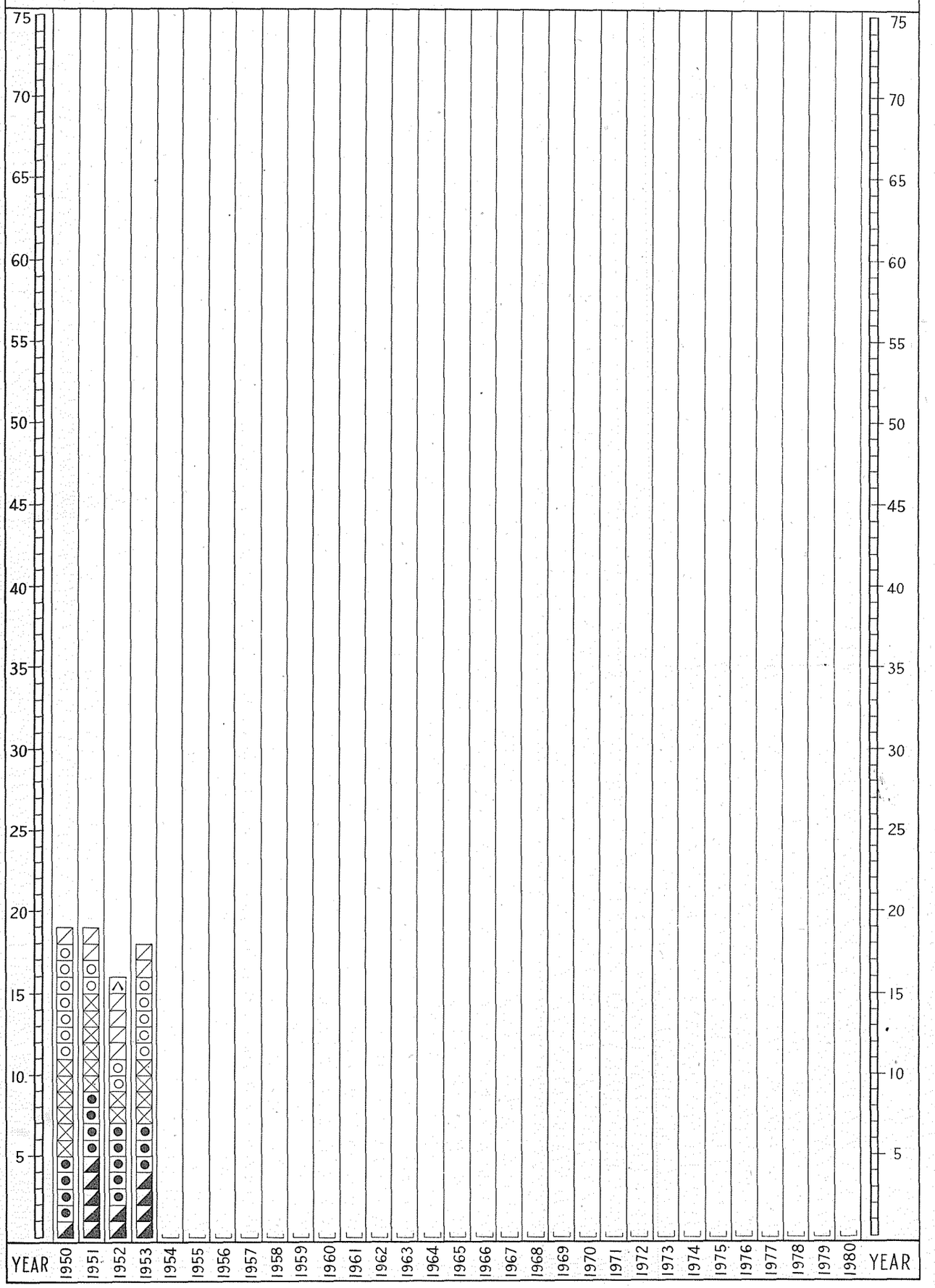
TABLE 10.

Average number of Men reported as engaged in Mining during 1952 and 1953.

Goldfield.	District.	Reef or Lode.		Alluvial.		Total.	
		1952.	1953.	1952.	1953.	1952.	1953.
Kimberley		5	5	....	....	5	5
West Kimberley		....	....	....	....	....	....
Pilbara	Marble Bar	85	77	....	....	85	77
	Nullagine	93	81	....	....	93	81
West Pilbara		3	1	....	....	3	1
Ashburton		....	4	....	....	....	4
Gascoyne		....	....	....	....	....	....
Peak Hill		71	60	....	....	71	60
East Murchison	Lawlers	14	8	....	....	14	8
	Wiluna	26	20	....	....	26	20
	Black Range	10	9	....	....	10	9
Murchison	Cue	439	442	....	....	439	442
	Meekatharra	39	35	....	....	39	35
	Day Dawn	14	16	....	....	14	16
	Mt. Magnet	127	153	....	....	127	153
Yalgoo		22	20	....	....	22	20
Mt. Margaret	Mt. Morgans	35	25	....	....	35	25
	Mt. Malcolm	265	286	....	....	265	286
	Mt. Margaret	54	57	....	....	54	57
North Coolgardie	Menzies	160	148	5	7	165	155
	Ularring	78	89	3	2	81	91
	Niagara	24	22	....	....	24	22
	Yerilla	43	50	2	1	45	51
Broad Arrow		163	104	5	4	168	108
North-East Coolgardie	Kanowna	40	35	4	4	44	39
	Kurnalpi	6	3	2	2	8	5
East Coolgardie	East Coolgardie	3,408	3,309	6	7	3,414	3,316
	Bulong	12	12	3	3	15	15
Coolgardie	Coolgardie	298	318	....	....	298	318
	Kunanalling	18	21	....	....	18	21
Yilgarn		412	501	....	....	412	501
Dundas		388	410	....	....	388	410
Phillips River		12	8	....	....	12	8
State Generally		....	....	....	....	....	....
Total, Gold Mining		6,364	6,329	30	30	6,394	6,359
MINERALS OTHER THAN GOLD.							
Asbestos		228	243	....	....	228	243
Barytes		....	3	....	....	....	3
Bentonite		4	1	....	....	4	1
Beryl		11	30	....	....	11	30
Clays		9	8	....	....	9	8
Coal		1,281	1,463	....	....	1,281	1,463
Copper Ore		2	1	....	....	2	1
Chromite		....	6	....	....	....	6
Cupreous Ore (Fertiliser)		18	18	....	....	18	18
Diatomaceous Earth		....	....	....	....	....	....
Dolomite		1	....	....	....	1	....
Felspar		10	9	....	....	10	9
Glass Sand		4	4	....	....	4	4
Glauconite		2	2	....	....	2	2
Gypsum		43	26	....	....	43	26
Iron Ore		127	129	....	....	127	129
Lead		250	122	....	....	250	122
Magnesite		3	1	....	....	3	1
Manganese		2	24	....	....	2	24
Ochre—Red and Yellow		2	2	....	....	2	2
Pyrites		188	209	....	....	188	209
Talc		5	6	....	....	5	6
Tantalo/Columbite		....	23	....	....	....	23
Tin		36	57	....	....	36	57
Tungsten—Scheelite		5	2	....	....	5	2
Wolfram		12	8	....	....	12	8
Vermiculite		2	2	....	....	2	2
Total, Other Minerals		2,245	2,399	....	....	2,245	2,399
Grand Total		8,609	8,728	30	30	8,639	8,758

DIAGRAM OF ACCIDENTS

Showing the number of deaths arranged in six classes in the Mines and Quarries of Western Australia



PART V.—ACCIDENTS.

TABLE 11.

MEN EMPLOYED IN MINES KILLED AND INJURED IN MINING ACCIDENTS DURING 1952 AND 1953.

A.—*According to Locality of Accident.*

Goldfield.	Killed.		Injured.		Total Killed and Injured.	
	1952.	1953.	1952.	1953.	1952.	1953.
1. Kimberley	....	....	3	....	3	....
2. West Kimberley	....	....	....	7	....	7
3. Pilbara	....	....	6	4	6	4
4. West Pilbara	....	2	8	11	8	13
5. Ashburton	....	....	1	1	1	1
6. Gascoyne	....	....	....	....	....	....
7. Peak Hill	....	....	4	3	4	3
8. East Murchison	....	....	....	....	....	....
9. Murchison	1	....	37	32	38	32
10. Yalgoo	....	....	....	....	....	....
11. Mount Margaret	1	....	11	30	12	30
12. North Coolgardie	1	1	16	20	17	21
13. North-East Coolgardie	....	....	....	....	....	....
14. Broad Arrow	....	....	....	....	....	....
15. East Coolgardie	8	6	305	319	313	325
16. Coolgardie	....	....	17	19	17	19
17. Yilgarn	....	3	17	18	17	21
18. Dundas	2	1	50	64	52	65
19. Phillips River	....	....	....	....	....	....
Mining Districts—						
Northampton	....	2	25	14	25	16
Greenbushes	....	....	....	....	....	....
Collie	2	2	103	130	105	132
South-West	1	1	6	9	7	10
Totals	16	18	609	681	625	699

From the above Table it will be seen that the number of fatal accidents for the year 1953 was 18 as against 16 in 1952. The number injured showed an increase of 72. These accidents are classified according to theircauses in the reports of the State Mining Engineer, Division II, and the Chief Coal Mining Engineer, Division X.

B.—*According to Causes of Accidents.*

Cause.	1952.		1953.		Comparison with 1952.	
	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.
1. Explosives	2	6	4	10	2	4
2. Falls of Ground	5	50	3	71(*e*)	— 2	21
3. In Shafts	2	17	4	14	2	— 3
4. Miscellaneous Underground	2	403	5	427	3	— 24
5. Surface	4(*a*)	129(*c*)	2(*b*)	158(*d*)	— 2	29
6. Fumes	1	4	....	1	1	— 3
Totals	16	609	18	681	2	72

(*a*) Includes 1 fatal accident in quarries.
(*b*) Includes 1 fatal accident in quarries.
(*c*) Includes 6 serious accidents in quarries.
(*d*) Includes 7 serious accidents in quarries.
(*e*) Includes 2 serious accidents in puarries.

OIL.

The big event of 1953 was of course the location of oil by West Australian Petroleum Proprietary Ltd. at Rough Range, Exmouth Gulf, in the first exporatory hole drilled. The Oil sands were encountered at a depth of 3,600 feet and continued for the following 20 feet. A test made by the Company of the flow over a period of 25 hours showed 23 barrels per hour.

This discovery in the initial drill hole was of the greatest importance, and provided maximum encouragement for further intense activity in the sedimentary areas in the State.

The Company is continuing the hole after cementing off this flow, and proposes, to drill to possibly 15,000 feet dependent upon the formations encountered.

It has during the twelve months also carried out an immense amount of geological, aerial and geophysical search, and has now sited a number of drill holes, the programme covering which will be entered upon during 1954. New drills have been ordered from the United States and Australia and all arrangements for their transport to the sites are in hand. At the same time ground search of its other areas is continuing.

The discovery of oil resulted in the formation of a number of local and Australian Companies which have been granted Permits to Explore in various parts of the State.

Some of these are already engaged in aerial and ground surveys of the areas held.

The Freney Kimberley Company during the year raised further capital and joined forces with another experienced Oil Search company with the object of deep drilling its areas in the Kimberleys.

This work will, it is anticipated, commence later in 1954.

Should the first discovery be followed by others and economic oil fields result, the State of Western Australia will enter into a new era, and its development should be accelerated beyond any previous expectation.

PART VI.—STATE AID TO MINING.

(a) State Batteries.

The number of State Batteries existing at the end of the year was 20, including Northampton Base Metal Plant, and there were no leased mills.

From inception to end of 1953 gold, tin and tungsten ores to the value of £15,532,523, including gold premium estimated at £5,112,277 have been put through the State Batteries. Additional premium paid to the prospector from sales of gold by the Gold Producers' Association Ltd., amounts to £36,375, and is included in the above total figure. Of this amount £15,420,053 came from 3,009,170 tons of gold ore, £94,577 from 81,818 tons of tin ore and £17,893 from 3,843 tons tungsten ore.

During the year 40,218 tons of ore were crushed for 17,702 ozs. of bullion estimated to contain 15,003 ozs. of fine gold, 7 dwts 11 grs. of gold per ton of ore. The average value of sands before cyanidation was 3 dwts 3.5 grs. making the average head value 10 dwts. 14.5 grs. 4,293 ozs. of fine gold were produced from cyanide plants giving a total estimated production for the year of 19,396 fine ozs. which realised £316,841 including Gold Producers Premium. In addition 248 tons of tungsten ores were crushed for 2,056 lb. of concentrates which yielded £1,273. Thus the grand total monetary yield from all operations was £318,114.

The working expenditure for all plants was £130,963 and the Revenue was £47,644, so that the working loss was £83,319 which does not include depreciation or interest. The capital expenditure since inception of the scheme has been £620,294 8s. 7d. made up of £443,251 14s. 10d. from General Loan Fund, £134,634 12s. 4d., from Consolidated Revenue, £28,621 13s. 5d. from Assistance to the Gold Mining Industry and £13,786 8s. 0d. from Commonwealth Assistance to Metalliferous Mining.

Head Office expenditure including insurance under the Workers Compensation Act and pay roll tax was £12,899 1s. 11d. as against £13,352 12s. 5d. for 1952.

The working expenditure from inception to the end of the year exceeds revenue by £481,065 3s. 6d.

(b) Geological Survey of Western Australia.

The principal work of the Geological Survey Branch for the year 1953 is covered by the following reports published in Division IV of this Report.

- Report on a Spodumene Bearing Pegmatite on Hampton Plains, Location 53, South of Kalgoorlie, W.A.
- Report on Prospects at Sunshine-Reward Amalgamated Gold Mine, Edwards Find, Yilgarn Goldfield.
- Report on a Reputed Titanium Deposit on the Coolgardie-Norseman Road, 3½ miles South-West of Higginsville.
- Report on Paringa Wheal Fortune Lead Mine, Northampton, W.A.
- Report on a Manganese Deposit on M.L. 22T in Temporary Reserve 1225H near Laverton, W.A.
- Summary Report on the Geology of the Mt. Ida District, North Coolgardie, Goldfield.
- Report on Water Supply, Yerecoin District.
- Further Report on Water Supply for East Kimberley Cattle Stations.
- An Outline of the Geology of the Country about Linden, North Coolgardie, Goldfields.
- Report on a Manganese Prospect near Naendip, Kent District, South-West Division, W.A.
- Report on the Broad Geological Structure of the Phillips River, Goldfield, W.A.
- Report on Underground Water Supply problem at Gabbin, South-West Division, W.A.
- Report on Reconnaissance Testing for Radioactivity in Phosphate Deposits, Dandaragan, W.A.
- Report on Radioactivity near Dundas, Dundas Goldfield, W.A.
- Progress Report on Diamond Drilling, Collie Mineral Field, W.A. (4) Bore No. 5—Site D—Mineral Lease 449.
- Progress Report on Diamond Drilling, Collie Mineral Field, W.A. (5) Bore No. 6—Site H—Mineral Lease 48.
- Preliminary Report on Government "Failing" Drilling, Centaur Area, Collie Mineral Field, W.A.
- Progress Report on Diamond Drilling, Collie Mineral Field, W.A. (6) Bore No. 7—Site A —Mineral Lease 384.
- Report on the Mt. McMahon Mining Group, Ravensthorpe, Phillips River, G.F., W.A.
- Report on Alleged Molybdenite Deposit on Location 41, Greenbushes, W.A.
- Report on a Shale Deposit, East of Albany Highway, Mundijong Area.
- Report on Barite Deposits on M.C. 487H, Cranbrook, South-West Division, W.A.
- Inspection of Artesian Bore Sites at Dongara and Yardarino.

During the year the following publications were issued:—

- Annual Progress Report of the Geological Survey of Western Australia for 1950.
- Bulletin No. 107: A re-Survey of the Coolgardie District, W.A., by J. C. McMath, B.Sc., N. M. Gray, B.Sc., & H. J. Ward, B.Sc.

Bulletin No. 103, Atlas No. 2 (Text and Atlas No. 1 already issued).

Geological and Economic Maps of the Metropolitan Area.

*Bulletin No. 108: The Geology of the Irwin River and Eradu Coal Basins, by W. Johnson, B.Sc. (Hons.), J. S. Gleeson, B.Sc. and L. E. de la Hunty, B.Sc.

*Annual Progress Report of the Geological Survey of Western Australia for 1951 and 1952.

The following reports have been compiled and await publication:—

Mineral Resources of Western Australia Bulletin No. 6: Silver, Lead and Zinc, by W. Johnson, B.Sc. (Hons.).

Mineral Resources of Western Australia Bulletin No. 7: Vermiculite, Talc and Soapstone, Fuller's Earth, Bentonite and Diatomite, by W. Johnson, B.Sc., (Hons.).

Mineral Resources of Western Australia Bulletin No. 8: Gypsum, by L. E. de la Hunty, B.Sc., and G. H. Low, B.Sc.

In course of Preparation:

Bulletin No. 109: A Geological Survey of the Ravensthorpe District, Phillips River Goldfield, W.A., by J. Sofoulis, B.Sc.

Officers of the Survey have rendered varied types of practical assistance to individuals, syndicates and companies, as well as other Government Departments who have been concerned with the exploration of mineral and water resources in all parts of the State.

ASSISTANCE UNDER THE MINING DEVELOPMENT ACT, 1902.

The following statement shows the sums advanced during the year 1953 under this Act:—

	£	s.	d.
1. Advanced in aid of mining work and equipment of mines with machinery	160,850	7	9
2. N.A.			
3. Providing means of transport equipment and sustenance for Prospectors	9,218	6	5
4. Other assistance	226	0	0
	170,294	14	2

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

	£	s.	d.
1. Refunds of Advances	64,234	0	11
2. Prospecting Refunds	918	12	2
	65,152	13	1

For the year 1952, the amount of assistance advanced under this Act was £289,868 18s. 5d.

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 6,818 against 6,641 total for the preceding year, showing an increase after all adjustments of 177 boilers.

Of the total 6,818 useful boilers, 3,694 were out of use at the end of the year, 2,977 thorough and 943 working inspections were made and 3,124 certificates were issued.

Permanent condemnations totalled 20 and temporary condemnations 11, three boilers were transferred beyond the jurisdiction of the Act.

The total number of machinery groups registered was 33,025 against 30,230 for the previous year, showing an increase of 2,795.

*These publications are still in the press.

Inspections made total 26,251 and 6,146 certificates were granted.

The total miles travelled for the year were 78,375 against 85,839 miles for the previous year, showing decrease of 7,464 miles. The average miles travelled per inspection were 2.6 as against 3.31 miles per inspection for the previous year.

Three hundred and thirty-two applications for engine drivers' and boiler attendants' certificates were received and dealt with, and 284 certificates, all class were granted as follows:—

Winding Competency (including certificates issued under Regulation 40 and Section 60).	8
First Class Competency (including certificates issued under Regulations 40 and 45, and Sections 60 and 63).	12
Second Class Competency (including certificates issued under Regulation 40 and Section 60)	20
Third Class Competency (including certificates issued under Regulations 40 and 45 and Sections 60 and 63 of the Act).	15
Locomotive Competency (including certificates issued under Regulation 40 and Section 60).	10
Traction Competency (including certificates issued under Regulation 40 and Section 60).	—
Internal Combustion Competency (including certificates issued under Regulation 40 and Section 60).	47
Crane and Hoist Competency (including certificates issued under Regulation 40 and Section 60).	83
Boiler Attendant's Competency (including certificates issued under Regulation 40 and Section 60).	85
Copies	4
Total:	284

The total revenue from all surces during the year was £13,529 10s. 2d. as against £12,492 17s. 1d. previous year, showing an increase of £1,036 13s. 1d.

The total expenditure for the year was £24,798 9s. 1d. against £20,962 2s. 3d. for the previous year, showing an increase of £3,836 6s. 10d.

PART VIII—THE GOVERNMENT CHEMICAL LABORATORIES.

The total number of samples received during the year for examination was 18,439. This figure is slightly less than last year 21,115 and covered a great variety of materials for either analysis or for examination and report from the following Departments—Mines, Agriculture, Public Health, Metropolitan Water Supply, Sewerage and Drainage, Public Works, Police, Factories, State Housing, Industrial Development, Government Stores and Tender Board, Charcoal Iron and Steel Industry, Main Roads, War Service Land Settlement and Forests. Samples were also received from various Commonwealth Government Departments and the general public.

The number of samples allotted to each of the five divisions was as follows:—

Food, drugs and toxicology	12,112
Mineralogy and mineral chemistry	1,425
Agriculture, forestry, water supplies	3,977
Fuel technology	894
Industrial chemistry	31

The large number of samples recorded in the Food, Drugs and Toxicology Division is due to the inclusion of field tests in connection with corrosion tests on sewers for the Metropolitan Water Supply, Sewerage and Drainage Department.

The chief sources of samples for analyses and chemical examination received by this division were from the Public Health Department, Police Department, Department of Agriculture, Milk Board of W.A. and Water Supply Department and embraced a wide variety of products including human and animal toxicological exhibits, criminal investigation exhibits, drugs and medicines, liquors, trade wastes, insecticides and fungicides, paints, oils, explosives, river and harbour pollution samples and a number of miscellaneous products. The programme of work on sewer corrosions undertaken in co-operation with the Water Supply, Sewerage and Drainage Department continues. Most of this work is done at the annexe laboratory, Lincoln Street.

The chief sources from which samples were received by the Mineral Division were the Government Geologist, State Batteries and the general public. Its activities are largely concerned with the development of the mineral industry in this State. Apart from general analyses and assaying a large number of minerals and ores of potential economic value were examined. Metals, alloys and building materials were also examined for their susceptibility to corrosion and for compliance with specifications. Many specimens and ores were tested for radio-activity both departmentally and for the general public samples are tested free to assist the search for radio-active minerals in this State.

Of the 3,977 samples handed by the Agricultural Division, 2,280 were examined for the Department of Agriculture. These include soils, pastures, cereals, various plant and tree products and miscellaneous elements of fertilising value as required by its various branches. Plant nutrition, plant pathology, horticulture, dairying, entomology, animal health and nutrition. Poultry, wheat and sheep, vegetable, irrigation and tobacco etc. Chemical research into the properties of Western Australian tobacco continued in co-operation with the Tobacco Officer in Manjimup. A number of fertilisers and feeding stuffs for compliance with the respective acts were analysed. Many water samples were analysed for bona fide farmers and advice given as to their suitability for domestic, irrigation and stock purposes. The routine examinations of existing water supplies to cities and towns both metropolitan and country have been continued. Water samples were also examined for the War Service Land Settlement Scheme.

The Fuel Technology division has systematically sampled and examined coal samples from the Collie field with a view to advising as to the best types and the best methods of utilisation in industry. A systematic survey of the working faces of each mine was also made as development proceeds. By this means any variation in the composition and ash content can be detected and a check kept on the quality of coal mined. The problem of developing a succesful coked briquette from Collie coal as a coke substitute has now almost passed the successful laboratory scale and has proceeded to a larger unit process scale in co-operation with the Department of Industrial Development. A number of coal core samples were examined for the Government Geologist as a result of the drilling programme being undertaken at Collie. Coal samples have also been examined for private industry. The investigation into the washability of Collie Coal was continued at Collie during the year on a larger scale by using a pilot unit heavy media separator. It is expected that these results will be available next year.

The work of the Industrial Chemistry division was again limited by the lack of proper facilities but the erection of the Unit Process building is well in hand and should be ready for occupation early next year. All the plant has been ordered and received with the exception of two items which are expected in time for the completion of the building. Notwithstanding much valuable work has been done in consolidating a proposed programme of work. Again this year assistance was given to industry and to Government departments by the provision of technical information and literature. A number of analyses has been carried out for the Government Geologist which has laid a foundation for future operations on a Unit Plant Scale.

PART IX—SCHOOL OF MINES.

(a) Kalgoorlie.

The total number of students enrolled was 401—a decrease of 20 by comparison with 1952.

607 samples or specimens were received for mineral examination or assay for the mining public, as against 374 for the previous year.

The work received at the Metallurgical laboratory was equal to previous years. 63 applications were received and 61 reports were issued: Of these 18 had referene to Gold, the remainder to metals and non-metallics.

(b) Norseman.

The enrolments for the year was 60—a decrease of 3 compared with 1952. In addition classes were arranged in general science and thirty-two State school children attended.

(c) Bullfinch.

A new branch was established at this centre and commenced in February.

The total number of students enrolled during the year was 69. This figure was higher than anticipated.

Ten subjects were taught and thanks are due to Great Western Consolidated who not only provided accomodation in the mine workshops but also provided a building in which other classes were held.

The Bullfinch Country Club offered a prize each year for the student under 18 years who does the best years' work.

PART X—EXPLOSIVES.

During 1953 a much greater volume of Explosives was used in the State. 5,647,950 lbs. compared with 4,919,350 lbs. in 1952. The bulk of this was used in gold mining operations.

Tests were made of all shipments at Woodman's Point Explosives Reserve before it was permitted to be distributed.

In addition stocks at consumers' magazines were regularly inspected by the Staff and advice given on safety methods.

Imported stocks of fireworks were also tested before distribution was permitted.

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

In 1953 all Goldfields were visited with the exception of Ashburton, Gascoyne, Kimberley and Phillips River which are all remote and contain few mine workers.

The number of examinations made was 4,809 compared with 5,359 in 1952.

PART XII.—CHIEF COAL MINING ENGINEER.

The Chief Coal Mining Engineer's report sets out that good progress was made in the mechanisation programme. At the end of 1953 no less than 90% of deep mined output being won by this method.

885,433 tons of coal were mined during the year as compared with 830,857 tons in 1952. Kalgoorlie Power Corporation commenced using coal and consumed 25,294 tons.

Two new deep mines were commenced during the year, one on the Ewington Leases the other on Westralia group. These mines will be mechanised from their inception.

STAFF.

I would again like to thank all members of the Staff, Head Office and Outstation, for their loyal and efficient service during the year.

In dealing with the various activities I have commented only on the principal items. Detailed reports of the responsible branch officers are contained in Division II to X.

(Sgd.) A. H. TELFER,
Under Secretary for Mines.

Department of Mines,
Perth, 1st May, 1954.

(2)—88619.

Division II.

Report of the State Mining Engineer for the Year 1953.

Department of Mines,
Perth, 1st May, 1954.

The Under Secretary For Mines.

I have the honour to submit for the information of the Hon. the Minister for Mines, my Annual Report on this branch of the Mines Department for the year 1953.

The details of mining activities in the State during the year 1953 have been compiled from information supplied by the Statistician and Inspectors of Mines. The section on drilling has been compiled by the Assistant State Mining Engineer.

STAFF.

Mr. J. H. Verran, the Senior Inspector of Mines, retired from that position on 2nd November, 1953, after nine years' service. Mr. H. L. Burrows was appointed to the position of Assistant Inspector of Mines, Ventilation, at Kalgoorlie on 2-2-1953.

ACCIDENTS.

Fatal and serious accidents in metal mines and quarries reported to the Department are shown below. The corresponding figures for 1952 are shown in brackets.

There were 16 (14) fatal and 551 (506) serious accidents.

In gold mines there were 10 (12) fatal and 481 (447) serious accidents. The number of men employed in such mines was 6,359 (6,394). The accident rate per 1,000 men employed was thus 1.57 (1.88) for fatal accidents and 75.64 (69.91) for serious accidents.

Of the remaining accidents two occurred in a lead mine, two in an asbestos mine, one in a pyrites mine and one in a quarry.

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

TABLE A.

SERIOUS ACCIDENTS FOR 1953.

(Minerals other than Coal).

Class of Accident.	Kimberley and West Kimberley.	East Coolgardie.	Peak Hill.	Yilgarn.	Coolgardie.	Dundas.	Mt. Margaret.	North Coolgardie.	Murchison.	Pilbara.	West Pilbara.	South-West.	Northampton.	Ashburton.	TOTAL.
Major Injuries—Exclusive of Fatal—															
Fractures :															
Head	....	2	....	....	....	1	....	....	....	....	....	1	1	....	5
Shoulder	....	1	....	....	....	....	....	....	....	....	....	1	1	....	3
Arm	....	4	....	....	....	1	....	....	1	....	....	1	....	....	7
Hand	....	2	....	1	....	....	2	1	....	....	....	....	....	....	6
Spine	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Rib	....	5	....	1	....	1	....	1	....	....	....	....	....	....	8
Pelvis	....	1	....	....	....	....	1	....	....	....	....	....	....	....	2
Thigh	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Leg	....	5	....	1	1	3	....	....	....	....	....	1	....	....	11
Ankle	....	1	....	....	....	....	....	....	....	....	....	....	1	....	2
Foot	....	4	....	....	1	1	....	....	2	....	....	....	....	....	8
Amputations :															
Arm	....	....	....	....	....	....	1	1	1	....	....	....	....	....	3
Hand	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Finger	....	4	....	1	....	2	....	2	....	....	....	1	....	....	10
Leg	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Foot	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1
Toe	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Loss of Eye	....	....	....	1	1	....	....	....	....	....	....	....	....	....	2
Serious Internal	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Hernia	....	2	....	....	....	1	1	....	....	....	....	....	....	....	4
Dislocations	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Other Major	....	1	....	....	....	1	....	....	....	....	2	....	....	....	4
Total Major	....	32	....	5	3	11	5	5	4	....	2	6	3	....	76
Minor Injuries—															
Fractures :															
Finger	....	7	2	....	....	2	2	....	2	1	1	....	1	....	18
Toe	1	6	....	....	....	1	3	....	1	....	....	....	1	....	13
Head	1	11	....	....	....	3	....	....	....	....	....	1	1	....	17
Eyes	1	5	....	....	1	1	2	....	2	....	1	....	....	....	13
Shoulder	....	7	....	....	....	1	1	1	1	....	....	....	....	....	11
Arm	....	25	....	1	....	2	3	2	2	....	1	....	....	....	36
Hand	1	64	....	4	6	14	6	5	9	....	1	....	1	....	111
Back	....	37	....	3	3	8	3	4	....	1	....	1	3	....	63
Rib	....	12	....	1	....	2	1	....	....	....	1	....	....	....	17
Leg	2	60	1	2	5	8	1	2	6	2	1	....	1	....	91
Foot	....	31	....	2	1	6	1	1	3	....	1	....	....	....	46
Other Minor	1	22	....	....	....	5	2	....	2	....	2	1	3	1	39
Total Minor	7	287	3	13	16	53	25	15	28	4	9	3	11	1	475
Grand Total	7	319	3	18	19	64	30	20	32	4	11	9	14	1	551

There were no accidents during the year under review in the following Goldfields—

Broad Arrow	East Murchison
North-East Coolgardie	Yalgoo
Phillips River	Gascoyne

Table "B" shows the fatal, serious and minor accidents reported and the number of men employed classified according to mineral mined.

TABLE B.

Mineral.	Men Employed.	Accidents.		
		Fatal.	Injured.	
			Serious.	Minor.
Copper	1	....	....	....
Gold	6,359	10	481	1,695
Iron Ore (for Pig)	36	....	....	....
Iron Ore (for Export)	93	....	7	11
Lead, zinc, silver	122	2	15	17
Tin, Wolfram, Tantalite	90	....	....	....
Asbestos	243	2	11	83
Other Minerals	351	1	28	102
Quarries	Not available	1	9	17
Total	7,295	16	551	1,925

Accidents classified according to causes for the various districts are shown in Table "C".

TABLE C.

Fatal and Serious Accidents showing Causes and Districts.

(Minerals other than Coal).

District	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.
Kimberley	....	....	....	....	....	....	....	....	....	....	....	....	....	....
West Kimberley	....	....	....	....	....	....	....	....	....	3	....	4	....	7
East Coolgardie	1	1	1	34	3	2	....	1	1	218	....	63	6	319
Peak Hill	....	....	....	....	....	....	....	....	....	1	....	2	....	3
Yilgarn	....	1	....	....	1	1	....	....	1	8	1	8	3	18
Coolgardie	....	1	....	3	....	....	....	....	....	11	....	4	....	19
Dundas	1	5	....	10	....	5	....	....	....	35	....	9	1	64
Broad Arrow	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Mt. Margaret	....	....	....	5	....	2	....	....	....	16	....	7	....	30
North Coolgardie	....	....	....	3	....	1	....	....	1	8	....	8	1	20
East Murchison	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Murchison	....	....	....	1	....	1	....	....	....	19	....	11	....	32
Pilbara	....	....	....	1	....	....	....	....	....	1	....	2	....	4
West Pilbara	1	2	....	2	....	....	....	....	1	....	....	7	2	11
South-West	....	....	....	2	....	....	....	....	....	....	1	7	1	9
Northampton	....	....	2	3	....	2	....	....	....	5	....	4	2	14
North-East Coolgardie	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Yalgoo	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Greenbushes	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Phillips River	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Ashburton	....	....	....	....	....	....	....	....	....	1	....	....	....	1
Gascoyne	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total for 1953	3	10	3	64	4	14	....	1	4	326	2	136	16	551
Total for 1952	2	6	4	41	2	17	1	4	1	322	4	116	14	506

FATAL ACCIDENTS.

A brief description of fatal accidents reported during the year is given below—

Name and Occupation.	Date.	Mine.	Details and Remarks.
Coles, Herbert Augustus (Mine Owner) Baston, George Hugo Strickland (Miner)	5–1–53	Baddera Lead Mine, Northampton	The two men were timbering in an empty shrink stope when a fall of ground buried them. Coles died from multiple head injuries and Baston was asphyxiated. The bodies were recoverd after six days of continuous work.
Rogantini, Eugenio (Timberman)	12–1–53	Callion Mine, New Coolgardie Gold Mines	The deceased sustained a fractured skull when he slipped off a plank in the 200 ft. level shrink stope and fell about 10 feet.
Madson, Leonard Carl (Trucker)	31–3–53	Iron King, Norseman Gold Mines (N.L.)	Received multiple injuries when four cases of fracteur exploded on the No. 5 level. He had lit a sandblast in a chute 17 feet from the stored explosives and had retired some 60 feet up the drive. The resultant explosion threw him about 100 feet. Five of his workmates were injured.
Gianoli, Attilio (Trucker)	9–4–53	Copperhead Great Western Consolidated Bullfinch	This man was killed when he fell 400 feet down the main shaft from the 600 ft. level. It appears that he was placing a derailed truck back on the line at the shaft when he slipped and fell.
Wlodarczyk, Stanislaw (Locomotive Driver)	21–4–53	Australian Blue Asbestos, Wittenoom	The deceased sustained a fractured skull when his head was jammed between the loco. and a scraper loading ramp. At the time he was slowly driving the loco. in the opposite direction to which he was facing.
Scenini, Carlo (Quarry Worker)	13–5–53	Limestone Quarry, South Coogee	Scenini's head was crushed between two pieces of limestone when the rill of stone moved downwards.
Needham, George Herbert (Timberman)	25–5–53	Edwards Shaft, Great Boulder Pty., Ltd.	Needham sustained extensive injuries when he fell 400 feet to the bottom of the shaft. He and his mate, Thomas, were riding on a kibble guide (monkey) between the 28 and 26 levels when the deceased was knocked off the monkey by a partly open tip door.
Neill, Arthur Wesson (Shaft Sinking)	3–7–53	Kalgoorlie Enterprise Gold Mine	Two men were descending below the No. 25 level via a sinking kibble. Neill, who was standing on the lip was struck by the rope crosshead which had been "hung up" in the shaft. He fell 160 feet to the bottom.
Quinn, William (Tool Sharpener)	Injured 6–7–53 Died 7–7–53	Copperhead Great Western Consolidated, Bullfinch	Died from peritonitis. Prior to the accident the deceased was engaged in carrying steel containers to the shaft some 30 yards away. During these operations he suffered a hernia and perforated lower bowel.
Esmond, Ernest John (Machine Miner)	23–7–53	Main Shaft, South Kalgurli Consolidated	Esmond was killed by an explosion on the 2,050 ft. level when he bored into fracteur remaining in a previously fired burn cut.
Riccetti, Pelligriono (Machine Miner)	4–8–53	Haoma G.M., Mt. Monger	Death was due to asphyxia following compression of the chest when he was crushed between a slab of rock and the wall of the 300 ft. level stope.
Willmott, Joseph William (Timberman)	7–8–53	Edwards Shaft, Great Boulder Pty., Ltd.	Willmott died from severe internal injuries and concussion of the brain when he fell approximately 150 feet to the bottom of the shaft. There was no evidence to show how he came to fall.
Camadini, Felice (Machine Miner)	12–8–53	Copperhead, Great Western Consolidated, Bullfinch	Camadini fired the second cut from a winze in an intermediate drive 35 feet below No. 4 level. On returning via the winze, a ladder, which had been weakened by the explosion gave way and the deceased fell 120 feet.
De Vaurno, Desmond (Machine Miner)	12–8–53	Australian Blue Asbestos, Wittenoom	The deceased suffered multiple injuries in the 2,000 crosscut when he bored into a butt which contained unexploded fracteur. Two other men were severely injured by the explosion.
Taylor, Frank (Hydraulic Filling)	17–11–53	Lane Shaft, Great Boulder Pty., Ltd.	Taylor died from multiple injuries received when he fell 100 feet from a ladderway into the 400 ft. level E.L.F. cut and fill stope.

WINDING MACHINERY ACCIDENTS.

Fifteen accidents involving winding machinery were reported during the year and are briefly as follows:—

Overwinds (4). Three of these accidents were caused by errors of judgment in estimating the speed of the cage or skip and in the remaining case the driver neglected to reverse his engine before starting to wind.

Derailments (3). Three skip derailments in the Sons of Gwalia shaft were reported.

Cages Hung Up (5). Two accidents caused by the escape of materials being hoisted in cages and resulting in the cage fouling the timbers were reported from the Great Boulder Mine. Three accidents in which cages were hung up were reported from the Enterprise mine. One of these was caused by an error but the other two occurred during hoisting operations.

Mechanical Failures (1). A skip broke away in the Campbell shaft of the Norseman Gold Mines when the detaching hook failed under load.

Miscellaneous (2).—A skip got away in the Copperhead shaft when the rope was being rewound on to the winder drum. A fatal accident occurred during sinking operations in the Victoria Shaft at the Kalgoorlie Enterprise when a monkey held up in the shaft and subsequently came down.

PROSECUTIONS.

Five prosecutions were conducted and all were successful. One man was prosecuted for firing outside the permitted hours and four others were prosecuted for boring in the butts of holes where explosives had been fired.

SUNDAY LABOUR PERMITS.

Twelve permits for Sunday labour were issued during the year. Two permits each for one day were for improvements to an ore pass in the North Kalgurli (1912) Ltd. Three permits each with a currency of three months were granted to Norseman Gold Mines N.L. to enable shaft timbering to be done at week ends during sinking operations. A similar permit with a currency of six months was

issued to Great Western Consolidated N.L. Three permits, each for one Sunday, were also granted to that company to allow access roads to the open cut to be repaired at the week end.

A permit covering eight Sundays was issued to Hill 50 Gold Mine to enable the Main Shaft to be timbered below No. 4 level without interrupting normal haulage.

A permit to work on one Sunday for the purpose of repairing shaft damage after an accident was granted to Big Bell Mines Ltd.

Horseshoe Gold Mines was granted permission to work on 8 Sundays in preparing the open cut.

CERTIFICATES OF EXEMPTION (SECTION 46).

Nine certificates were issued as compared with four in 1952.

AUTHORISED MINE SURVEYORS.

The Survey Board issued five certificates during the year.

ADMINISTRATIVE.

Regulations under the Mines Regulation Act have been amended as follows:—

Regulation 21.—To provide for an increase in the fees paid to Returning Officers.

Regulation 114.—To provide that engine drivers shall return all signals except the signal to hoist after the firing warning and the signal to stop.

The Mine Workers' Relief Act was amended by No. 7 of 1953 to vary the interpretation of the terms "Employer," "Mine and Mining" and "Mine Worker."

A new Regulation 16B has been added to provide for absentee voting at elections.

Regulations under the Mining Act have been amended as follows:—

A new regulation 115B provides for the regulation of mining coal by open cut methods.

Regulations 1 and 2 of the West Australian Coal Mines Advisory Board were gazetted on 20/3/53 and Regulation 7 of the Western Australian Coal Industry Tribunal Regulations has been amended.

VENTILATION.

The ventilation work of the Department has been under the control of Inspector Faichney. He has been assisted by the two Assistant Inspectors, Messrs. Ibbotson and Burrows.

Dust counts have been continued throughout the year and the results are tabulated below:—

	No. of Samples	Samples giving over 1,000 ppcc.	Average Count.
Development ..	355	5	212
Stoping	626	3	217
Levels	73	2	222
Surface	30	3	337

The results are comparable with those reported in former years.

Secondary ventilation has been maintained at a high standard.

The administration of Aluminium Therapy has continued at all major mines. A census of men taking the treatment was compiled in June and July and indicates that while most of the men get some treatment the average exposure to the aluminium dust is less than 10 minutes.

Talks on the reasons for Aluminium Therapy have been given by the staff of the Health Laboratory.

The more important of the improvements made to main ventilation systems are listed below.

A new return airway has been formed in the Ivanhoe mine by cleaning out and timbering Drysdale Shaft.

Great Boulder has also formed a new return airway and has moved one of the main fans to a more suitable position.

Several major alterations have been made on the Enterprise. The mine now has two exhaust fans and an internal fan at the 25 level.

Gold Mines of Kalgoorlie is mainly ventilated by natural means but fans are used on the Oroya South and New North Boulder.

Some trouble was occasioned on the North Kalgurli mine by a seasonal reversal but this was brought under control.

The completion of connections between No. 5 and No. 6 level has improved conditions on the Iron King Mine.

Great Western Consolidated has changed over to pressure ventilation, the main fan, which handles 35,000 c.f.m., being placed at the No. 8 level.

The exhaust fan on the surface at Big Bell has been moved to the No. 12 level. There are now fans on each of the four bottom levels and they handle a total of 96,500 c.f.m.

A fan has been placed on the old shaft at Hill 50 and the mine is very well ventilated.

GOLD MINING.

The ore produced during the year amounted to 3,169,875 tons, which is half a million tons greater than the amount of 2,626,612 tons produced in 1952.

The gold recovered was 823,331 fine ounces, which is almost 100,000 fine ounces greater than the return of 727,468 fine ounces in the previous year.

The average grade of 5.20 dwts. per ton is slighthly lower than the 5.54 dwts. per ton for 1952. This is mainly due to the contribution of Great Western which mined ore below the average grade. Most of the other mines were close to last year's grade.

The number of men employed in the industry, based on monthly averages was 6,359, only slightly less than the figure of 6,394 for the previous year.

The calculated value of the gold produced was £A12,754,770, which excluded £535,330 distributed by the Gold Producers' Association from the sale of 684,726 fine ounces of gold at an average premium of 15.636/- per fine ounce. The Mint value for gold throughout the year was £15 9s.10d. per fine ounce.

The average production of ore per man for the year was 498.49 tons valued at 80.48 shillings per ton (1952 — 410.79 tons valued at 89.92 shillings per ton). Gold recovery per man amounted to 129.47 fine ounces as compared with 113.77 fine ounces in the previous year.

Statistics relating to the gold mining industry are tabulated as follows—

Table "D"—Gold Production Statistics.

Table "E"—Classification of gold output by districts.

Table "F"—Classification of Gold Output 1949-1953.

Table "G"—Mines producing 5,000 ounces and over for the past five years.

Table "H"—Development Footages.

TABLE D.

Gold Production Statistics.

Year.	Tons Treated. (2,240 lb.)	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.	dwts.
1929 ...	628,400	372,064	1,580,426	50·30	4,108	84·96	11·84
1930 ...	645,344	419,767	1,874,484	58·09	4,284	89·33	13·01
1931 ...	982,163	518,045	3,042,019	61·94	5,961	117·44	10·55
1932 ...	1,327,021	599,421	4,358,989	65·70	8,695	145·44	9·03
1933 ...	1,588,979	636,928	4,884,112	61·48	9,900	153·36	8·01
1934 ...	1,772,931	639,871	5,461,004	61·60	12,523	170·69	7·22
1935 ...	1,909,832	646,150	5,676,679	59·45	14,708	175·71	6·77
1936 ...	2,492,034	852,422	7,427,687	59·61	15,698	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	53·38	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	5,966,451	55·89	4,614	210·18	5·32
1945 ...	1,736,952	469,906	5,025,039	57·86	4,818	213·87	5·41
1946 ...	2,194,477	618,607	6,657,762	60·70	6,961	215·25	5·64
1947 ...	2,507,306	701,752	7,552,611	60·25	7,649	215·25	5·59
1948	2,447,545	662,714	7,132,748	58.28	7,178	215.25	5.42
1949	2,468,297	649,572	7,977,200	64.64	6,800	245.62	5.26
1950	2,463,423	608,633	9,428,745	76·55	7,080	309·83	4·94
1951	2,471,679	648,245	10,042,392	81·26	6,766	309·83	5·25
1952	2,626,612	727,468	11,269,689	85·81	6,394	309·83	5·54
1953	3,169,875	823,331	12,754,770	80·47	6,359	309·83	5·20

TABLE E.

Classification of Gold Output for 1953 by Goldfields.

Goldfield.	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.	
		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	232	1	6	....	....	....	....	....	....	....	....	....	....	....	....
Ashburton	84	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Pilbara	143	13	329	5	1,244	2	1,283	1	1,180	....	....	1	3,795	....	....
Peak Hill	27	4	91	....	....	....	....	....	....	....	....	....	....	....	....
East Murchison	67	8	237	1	350	1	545	....	....	....	....	....	....	....	....
Murchison	1,262	19	530	9	2,587	1	710	....	....	....	....	....	....	....	....
Mount Margaret	257	8	229	6	1,044	1	536	1	1,048	....	....	....	....	....	....
Yalgoo	17	4	24	2	381	....	....	....	....	....	....	....	....	....	....
North Coolgardie	147	10	374	9	1,908	3	2,111	2	2,857	....	....	....	....	....	....
Broad Arrow	235	9	234	7	1,522	1	559	....	....	....	....	....	....	....	....
North-East Coolgardie	234	2	21	1	129	....	....	....	....	....	....	....	....	....	....
East Coolgardie	202	30	932	7	1,157	....	....	2	2,600	....	....	....	....	1	4,636
Coolgardie	517	31	612	2	690	1	605	....	....	....	....	....	....	....	....
Yilgarn	152	10	297	3	740	2	1,545	....	....	1	2,703	....	....	....	....
Dundas	47	2	10	1	209	....	....	....	....	....	....	....	....	....	....
Phillips River	....	2	62	1	417	....	....	....	....	....	....	....	....	....	....
West Pilbara	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....
West Kimberley	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Gascoyne	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
State Generally	39	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total	3,666	153	3,988	54	12,378	12	7,894	6	7,685	1	2,703	1	3,795	1	4,636

Goldfield.	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.		Over 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.).
Kimberley	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Ashburton	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Pilbara	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Peak Hill	1	8,896	....	....	....	....	....	....	....	....	....	....	....	....
East Murchison	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Murchison	....	....	....	....	....	....	....	....	1	41,799	1	54,142	....	....
Mount Margaret	....	....	....	....	1	26,026	....	....	....	....	....	....	....	....
Yalgoo	....	....	....	....	....	....	....	....	....	....	....	....	....	....
North Coolgardie	....	....	2	29,063	....	....	....	....	....	....	....	....	....	....
Broad Arrow	....	....	....	....	....	....	....	....	....	....	....	....	....	....
North-East Coolgardie	....	....	....	....	....	....	....	....	....	....	....	....	....	....
East Coolgardie	1	9,246	1	18,119	1	23,673	1	33,677	....	....	2	118,241	2	272,467
Coolgardie	....	....	1	17,176	....	....	....	....	....	....	....	....	....	....
Yilgarn	....	....	....	....	....	....	....	....	....	....	1	50,192	....	....
Dundas	....	....	....	....	....	....	....	....	....	....	1	73,869	....	....
Phillips River	....	....	....	....	....	....	....	....	....	....	....	....	....	....
West Pilbara	....	....	....	....	....	....	....	....	....	....	....	....	....	....
West Kimberley	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Gascoyne	....	....	....	....	....	....	....	....	....	....	....	....	....	....
State Generally	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total	2	18,142	4	64,358	2	49,699	1	33,677	1	41,799	5	296,444	2	272,467

TABLE F.

Classification of Gold Output, 1949–1953.

Range of Output.	1953.			1952.			1951.			1950.			1949.		
	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	2	272,467	33·2	1	146,256	20·1	1	155,044	23·9	1	126,749	20·9	1	132,984	20·5
50,000—100,000	5	296,444	36·0	4	293,217	40·3	2	146,381	22·6	2	139,252	22·9	3	202,381	31·2
40,000—50,000	1	41,799	5·1	1	47,286	6·5	3	140,437	21·7	3	131,549	21·6	2	87,936	13·5
30,000—40,000	1	33,677	4·1	1	30,578	4·2	1	33,126	5·1	....	....	....	1	32,529	5·0
20,000—30,000	2	49,699	6·0	1	23,616	3·3	2	45,340	7·0	3	71,291	11·7	2	44,227	6·8
10,000—20,000	4	64,358	7·8	6	104,197	14·3	3	47,485	7·3	4	59,421	9·8	5	70,922	10·9
5,000—10,000	2	18,142	2·2	4	29,537	4·1	2	14,116	2·2	3	22,527	3·7	2	15,306	2·4
4,000—5,000	1	4,636	0·6	....	....	....	1	4,283	0·7	....	....	....	....	....	....
3,000—4,000	1	3,795	0·5	2	7,290	1·1	1	3,327	0·5	....	....	....	1	3,743	0·6
2,000—3,000	1	2,703	0·3	3	6,735	0·9	5	12,522	1·9	3	6,770	1·1	3	6,275	1·0
1,000—2,000	6	7,685	0·9	5	6,869	0·9	6	8,517	1·3	8	10,592	1·7	7	10,089	1·5
500—1,000	12	7,894	0·9	14	9,704	1·3	15	10,222	1·6	15	10,596	1·7	24	14,933	2·3
100—500	54	12,378	1·5	56	13,293	1·8	71	16,208	2·5	76	17,620	2·9	70	15,734	2·4
Under 100	184	3,988	0·5	177	5,081	0·7	175	5,277	0·8	211	5,890	1·0	194	6,132	0·9
Sundry Claims, etc.	....	3,666	0·4	....	3,808	0·5	....	5,960	0·9	....	6,376	1·0	....	6,381	1·0
Totals	276	823,331	100·0	275	727,467	100·0	288	648,245	100·0	329	608,633	100·0	315	649,572	100·0

TABLE G.

Mines Producing 5,000 ounces and upwards for the Past Five Years.

Mine.	1953.			1952.			1951.			1950.			1949.		
	Tons Treated.	Fine Ounces.	Dwts. per Ton.	Tons Treated.	Fine Ounces.	Dwts. per Ton.	Tons treated.	Fine Ounces.	Dwts. per ton.	Tons treated.	Fine Ounces.	Dwts. per Ton.	Tons Treated.	Fine Ounces.	Dwts. per Ton.
Big Bell Mines, Ltd.	402,906	54,142	2·69	400,563	53,610	2·68	369,412	49,726	2·69	359,082	47,592	2·65	424,525	56,071	2·64
Blue Spec Mining Co., N.L.	2,297	3,795	33·04	6,819	6,494	19·05	....	....	....	....	....	....	....	....	....
Boulder Perseverance, Ltd.	136,257	33,677	4·94	131,840	30,578	4·64	135,474	33,126	4·89	114,443	24,455	4·27	133,000	32,529	4·89
Callion (Western Mining Corporation, Ltd.)	29,926	16,023	10·71	25,214	14,697	11·66	....	....	....	....	....	....	....	....	....
Central Norseman Gold Corporation, N.L.	155,451	73,869	9·50	158,447	78,241	9·88	151,322	43,868	5·80	155,822	42,475	5·45	132,930	46,865	7·05
Gold Mines of Kalgoorlie	191,292	57,184	5·98	171,659	47,286	5·51	167,889	46,843	5·58	163,829	41,482	5·06	163,552	41,071	5·02
Great Boulder Pty. Gold Mines, Ltd.	409,814	106,775	5·21	376,564	96,111	5·10	325,924	96,985	5·34	331,739	79,827	4·81	333,109	83,259	5·00
Great Western Consolidated, N.L.	392,508	50,192	2·56	....	....	....	....	....	....	....	....	....	....	....	....
Hannan's North (Broken Hill Pty., Ltd.)	....	....	....	....	273	....	9,324	3,327	7·13	39,166	9,256	4·73	42,490	13,027	6·13
Hill 50 Gold Mines, N.L.	83,865	41,799	9·97	53,803	15,839	5·89	28,352	7,557	5·33	44,632	11,517	5·16	49,230	13,128	5·33
Horseshoe (Anglo Westralian Mining Pty., Ltd.)	54,923	8,896	3·24	35,602	5,428	3·05	....	....	....	....	....	....	....	....	....
Kalgoorlie Enterprise, Ltd.	65,220	18,119	5·56	62,869	18,826	5·99	56,050	16,897	6·03	46,940	14,417	6·14	52,489	16,981	6·47
Lake View & Star, Ltd.	657,621	156,589	4·76	610,111	146,256	4·79	614,051	145,681	4·75	525,924	122,083	4·64	501,261	130,169	5·19
Mountain View Gold, N.L.	1,460	710	9·73	1,434	1,160	16·18	805	489	11·98	1,655	2,332	28·18	3,638	6,007	33·02
New Coolgardie Gold Mines, N.L.	39,570	17,176	8·68	37,436	19,387	10·36	41,756	20,914	10·02	32,154	16,429	10·22	24,062	9,299	7·73
North Kalgurli (1912), Ltd.	253,967	61,057	4·81	256,040	65,255	5·10	255,315	59,395	4·65	241,365	59,425	4·92	231,836	63,051	5·44
Paringa Mining & Exploration, Ltd.	....	....	....	1,493	204	2·73	8,231	2,811	6·83	96,488	17,058	3·54	91,811	17,782	3·87
South Kalgurli Consolidated, Ltd.	102,449	23,673	4·62	93,992	23,616	5·03	98,594	24,426	4·96	90,094	21,279	4·72	84,785	20,654	4·87
State Batteries	40,218	15,003	7·47	42,270	17,386	8·23	48,959	19,578	8·00	50,871	20,390	8·02	41,171	22,555	10·96
The Sons of Gwalia	100,525	26,026	5·18	85,263	23,768	5·58	73,825	19,186	5·20	88,745	25,558	5·76	81,395	23,573	5·79
Timoni (Moonlight Wiluna G.M., Ltd.)	23,105	13,039	11·29	23,410	11,680	9·98	23,976	11,402	9·51	11,211	5,610	10·00	....	....	....
Total	3,143,374	777,744	4·95	2,574,829	676,095	5·25	2,409,269	592,211	4·92	2,394,160	561,185	4·69	2,391,284	596,021	4·99
Other Sources (Excluding large retreatment plants)	26,501	22,946	17·32	51,783	27,046	10·44	62,410	32,580	10·44	69,262	17,972	5·19	77,013	34,905	9·06
Total (excluding large Retreatment Plants)	3,169,875	800,690	5·05	2,626,612	703,141	5·35	2,471,679	624,791	5·06	2,463,422	589,157	4·79	2,468,297	630,926	5·11
Golden Horseshoe Sands Retreatment	....	9,246	....	....	9,767	....	....	6,559	....	....	7,661	....	....	10,004	....
Lake View & Star Retreatment	....	9,102	....	....	7,848	....	....	9,384	....	....	4,665	....	....	2,815	....
State Batteries Tailing Treatment	....	4,293	....	....	6,712	....	....	7,511	....	....	7,150	....	....	5,827	....
GRAND TOTAL	3,169,875	823,331	5·20	2,626,612	727,468	5·54	2,471,679	648,245	5·25	2,463,422	608,633	4·94	2,468,297	649,572	5·26

TABLE H.

Development Footages Reported by the Principal Mines.

Gold or Mineral Field.	Mine.	Shaft Sinking.	Driving.	Cross Cutting.	Rising and Winzing.	Diamond Drilling.	Total.
		Feet.	Feet.	Feet.	Feet.	Feet.	Feet.
Gold—							
Pilbara	Comet	....	50	40	60	480	630
	Blue Spec	....	8	13	145	....	166
	Barton	70	60	....	....	....	130
Murchison	Big Bell	....	2,088	1,972	2,292	336	6,688
	Mountain View	29	....	32	....	....	61
	Hill 50	150	2,533	1,346	835	1,373	6,237
Mt. Margaret	Sons of Gwalia	....	446	214	1,176	5,301	7,137
North Coolgardie	Yilgangie Queen	....	130	....	48	....	178
	Callion	80	959	94	581	....	1,714
	Timoni	155	506	856	287	35	1,839
East Coolgardie	Boulder Perseverance, Ltd.	....	2,876	....	2,218	14,582	19,676
	Kalgoorlie Enterprise, Ltd.	119	757	45	946	4,573	6,440
	Gold Mines of Kalgoorlie	....	3,586	1,391	1,786	34,437	41,200
	Great Boulder Pty., Ltd.	....	10,000	1,492	2,600	9,891	23,983
	Lake View & Star, Ltd.	....	17,177	1,837	7,183	8,756	34,953
	North Kalgurli (1912), Ltd.	....	7,424	658	2,723	8,535	19,340
	South Kalgurli Consolidated	....	3,918	667	1,052	4,617	10,254
	Haoma	....	553	314	193	....	1,060
Coolgardie	New Coolgardie Gold Mines N.L.	247	2,051	569	1,132	8,616	12,615
Dundas	Central Norseman Gold Corporation	299	6,799	518	2,284	11,305	21,205
Yilgarn	Great Western Consolidated	....	2,952	448	403	19,049	22,852
	Sunshine Reward	....	400	320	50	....	770
	Total in Gold Mines	1,149	65,273	12,826	27,994	131,886	239,128
Pyrite—							
Dundas	Norseman Gold Mines N.L.	762	1,636	238	963	1,644	5,243
Lead—							
Ashburton	Gift Lead Mine	....	28	....	40	....	68
	Ridge Lead Mine	25	....	....	....	....	25
	Dingo Lead Mine	....	80	8	68	....	156
	June Audrey Lead Mine	70	40	....	....	....	110
Northampton	Protheroe Lead Mine	47	283	15	105	....	450
	Paringa Wheal Fortune	38	710	86	678	269	1,781
	Maguire's Lead Mine	30	40	....	14	....	84
	Three Sisters North	125	110	20	20	....	275
	Total in Lead Mines	335	1,291	129	925	269	2,949
Asbestos—							
West Pilbara	Australian Blue Asbestos	....	1,020	2,264	323	....	3,607
	Nunyerri	110	140	15	....	....	265
	Total in Asbestos Mines	110	1,160	2,279	323	....	3,872
	Total in all Mines	2,356	69,360	15,472	30,205	133,799	251,192

OPERATIONS OF THE PRINCIPAL MINES.

East Coolgardie Goldfield.

The total ore treated in this goldfield amounted to 1,834,556 tons and the gold yield of 484,949 fine ounces is an average of 5.29 dwts. per ton. Gold production is 59.0 per cent. of the total for the State. In the previous year 1,719,238 tons of ore were treated for a return of 454,932 fine ounces, the average grade being 5.29 dwts. per ton, as for this year.

The number of men employed was 3,331 as compared with 3,429 in the previous year.

Mining activity in the *Bulong District* was limited, the production for the year being 176 fine ounces.

In the *East Coolgardie District* 484,773 fine ounces was recovered from the treatment of 1,834,029 tons of ore at an average of 5.29 dwts. per ton.

The principal producers were as under.

Lake View & Star milled 657,621 tons, the greatest tonnage treated for many years. The grade was practically as for the previous year—4.76 dwts. per ton as against 4.79—and there was a corresponding increase in the gold won to 156,589 fine ounces as against 146,256 in the previous year.

The main factor in achieving this result has been the light rock drill using tungsten carbide tipped steel.

Not only have increased footages per machine shift been obtained but there has been at the same time a saving in compressed air. It has also been possible to confine machine work to the day shift.

A vigorous development policy did not discover any new ore body of consequence but 11,000 tons of ore was added to the ore reserves which at the last annual report stood at 3,735,300 tons averaging 4.81 dwts. per ton.

A new steel headframe equipped with an electric winder has been placed on the Associated shaft and a new store building and assay office have been constructed.

Great Boulder Pty. Gold Mines Ltd. also report the best year for some considerable time. The ore milled was 409,814 tons as against 376,564 in the previous year while the gold return was 106,775 fine ounces as against 96,111 fine ounces. The grade advanced from 5.10 dwts. per ton to 5.21 dwts. per ton.

Satisfactory developments have been obtained in several places which indicate substantial ore bodies in the western portion of the workings from Hamilton Shaft and in the deeper sections served by Edwards Shaft.

The new power house is nearing completion and is expected to be in commission during the early part of 1954.

Ore reserves stand at 2,000,262 tons with an average value of 5.2 dwts. per ton.

North Kalgurli (1912) Ltd. treated 253,967 tons of ore for a return of 61,057 fine ounces at an average of 4.81 dwts. per ton. Figures for the previous year were 256,040 tons of ore for 65,255 fine ounces at an average of 5.10 dwts. per ton. Ore reserves are placed at 2,265,193 tons averaging 5.51 dwts. per ton.

All mining is done on day shift.

Gold Mines of Kalgoorlie also reports the best return for many years. Ore milled amounted to 191,292 tons and returned 57,184 fine ounces of gold at an average of 5.98 dwts. per ton. In the previous year 171,659 tons of ore were treated for 47,286 fine ounces of gold at an average of 5.51 dwts. per ton.

The Paringa mine was purchased by this company and has yielded them some 8,000 tons of ore.

Provision has been made for the addition of another alternator to the power house.

Boulder Perseverance treated 136,257 tons of ore for a return of 33,677 fine ounces at an average of 4.94 dwts. per ton as compared with 131,840 tons for 30,578 fine ounces at an average of 4.64 dwts. per ton in the previous year.

This mine has little new ground to explore but maintains its position by careful operation.

South Kalgurli Consolidated treated an increased tonnage as compared with the previous year, the respective figures being 102,449 tons and 93,992 tons. The gold returns were practically unchanged, 23,673 fine ounces and 23,616 fine ounces, and the grade consequently declined from 5.03 dwts. per ton to 4.62 dwts. per ton.

A new level has been opened up at 2,300 feet and old shrink stopes are being filled with tailings to stabilise the shaft.

A steel headframe and electric winder have been placed in commission on the Hainault Shaft.

Kalgoorlie Enterprise recovered 18,119 fine ounces from the treatment of 65,220 tons of ore averaging 5.56 dwts. per ton. In the previous year 18,826 fine ounces was obtained from the treatment of 62,869 tons of ore averaging 5.99 dwts. per ton. The drop in grade has not been fully compensated by the increased tonnage.

The only other activity in the goldfield was at *Mount Monger* where *Haoma* (3,827 tons for 4,636 fine ounces) and *Daisy* (1,506 tons for 1,212 fine ounces) were the most successful.

Murchison Goldfield.

A considerable increase in production is recorded and this goldfield is now the second largest producer, having displaced Dundas from that position. The total ore treated amounted to 496,112 tons and yielded 101,030 fine ounces, equal to 12.3 per cent of the State's production. The average grade was 4.07 dwts. per ton.

In the previous year 462,258 tons were treated for a return of 75,319 fine ounces, the average grade being 3.26 dwts. per ton.

The number of men employed was 646 as against 619 in the previous year.

Cue District produced 54,782 fine ounces from the treatment of 403,916 tons of ore averaging 2.71 dwts. per ton.

In the previous year the treatment of 401,618 tons averaging 2.75 dwts. per ton yielded 55,141 fine ounces of gold.

Big Bell Mines Ltd. treated 402,906 tons for a recovery of 54,142 fine ounces at an average of 2.69 dwts. per ton. Small increases both in tonnage and grade are thus reported in comparison with the figures for the previous year when 400,563 tons of ore yielded 53,610 fine ounces of gold at an average of 2.68 dwts. per ton.

Among the small mines *Table Top* with 269 fine ounces from 400 tons was the most successful.

Meekatharra District produced 3,459 fine ounces from the treatment of 6,244 tons of ore at an average of 11.08 dwts. per ton, as compared with 2,455 fine ounces from the treatment of 4,673 tons at an average of 10.51 dwts. per ton in the previous year.

Alluvial claims contributed over 1,000 fine ounces and among the small mines, of which several are operating in this district, the best was *Albury Heath* with 315 fine ounces from 349 tons.

Day Dawn District produced 731 fine ounces from the treatment of 1,672 tons of ore at an average of 8.75 dwts. per ton. In the previous year 1,186 fine ounces were obtained from 1,451 tons of ore, the average being 16.36 dwts. per ton.

The *Mountain View* was responsible for almost the whole of this production.

Mount Magnet District produced 42,058 fine ounces of gold from the treatment of 84,280 tons of ore averaging 9.98 dwts per ton. This is a very considerable increase on the figures for the previous year when 16,537 fine ounces of gold were obtained from 54,517 tons of ore averaging 6.07 dwts. per ton.

This spectacular improvement is due to the mining of high grade ore on the *Hill 50* where 83,865 tons of ore, averaging 9.97 dwts. per ton, were milled for 41,799 fine ounces of gold. Comparison with the figures 53,803 tons for 15,839 fine ounces at an average of 5.89 dwts. per ton indicates a considerable increase in milling capacity as well as higher grade.

Prospecting and exploration in the district have been greatly stimulated by these returns but no other production of note has been recorded.

Dundas Goldfield.

Dundas Goldfield with 74,135 fine ounces from the treatment of 156,329 tons of ore at an average of 9.48 dwts. per ton was slightly below the previous year when 78,914 fine ounces were recovered from 159,519 tons of ore at an average of 9.89 dwts. per ton. Production is equal to 9.00 per cent. of the State total.

The number of men employed was 410 as compared with 388 in the previous year.

Central Norseman Gold Corporation with 73,869 fine ounces from 155,451 tons averaging 9.50 dwts. per ton was the only important producer and was

slightly below last year's figures when 78,241 fine ounces were recovered from 158,447 tons of ore averaging 9.88 dwts. per ton.

Main production is now from the Regent Shaft. The headframe and winder from the Phoenix Shaft have been removed to the North Royal Shaft.

Yilgarn Goldfield.

This goldfield returned 55,630 fine ounces from the treatment of 402,097 tons of ore averaging 2.77 dwts. per ton. In the previous year 7,480 fine ounces were obtained from the treatment of 40,329 tons averaging 9.87 dwts. per ton. The number of men employed was 501.

The very large increase in tonnage is due to the operations of *Great Western Consolidated* which treated 392,508 tons for a return of 50,192 fine ounces. The grade of 2.56 dwts. per ton is the lowest treated in any mine in the State. Ore from the open cut has been lower in grade than anticipated.

Edwards Find reported 2,703 fine ounces from 6,612 tons, the *Radio* 780 ounces from 840 tons and *Frances Firness* 396 fine ounces from 725 tons.

The new find at Mount Rankin, named *Marjorie Glen* obtained 765 ounces from 450 tons.

North Coolgardie Goldfield.

This Goldfield with a return of 36,459 fine ounces, representing 4.4 per cent. of the State output obtained from 58,923 tons of ore averaging 12.38 dwts. per ton, has improved on the previous year's return of 34,830 fine ounces from 55,992 tons at an average of 12.44 dwts. per ton.

The number of men employed was 319 as compared with 315 in the previous year.

In the *Menzies District,* which had a total production of 14,446 fine ounces from 24,067 tons of ore averaging 12.01 dwts., the principal mine was the *Timoni* which treated 23,105 tons of ore averaging 11.29 dwts. per ton for a return of 13,039 fine ounces of gold.

Tributes on the *First Hit* obtained 461 fine ounces from the treatment of 471 tons.

In the *Ularring District* 18,197 fine ounces of gold were obtained from the treatment of 32,313 tons of ore averaging 11.26 dwts. per ton.

The principal mine is the *Callion* which obtained 16,023 fine ounces from the treatment of 29,926 tons of ore. Good returns were obtained from the *First Hit* (Morley's Find), which returned 264 fine ounces from 247 tons and the *Oakley* with 594 fine ounces from 300 tons.

In the *Niagara District* the *Altona* with 560 fine ounces from 405 tons was the principal producer but 1,303 fine ounces of gold were obtained by *Vickery Treatment Syndicate.* The total for the district was 1,888 fine ounces.

In the *Yerilla District* 1,928 fine ounces were produced from the treatment of 2,131 tons of ore, the only producer of note being *Yilgangie Queen* with 1,553 fine ounces from 1,463 tons.

Mt. Margaret Goldfield.

Production in the *Mount Margaret Goldfield* amounted to 29,140 fine ounces of gold equal to 3.5 per cent. of the State's output. This was obtained from the treatment of 106,176 tons at an average of 5.49 dwts. per ton. In the previous year 27,982 fine ounces of gold were obtained from the treatment of 91,506 tons of ore averaging 6.12 dwts. per ton. While the tonnage treated and gold returned showed an upward trend there has been a decrease in the average grade. The number of men employed was 368 as compared with 354 in the previous year.

Mount Morgans District shows some improvement, the treatment of 1,511 tons yielding 748 fine ounces at an average of 9.91 dwts. per ton. The principal contributor was *Linden Gold* with 536 fine ounces from 1,245 tons.

Mount Malcolm District returned 26,240 fine ounces of gold from the treatment of 101,372 tons of ore at an average of 5.18 dwts. per ton. In the previous year 24,073 fine ounces were recovered from the treatment of 86,801 tons at an average of 5.55 dwts. per ton. The *Sons of Gwalia* with 26,026 fine ounces from 100,525 tons of ore showed some increase over the figures of 23,768 fine ounces from 85,263 tons of ore in the previous year, but the grade declined from 5.58 to 5.18 dwts. per ton.

Mount Margaret District treated 3,293 tons of ore and returned 2,151 fine ounces, the average being 13.06 dwts. per ton. In the previous year 4,430 tons yielded 3,682 fine ounces at an average of 16.62 dwts. per ton.

High grade ore was obtained from the *Boomerang* with 38 tons for 259 fine ounces and *Nil Desperandum* with 90 tons for 230 fine ounces. *Lancefield* treated 1,772 tons for 150 fine ounces and *Gladiator* 1,125 tons for 122 fine ounces.

Coolgardie Goldfield.

This goldfield returned 19,601 fine ounces, equal to 2.4 per cent. of the State's output, from the treatment of 45,043 tons of ore, the average being 8.70 dwts. per ton. In the previous year 22,867 fine ounces were obtained from the treatment of 42,833 tons at an average of 10.68 dwts. per ton. The number of men employed was 339 as against 316 in the previous year.

Kunanalling District was dormant, the total return being only 41 fine ounces.

Coolgardie District obtained 19,560 fine ounces from 44,904 tons of ore, the largest contributor being *New Coolgardie* with 17,176 fine ounces from the treatment of 39,570 tons at an average of 8.68 dwts. per ton. The tonnage treated is greater than 37,436 tons treated in the previous year but the gold return is lower than 19,387 fine ounces and the grade has thus fallen from 10.36 dwts. per ton as reported for that year. There was a fair amount of activity in the district the most successful of the smaller mines being *Rayjax* with 43 tons for 99 fine ounces, *Jackpot* with 934 tons for 490 fine ounces and *McPhersons Reward* with 540 tons for 200 ounces.

Peak Hill Goldfield.

This Goldfield returned 9,014 fine ounces or 1.1% of the State's output from the treatment of 55,489 tons of ore at an average of 3.25 dwts. per ton as compared with 5,603 fine ounces from the treatment of 36,551 tons at a average of 3.07 dwts. per ton in the previous year. An average of 60 men were employed.

The *Horseshoe* mine was the only substantial producer and returned 8,896 fine ounces from the treatment of 54,923 tons all obtained by open cut operations and averaging 3.24 dwts. per ton. This represents some improvement on the previous year's operations when 5,428 fine ounces were obtained from the treatment of 35,602 tons of ore at an average of 3.05 dwts. per ton.

Pilbara Goldfield.

This Goldfield showed a considerable decline in production the return of 7,974 fine ounces which is 1.0% of the State production being considerably less than 12,937 fine ounces reported in the previous year. The ore treated declined from 11,367 tons to 8,973 tons while the grade fell from 22.76 dwts. per ton to 17.77 dwts. per ton.

The number of men employed was 158 as compared with 178 in the previous year.

Marble Bar District recorded 3,188 fine ounces from the treatment of 5,896 tons of ore at an average of 10.81 dwts. per ton.

The *Comet* mine obtained 1,180 fine ounces from 2,440 tons, while *Normay* obtained 631 fine ounces from 1,465 tons, and *Table Top* 428 fine ounces from 722 tons.

Nullagine District recorded 4,786 fine ounces from the treatment of 3,077 tons. Production from the *Blue Spec* which includes some returns carried over from the previous year was 3,795 fine ounces from 2,297 tons. A reorganization of this mine is in progress. Good returns were obtained from the *Barton* with 652 fine ounces from 576 tons and the *Alice* with 269 fine ounces from 28 tons.

Broad Arrow Goldfield.

This Goldfield reported 2,550 fine ounces from 4,505 tons of ore at an average of 11.32 dwts. per ton. Figures for the previous year were 3,225 fine ounces from 4,808 tons of ore at an average of 13.42 dwts. per ton. High grade ore was obtained by *Bellevue* with 361 fine ounces from 241 tons and *New Mexico South* with 333 fine ounces from 110 tons.

East Murchison Goldfield.

This Goldfield reported only 1,199 fine ounces of gold and most of this was obtained from the clean-up of the Wiluna plant and sands retreatment.

Yalgoo Goldfield.

This Goldfield produced 423 fine ounces from the treatment of 339 tons of ore and this was mainly from the *Ark* with 273 fine ounces.

Small returns were received from *Kimberley, Ashburton, Phillips River* and *West Pilbara Goldfields.*

No gold was reported from the *West Kimberley* and *Gascoyne Goldfields.*

MINERALS OTHER THAN GOLD OR COAL.

The production of minerals other than gold and coal for 1952 and 1953 is shown in the table below:—

PRINCIPAL MINERALS OTHER THAN GOLD AND COAL.

Mineral.	1952.		1953.	
	Tons.	Value. £A.	Tons.	Value. £A.
Antimony Ore and Concentrates	264·58	43,397	358·43	10,313
Asbestos—				
Chrysotile	652·35	37,255	605·58	65,769
Crocidolite	2,940·09	557,861	3,795·40	641,595
Barytes	9·00	50	211·87	1,790
Bentonite	586·00	2,036	217·70	741
Beryl Ore	85·29	14,562	124·62	22,223
Chromite	773·00	11,100	1,968·00	29,717
Clays—				
Cement Clay	15,310·10	5,664	13,619·90	5,266
Fire Clays—				
Kaolin Type	1,772·00	1,684	1424·95	1,359
Kaolin and Other Type	7,836·00	7,836	7,393·00	7,393
White Clays—				
Ball Clay (Ceramic)	780·00	3,000	458·00	1,763
Kaolin (Filler Material)	267·75	1,303	20·00	100
Corundum	54·00	380	....	....
Copper Ore	15·51	1,188	50·29	3,199
Cupreous Ore (Fertiliser)	1,643·59	21,595	1,948·08	21,004
Dolomite	555·25	2,423	....	....
Felspar	2,503·50	10,452	2,127·00	8,860
Fergusonite	·17	165	....	....
Fuller's Earth	25·00	125	15·75	79
Glass Sand	7,669·12	5,629	6,905·74	4,690
Glauconite	230·00	7,305	319·50	11,182
Graphite	....	....	20·00	180
Gypsum	50,331·56	33,257	40,247·11	30,178
Iron Ore (for Pig)	17,703·45	226,844	16,851·77	221,006
Iron Ore (Exported)	204,945·00	203,238	687,895·00	682,162
Lead / Silver-Lead / Silver-Lead-Zinc Ore and Concentrates	7,448·98	935,200	6,425·48	358,328
Magnesite	1,054·67	2,842	19·60	73
Manganese	5,044·80	35,634	16,324·00	150,991
Ochre—				
Red	296·55	3,252	286·67	2,742
Yellow	....	....	20·50	145
Pyrites	53,577·00	422,029	59,248·00	489,985
Silver (Fine Ozs.)	199,153·41	80,125	229,364·39	89,401
Talc	1,223·61	14,683	2,228·07	30,932
Tantalo/Colombite Ore and Concentrates	7·02	10,010	8·09	20,200
Tin	97·80	68,716	113·27	63,129
Tungsten—				
Scheelite (lbs.)	5,139·00	3,691	6,520·00	3,361
Wolfram (lbs.)	60,352·00	46,018	7,733·00	4,473
Vermiculite	62·00	744	29·00	348
Zinc (Metallic)*	....	....	114·16	1,376
Zinc Ore (Fertilizer)	....	....	10·00	50
TOTAL		2,821,293		2,986,103

* By-product from Silver/Lead/Zinc mining.

Considerable advance was made in the production of Iron, Manganese and Chromite ores used in the manufacture of steel. Australian Iron and Steel Ltd. increased their output at Cockatoo Island threefold to 687,895 tons. The value of the year's production of the above metals amounted to £1,083,876.

The upward trend in Crocidolite and Pyrites production continued during the year. A gradual decline in lead production followed a rapid decrease in the market value of the product. The State's largest producer, Anglo Westralian at Protheroe ceased operations during the year.

Brief notes on the various minerals are given below.

Antimony.

The Blue Spec at Nullagine was the only producer, the antimony being recovered from auriferous antimonial concentrates. 358 tons of concentrate yielded 3,795 ozs. of fine gold and antimony to the value of £10,313.

With the introduction of more capital and a Government loan, work is going ahead with the rehabilitation of plant and workings.

Asbestos.

606 tons of chrysotile fibre worth £65,769 was recovered from mining operations at Lionel and Nunyerri in the West Pilbara Goldfield. Sales of grade 6 and serpentine flour increased due to increased demand for material for floor tiles and arc welding rod flux.

Crocidolite production at the Australian Blue Asbestos mine at Wittenoom increased by nearly 30 per cent. to 3,795 tons valued at £641,595. Extensive development work off the new portal, new track facilities and opening up of workings in Colonial Gorge indicate a further tonnage increase during 1954.

Barytes.

Rotary drilling for oil in the State has increased the demand for barytes, which is used to give weight to drilling muds. 170 tons worth £1,410 was mined at Cranbrook. A 42 ton parcel worth £380 was mined at Coonana in the North East Coolgardie Goldfield and milled in Perth.

Bentonite.

Production at Marchagee declined to 218 tons during the year. This reduction was brought about by ample stocks held by the milling companies at the end of the previous year.

Tests carried out by the Kalgoorlie School of Mines indicate that a beneficiated Marchagee bentonite containing 2-3 per cent. of Sodium Carbonate to bentonite by weight produces a drilling fluid which is comparable with imported muds.

Beryl.

Production for the year amounted to 125 tons containing 1,497 units of Beryllium oxide and valued at £22,223. The beryl was obtained from the following localities—Mt. Francisco, Pippingarra, Wodgina, Abydos, Spargoville, Ailsa Downs, Noongal, Strelly, Cooglegong, Yinnietharra and Hillside.

Chromite.

1,968 tons assaying 43.75 per cent. Cr_2O_3 and valued at £29,717 was mined at Coobina.

Clays.

Within 100 miles of Perth 22,916 tons worth £15,881 was mined for use in cement making, fireclays, and ceramics.

Copper.

Production of ores for fertilizers increased during the year to 1,948 tons with a slight drop in grade to 8.67 per cent. Cu. Output was valued at £21,004. Production centres were widely separated between Whim Creek in the north to Mt. Desmond near Ravensthorpe in the south.

50 tons of concentrates worth £3,199 were exported for treatment.

Felspar.

The Australian Glass Manufacturers quarry at Londonderry produced 2,080 tons worth £8,682. A small parcel of 47 tons was mined at Balingup in the south-west.

Fullers Earth.

16 tons valued at £79 was mined at Marchagee for local use in refining.

Glass Sand.

Local requirements were obtained from Lake Gnangarra. 6,906 tons valued at £4,690 was mined.

Glauconite.

320 tons worth £11,183 were recovered from 1,917 tons of greensand from Gingin.

Graphite.

A test parcel of 20 tons, assaying 11% C. and valued at £180, was mined at Munglinup.

Gypsum.

Production declined to 40,247 tons, a drop of 20% on last year's figures. This year's output was valued at £30,178 f.o.r. The main sources of supply were Yellowdine, Lake Brown, Baandee and Hines Hill.

Iron Ore.

Australian Iron and Steel Ltd., operating at Cockatoo Island, exported to the Eastern States 687,895 tons assaying 63.39% Fe and valued at £682,162. This is more than three times last year's production. Further increases in tonnage are contemplated when problems associated with sintering the ore at Port Kembla are overcome.

Thirteen thousand one hundred and seventy-six tons of ore averaging 62.11% Fe was mined at Koolyanobbing for use by the Charcoal Iron and Steel industry at Wundowie. Ore mined at Wundowie totalled 3,676 tons assaying 42.55% Fe. Pig iron from the blast furnace was valued at £221,006.

Lead.

A sharp decline in the price of lead to an average price of £76 per ton led to a gradual decline in the production of ores and concentrates. The State's largest producer, Anglo Westralian at Protheroe, ceased operations during the year but its re-opening is expected in the near future.

Ores and concentrates exported during the year amounted to 6,425 tons valued at £358,328. An additional £5,692 was received by the producers for the by-products, silver and zinc. The principal producing area was Northampton with nearly 4,000 tons.

Magnesite.

A small parcel of 20 tons valued at £73 was mined at Coolgardie.

Manganese.

From Horseshoe in the Peak Hill area 16,324 tons of 43.02% Mn ore was exported to the Eastern States for metallurgical purposes. This ore was valued at £150,991, a slight increase per ton on last year's figure.

Late in the year 4,800 tons of ore assaying 53.38% Mn was shipped overseas from Port Hedland. Returns for this shipment have not been finalised. The manganese was obtained from deposits around Mount Sydney in the Pilbara Goldfield.

Ochres.

Total production amounted to 307 tons of red and yellow ochres valued at £2,887. All except 41 tons was obtained from deposits in the Weld Range on the Murchison Goldfield, other centres being in the Kimberleys and at Mount Monger.

Oil.

Preliminary drilling operations at Rough Range near Learmonth were commenced by West Australian Petroleum Pty. Ltd., on 2nd September and continuous shift work started on the 14th of the same month.

Six hundred and seventy feet of 12¼ inch diameter hole was reamed out to 25½ inches to take 20 inch casing. At 3,879 feet, 13⅜ inch casing was cemented in. At the end of December the hole depth was 5,322 ft. and had been drilled as 8⅜ inch and reamed to 12¼ inch diameter in stages to a depth of 5,038 feet.

Towards the end of November a zone of medium to coarse grained highly glauconitic quartz sand was encountered between the depths of 3,603 and 3,630 feet. After preliminary tests and setting of casing, the zone of interest in the interval 3,605-3,620 feet was then perforated with four half-inch holes per foot. From this zone a light green waxy crude oil flowed steadily through a ¼ inch orifice in the tester tool for a total of 578 barrels (20,212 Imperial gallons) during a period of 25 hours.

Pyrites.

The Iron King mine at Norseman railed 59,248 tons of ore and concentrate to superphosphate works in the metropolitan area. This represented an increase of nearly 6,000 tons on last year's figure. The output of the mine was valued at £489,985.

The new main shaft was completed at 1,033 feet. Connection to the Campbell Shaft workings has been made on the No. 6 level. It is expected that the new shaft will be fully operative early in the new year.

Silver.

Two hundred and twenty-nine thousand, three hundred and sixty-four ounces valued at £89,401 were recovered as a by-product from gold mining (214,766 ounces) and from copper, silver/lead, and silver/lead/zinc ores.

Talc.

Production of 2,228 tons worth £30,932 was nearly double that of the the previous year. 95% of the output was obtained from Three Springs by the Universal Milling Co. Ltd., the balance being obtained from Mount Monger.

Tantalo/Columbite.

The production of Tantalo/Columbite concentrates amounted to 8 tons valued at £20,200. One third was obtained from Greenbushes in tin concentrates, one third from eluvial deposits on the Pilbara Goldfield and the balance was from pegmatites at Yinnietharra, Spargoville and Ravensthorpe.

Tin.

J. A. Johnston and Sons of Cooglegong were again the principal producers for the year with an output of 64 tons of concentrate. Production at Greenbushes also increased to 41 tons. Total production for the State was 113 tons valued at £63,129.

Tungsten.

Interest in Scheelite and Wolfram declined during the year following the fall in the price of Tungsten. A number of small syndicates produced 6½ tons valued at £7,834.

Vermiculite.

The Perth Modelling Works obtained 29 tons worth £348 from the Young River deposits.

Zinc.

One hundred and fourteen tons valued at £1,376 was obtained as a by-product of Silver/Lead/Zinc mining in the West Kimberley Goldfield. In addition a small parcel of 10 tons of ore for fertilizer realised £50.

(Sgd.) E. E. BRISBANE,
State Mining Engineer.

APPENDIX No. 1.

SHALLOW DRILLING AT COLLIE.

Government diamond drilling at Collie commenced in 1894, when seven holes were drilled in two years, the deepest being 952 feet (Bulletin 105, page 151). In the first 10 years of the coalfields development 12 holes were sunk by companies as compared with 8 in the next 40 years. The deepest hole put down in the field up to 1950 was the No. 1 Municipal bore, which was drilled to 1,134 feet in 1920, to augment the town water supply.

Active prospecting by drilling lapsed till the completion in 1947 of a Geological and Geophysical survey of the Collie Basin, carried out jointly by the Geological Survey of Western Australia and the Geophysical section of the Commonwealth Bureau of Mineral Resources.

During the period 1948-1950, two contractors drilled a total of 4,676 feet in the basin with varying success, core recovery in all cases being low. Drilling with bentonite mud fluid was introduced in 1950 in an attempt to increase core recovery and to keep the holes open till completion. One hole reached 1,872 feet. In March, 1951, McCallum Bros. and Grill, drilling contractors, commenced drilling for the Government with a Mines Department drilling plant, namely a Boyles Bros. BBS.4, capable of drilling a 3 inch diameter hole to 4,000 feet, 20,000 feet of drilling was carried out by these contractors till the termination of the contract in July, 1954. Core recovery was good, in one case reaching 83.5 per cent. The deepest hole in the Collie field now stands at 2,796 feet.

A second drill, a Failing M.1, was put into operation in November, 1952, to assist in the drilling programme. The primary object of the drilling was not the discovery of new coal, but the correct estimation of the resources of the basin. In the South-East part of the Eastern basin rotary and percussion drilling has added 55 million tons of coal to the inferred coal reserves of the field. The above estimate is based on seams 4 feet to 40 feet in thickness.

Failing M.1 Drill.

This report covers in detail the operation of the Failing M.1 portable water well drill used for slim hole diamond drilling in the Collie basin. The rig, mounted on a 3 axle dual wheel trailer, has a rated drill pipe load of 15,000 lbs., or 2,500 feet of 2⅜ inch drill pipe. The 42 foot tubular steel mast is raised and lowered by means of two double acting hydraulic cylinders. A retracting type drillhead with rotary drive transmits rotation to 3.3/8 inch diameter kelly connected to the drill pipe column. Rate of penetration and/or weight on bit is controlled by brake on drawworks, hoisting line being attached to kelly whilst drilling is in progress.

The mud pump, an Evans duplex reciprocating type with 6 inch bore by 6 inch stroke capable of delivering 200 gallons per minute, was later converted to 4 inch bore by replacement of cylinder liners and piston assembly. Power for the unit is supplied by a six cylinder Leyland diesel, P.U.300, developing a maximum of 75 B.H.P. at 2,000 r.p.m. The rotary and drawworks are driven through a 5 forward and 1 reverse speed gear box. This allows the rotary to be driven at rates varying between 20 and 286 r.p.m. at engine speeds of 1,000 and 2,000 r.p.m. respectively.

Drill Operations.

The operational staff of the drill consists of a drill foreman and three drill crews, each crew consisting of a driller and two assistants. Drilling is continuous throughout a five day working week. Rate of pay for a driller is £18/4/7 per week and for the assistants £16/14/7, which sums include shift loading for afternoon and night shift, and attendance allowance for a 40 hour week. (Basic Wage £12/6/0). The drill crews are transported free of charge to and from the drill sites, situated in the Muja area some 17 miles from Collie.

Although much of the Failing equipment had not arrived, including drill pipe, core barrels, bits, etc., a start was made on the 10/11/52 at the Co-Operative using 20 foot Reed core barrels, 6 inch Reed Kor-King drag and roller bits and "N" rod. Core recovery was low and after 630 feet drilling was continued with "NM" bottom discharge diamond core bits and "NM" barrel to a final depth of 794 feet. Core recovery amounted to 72 per cent. from 200 feet which at that time was considered good, considering that the drill crews had not previously operated this type of machine. Since that date core recovery has increased and on one hole reached 90 per cent., which has never before been attained in this field. Except for the first hole, all Failing drill operations during the first 20 months have been carried out in the Eastern basin on ground held by the Griffin and Western Collieries. Where possible holes have been drilled 3.13/16 inches diameter and cutting a core of 2.218 inches. On occasions it has been necessary to reduce to "NM" size after casing section of the hole, but this reduction is avoided if possible.

The design of a suitable drilling bit for all types of rock met with in the basin presents may problems. Rock types include sandstones, shales, coal, mudstones and granite. The variable nature of the sandstones, which vary from well consolidated fine grained to coarse grained friable material with all grades in between is not inducive to good core recovery. Most core is lost in drilling this rock, which in some cases could be classed as beach sand with very little cementing material. Diamond loss occurs most frequently in the sandstones as the tendency is for the diamonds to pluck quartz pebbles, up to 3/16 inch diameter, out of the country, these pebbles then being in a position to abrade the bit shell and matrix, thus undermining the diamonds on the periphery. To overcome this abrasion bits were made up containing—

(i) Mintung 71 inserts on outer edge.

(ii) Strips of hard metal weld of cobalarc or stellite along bit skirt.

(iii) Diamonds set in Mintung 71 matrix on the outside diameter to act as kicker stones.

The bit set with kicker stones proved the most successful but some wear still occurs in the half inch space between the face diamonds and the kicker stones. A maximum of 940 feet has been drilled with one bit of this 3.13/16 inch type for a diamond loss of 0.035 carats per foot, These bits are Mineral Drillers type 1833 bottom discharge core bits with kicker stones on periphery, having six waterways and carrying approximately 62 carats of screen size 16 and larger stones (two stones per carat). These bits with reamers have drilled 5,023 feet at an average cost of 2s. 10d. per foot with diamond loss of 0.053 carats per foot, which is a considerable reduction on the average bit cost of 4s. 5d. per foot for the drilling up to date.

The fine grained shales and mudstones present no drilling difficulties except that the drilling rate is somewhat reduced in these bands. The 3.13/16 bit with large diamonds is not suited for the drilling of granite, but is used as only one hole in four is cored to bedrock and then only 10 feet into it. Maximum coal core recovery is usually obtained, either in the NM or larger size as long as a stationary inner tube core barrel is used, this type being standard for the drilling. To reduce wear on the water end of the barrel a fixed ferrule is fitted, this ferrule being built up with hard metal weld as required.

Drilling rates vary but are between five and twenty feet per hour depending upon the ground. Weight on the bit and feed, as stated earlier, is controlled through the brake on the draw-works, weight being shown on the drilling line weight indicator attached to anchored end of drill cable. Although this method is quite satisfactory the set up is not sensitive enough when drilling with small bits of NM size, which require a load of about 500 lb. for normal operation. On one occasion we had the misfortune to drive the reamer shell through the bit. With the 3.13/16 inch bits the load can be increased from 1,500 lb., the normal drilling weight, to 3,000 lb. without any apparent damage to the bit.

From experience it has been found that successful drilling of rotary holes in the sedimentary formations of the Collie field can only be achieved when bentonite mud is used as the circulating fluid. The amount of casing required is considerably reduced or dispensed with when using bentonite. During the last eight months' operations no more than 100 feet of casing has been placed in any one hole. This casing is used, not so much as a wall support but to prevent loss of mud into the country through fissures or watercourses that are frequently met with in the upper sections of a hole. Over 15,000 feet have been drilled with the Failing for a loss of 380 feet of NX casing, which was lost in hole No. 9. This hole was cased to 650 feet.

About 5 per cent. by weight of imported bentonite "Volclay" to water is used to make up the initial batch of drilling mud having a viscosity of 35 seconds; viscosity being measured by the time of outflow of 1,000 ccs. from a Marsh funnel. Below 500 feet the normal practise is to allow the viscosity to progressively reduce to a mimimum of 30 seconds. The thicker mud is used in the upper section of the hole to effectively seal off the more porous standstones.

Filter press tests are conducted each shift to ascertain the wall building characteristics of the mud. In this test mud in a cylinder, closed at one end by a filter paper, is subjected to a pressure of 100 lb. per square inch for 15 minutes. The filtrate is collected and measured as is also the mud cake on the filter paper. A mud, subjected to the above pressure which simulates conditions expected in the hole, is considered satisfactory if the filtrate, associated with a mud cake of about 1/16 inch, is between 10 and 20 ccs. A thick cake indicates a poor mud, probably carrying too much sand, which in the hole will form a thick wall cake and probably lead to stuck tools. Filtrate is kept as low as possible as all water lost in the hole has to be replaced by water carted from Collie or from the mines.

In several holes beneficiated Marchagee bentonite has been used alone and in conjunction with Volclay. See Report No. 548, issued by the Kalgoorlie Metallurgical Laboratory on "Beneficiation of a Western Australian Bentonite For Use in Drilling Muds". This local bentonite has 3 per cent. by weight of sodium carbonate to bentonite added to it. This mud is suitable for our requirements, the only disadvantage being that twice as much is used in making up a drilling fluid equal to a Volclay suspension. (Note—Volclay costs twice as much as local bentonite). Eighteen tons of imported and local bentonite costing £603 12s. 7d. has been used in the drilling to date, usage being at the rate of one ton per 835 feet.

A summary of drilling costs is shown in the table below. Plant replacement costs were high, more than half this cost being taken up by the replacement of N rod with 1,600 feet of Failing drill pipe.

Operational Cost of Failing M.1 Rotary Drill for Period 10/11/52-10/7/54.

	£ s. d.	per foot s. d.
Supervision	2,678 12 3	3 7
Wages	13,574 10 7	18 1
Bits	3,359 16 3	4 5
Fuel	806 3 1	1 1
Bentonite	603 12 7	0 10
Plant Replacement ..	5,438 5 3	7 3
Repairs	243 11 5	0 4
Transport	1,479 19 9	1 11
	28,184 11 2	

Feet Drilled .... 15,022 feet
Cost/Foot Drilled .. £1 17s. 6d.

Conclusion.

Seventeen holes have been drilled in the first 20 months of operation, at a drilling rate of 751 feet per month, and at an average cost of £1 17s. 6d. per foot. Depth of holes varied between 195 and 1,781 feet, with an average of 884 feet. Four holes were less than 500 feet, six between 500 and 1,000 feet, four between 1,000 and 1,500 feet, and three over 1,500 feet. The Failing operated satisfactorily at all times during the drilling period under review, but from a study of the cost sheets it is apparent that the most economical range is between 500 and 1,500 feet.

(Sgd.) J. K. N. LLOYD,
Assistant State Mining Engineer.

Appendix No. 2.

REPORT ON ACTIVITIES OF BOARD OF EXAMINERS FOR UNDERGROUND SUPERVISORS' & MINE MANAGERS' CERTIFICATES FOR 1953.

School of Mines,
Kalgoorlie.
7th December, 1953.

The Chairman, Board of Examiners for Mine Managers' & Underground Supervisors' Certificates, Mines Department, Perth.

I submit herewith the annual report on the work of the Board of Examiners for Mine Managers' and Underground Supervisors' Certificates for the year 1953.

Mr. J. H. Verran, Senior Inspector of Mines, vacated his position as a member of the Board in November when he retired from the Public Service. Mr. Verran had been a member of the Board since its inception in 1949. His position on the Board will be filled by his successor, Mr. J. Boyland.

Underground Supervisors' Association.

During the year a request was made by the W.A. Gold Mines Supervisors' Association for a representative of the Association to be admitted to the meetings of the Board. Approval was given by the Under Secretary for Mines for a representative to be co-opted to those meetings of the Board where examinations for Underground Supervisors are conducted.

Reciprocity.

Advice was received from the Board of Examiners in New Zealand that they had agreed to grant reciprocity between New Zealand Mine Managers' Certificates and Western Australian Mine Managers' Certificates.

The New South Wales Board of Examiners has not yet reached a decision on the matter of reciprocity. It is anticipated, however, that a decision will be given shortly.

Mine Managers' Certificates of Competency.

Applications for Mine Managers' Certificates of Competency numbered 12, of which eight were approved, two deferred and two refused.

The names of the successful applicants are as follows:—

J. P. Boyd	J. M. Hogg
H. L. Burrows	A. W. Ibbotson
J. H. Crawford	L. W. McNamara
K. E. Denham	L. J. Walker

One duplicate Mine Manager's Certificate of Service was issued during the year.

Examination in Mining Law.

An examination in Mining Law was held on the 27th April, 1953, the results being as follows:—

Number entered	30
Number passed	18

Following are the names of the successful candidates:—

J. A. Cedro	L. W. McNamara
E. T. Coles	D. O'Driscoll
W. B. Edlington	D. R. Spivak
E. T. Forster	W. D. Steel
J. M. Hogg	N. K. Scarff
C. E. Ion	V. J. Tie
F. H. Jones	S. A. Tomich
E. O. Myers	L. J. Walker
T. G. P. McDonald	A. A. Wells

Underground Supervisors' Examination.

An examination for Underground Supervisors' Certificates of Competency was held on September 14th, 1953.

Applications were received from the following centres:—

Kalgoorlie	10
Coolgardie	2
Norseman	3
Big Bell	2
Cue	1
Meekatharra	1
Perth	1

The results of the examination were as follows:—

Number entered	20
Number passed	15

The names of the successful candidates are as follows:—

B. L. Berry	G. McGillivray
G. S. Compton	A. J. O'Connor
T. P. Dolan	A. E. Pringle
E. A. Duffy	G. Ruvidini
H. G. Field	S. W. Silvester
A. C. Gilbert	J. L. Thomson
C. E. Ion	V. R. Zani
O. E. Johnson	

One duplicate Underground Supervisor's Certificate of Service was issued during the year.

(Sgd.) G. M. LUMB,
Secretary,
Board of Examiners.

(3)—88619.

Index to State Mining Engineer's Annual Report for 1953.

Division III.

Report of the Superintendent of State Batteries.

Under Secretary for Mines.

For the information of the Hon. Minister I submit my report on the operation of State Batteries for the year ending 31st December, 1953.

Crushing.

One 15 head, seven 10 head, and eight five head mills crushed 40,218½ tons of ore made up of 576 separate parcels, an average of 69.82 tons per parcel. The bullion produced amounted to 17,703 ozs., which is estimated to contain 15,003 ozs. of fine gold, or 7 dwts. 11 grs. of gold per ton of ore.

The cost of crushing including administration was 41s. 8d. per ton as against 40s. 4d. for the previous year, a rise of 1s. 4d. per ton. Kalgoorlie, the only 15 head mill which operates continuously had the best cost figure at 21s. 10d. per ton.

The average assay value of all the ore after amalgamation but before cyanidation was 3 dwts. 3.5 grs. Thus the total head value of the ore was 10 dwts. 14.5 grs., which is 1 dwt. 8 grs. less than the previous year's figure.

Values in this ore before cyanidation can be segregated as follows:—

	Tons.	%
Over 2 dwts. 8 grs. per ton	18,698	46.5
1 dwt. 18 grs. to 2 dwts.. 8 grs. per ton	5,938½	14.8
Under 1 dwt. 18 grs. per ton	15,080	37.5
Refractory	502	1.2
	40,218½	100.0

Cyaniding.

Nine plants handled 26,659 tons of crushed ore for a production of 4,293 fine ozs. worth £66,566. The average content of this tonnage was 4 dwts. 7 grs. before treatment while the residue contained 1 dwt. 1 gr. The theoretical extraction by cyanidation was therefore 75.2% and the actual extraction 74.2%.

The cost of cyanidation was 34s. 3d. per ton an increase of 7s. 10d. per ton on the previous year. Kalgoorlie and Laverton showed the best figures with 28s. 2d. and 28s. 8d. respectively, whilst Meekatharra was 29s. 10d.

Estimated Overall Recovery.

With the average extraction in all cyanide plants at 74.2% and the average grade before cyanidation at 3 dwts. 3.5 grs. the average cyanidation recovery would be 2 dwts. 8 grs. Figures for estimated recovery would then be:—

	Dwts.	Grs.	%
Head Value	10	14.5	100
Amalgamated recovery	7	11	70.34
Cyanidation recovery	2	8	22.00
Total recovery	9	19	92.34

The estimated value of production since inception excluding the value of gold tax paid to the Commonwealth is:—

	1953.	Grand Total.
	£	£
Par production—		
Crushing	63,730	8,218,400
Cyanidation	18,281	2,042,673
Gold Premium—		
Crushing	168,694	3,914,960
Cyanidation	48,284	1,197,317
Open Market premium—		
Crushing	5,232	28,428
Cyanidation	2,292	9,844
Tin production—		
Ore	122	94,005
Residues	—	572
Tungsten production—		
Concentrates	1,273	17,893
	£307,908	£15,524,092

FINANCIAL.

	Tons.	Expenditure.	Receipts.	Profit.	Loss.
Crushing	40,218½	85,309	19,858	—	65,451
Cyaniding	26,659	45,654	27,786	—	17,868
		£130,963	£47,644	—	£83,319

The loss of £83,319 is an increase of £11,451 on the previous year and does not include depreciation or interest. Capital expenditure was incurred as below:

			General Loan Fund.			Consolidated Revenue Fund.		
			£	s.	d.	£	s.	d.
Kalgoorlie	Reconstructing Pipe Line		....			166	11	3
Marble Bar	Water Tank		....			38	7	4
Northampton	Erection of Battery		15,782	0	5	3,651	18	0
			£15,782	0	5	£3,856	16	7

Cartage Subsidies.

	Tons.	Cost. £
On ore carted to State plants	11,645	5,553
On ore carted to private plants	371	228
	£12,016	£5,781

Comparative figures for the last three years are:—

	State Plants.			Private Plants.			
	Tons Crushed	Tons Subsidised	% Subsidised	Cost.	Tons Crushed	Cost.	Total Cost.
1951	48,589	12,489	25·7	6,049	844	314	6,363
1952	42,270	12,895	30·5	5,894	607	372	6,266
1953	40,218	11,645	29·0	5,553	371	228	5,781

STAFF.

During the year Manager Breustedt retired from the position of Senior Manager at Kalgoorlie. He was the last of the old time Managers having joined the Service as a youth in the early 1900's. Though there were a couple of short breaks in his service he had worked at practically every mill in the system.

Manager Chegwidden was transferred to Kalgoorlie, while Manager Ball from the North West circuit changed places at Meekatharra with Manager Clemesha, Manager Young of Coolgardie changed places with Manager Crew of Ora Banda.

It is with regret that I record the death of Leading Hand Howard at a comparatively early age. He was a conscientious officer who had the respect of all of his associates.

I wish to thank the staff at Head Office and in the field for their efficient service to the Department, and for the maintenance of good relations with our customers.

ADMINISTRATION.

Expenditure amounted to £13,954 1s.8d., as against £13,352 12s.5d. for 1952 and was equivalent to 4s.2d. per ton of ore crushed and cyanided as against 3s.

	1952 £ s. d.	1953 £ s. d.
Salaries	5,687 10 2	7,616 9 1
Pay Roll Tax	2,361 12 2	2,084 4 0
Workers Compensation	3,041 5 2	2,839 14 2
Travelling and Inspection	917 5 0	1,236 2 11
Sundries	1,344 19 11	177 11 6
	£13,352 12 5	£13,954 1 8

GENERAL REMARKS.

Costs continued their steep rise in the first half of the year, but showed some tendency towards stabilisation towards the end of the year. At the beginning of May it was decided to increase the advance payment for cyanide gold from £10 15s.3d. per ounce to £14 0s.0d. per ounce, which means that the prospector has more ready cash to carry on with. This decision is probably reflected in the figures here presented. The average head value of all ore dropped by 1⅓ dwts. and the tonnage of ore above 2 dwts. 8 grs. per ton fell 10.1% from 56.6% to 46.5%. It appears then that the decision has helped the prospector to mine lower grade ore, whereas in times of rising costs Companies are usually forced to lift their grades.

The Northampton plant was completed and tested by the end of the year, but produced no marketable products.

C. F. ADAMS,
Superintendent of State Batteries.

SCHEDULE 1.

Number of Parcels Treated, Tons Crushed and Head Value for the Year ended 31st December, 1953.

No. of Parcels Treated.	Battery.	Tons Crushed.	Yield by Amalgamation. (Bullion).	Yield by Amalgamation. (Fine Gold).	Tailings Gross @ 100%	Total Contents of Ore. (Fine Gold).	Average per Ton (Fine Gold).	Gross Value per Ton at £4 4s. 11½d. per Ounce.
			Ozs. Dwts.	Ozs. Dwts.	Ozs. Dwts.	Ozs. Dwts.	Dwts. Grs.	£ s. d.
21	Bamboo Creek	1,120½	521 3	441 13	226 18	668 11	11 22	2 10 7
11	Boogardie	332	190 19	161 16	86 4	248 0	14 22	3 3 5
110	Coolgardie	4,840¾	1,698 17	1,439 16	766 15	2,206 11	9 3	1 18 9
27	Cue	2,686	1,356 15	1,149 17	326 0	1,475 17	11 0	2 6 9
188	Kalgoorlie	16,463	4,124 5	3,495 6	1,971 14	5,467 0	6 15	1 8 2
7	Lake Darlot	682	142 15	120 19	95 0	215 19	6 8	1 6 11
43	Laverton	3,419½	1,319 10	1,118 5	1,060 3	2,178 8	12 18	2 14 2
10	Marvel Loch	1,037¾	612 15	519 6	154 18	674 4	13 0	2 15 3
45	Meekatharra	2,244	2,112 16	1,790 12	380 9	2,171 1	19 4	4 1 5
3	Mt. Ida	536½	214 8	181 14	118 17	300 11	11 5	2 7 7
15	Norseman	913¾	331 10	280 19	66 7	347 6	7 14	....
9	Nullagine	199	120 10	102 3	23 7	125 10	12 15	2 13 7
48	Ora Banda	2,472¼	1,817 15	1,540 11	684 10	2,225 1	18 0	....
10	Paynes Find	338½	472 4	400 4	48 6	448 10	26 12	....
3	Peak Hill	462	79 6	67 4	23 10	90 14	3 22	16 8
26	Yarri	2,471	2,587 3	2,192 13	297 9	2,490 2	21 13	4 13 3
576		40,218½	17,702 11	15,002 18	6,330 7	21,333 5	10 15	2 5 1

Average Tons per Parcel .... 69·82
Average Yield by Amalgamation per ton (fine gold).... .... 7 dwts. 11·05 grains.
Average Value by Amalgamation per ton (fine gold).... .... £1 11s. 8d. Australian £5 15s. 6d.
Average Head Value of Tailings (fine gold) .... 3 dwts. 3·5 grains.
Average Value of Tailings per ton .... 13/4 Australian £2 8s. 8d.

SCHEDULE 2

Details of Extraction—Tailing Treatment, 1953.

Battery.	Tons Treated.	Head Value.	Contents.	Tail Value.	Contents.	Recovery.	Call.	Recovery.	Shortage.	Surplus.
		Dwts. Grs.	Dwts.	Dwts. Grs.	Dwts.	%	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Coolgardie	3,744	4 3	15,440	1 3	4,160	73	2,396 8 10	2,339 3 4	57 5 6	....
Cue	1,372	3 7	4,520	– 21	1,180	74	711 4 11	681 17 3	29 7 8	....
Kalgoorlie	9,840	3 9	33,400	– 18	7,500	77	5,518 18 0	5,305 9 11	213 8 1	....
Laverton	3,680	5 23	21,940	1 8	4,900	78	3,618 7 6	3,794 8 1	....	176 0 7
Marble Bar	1,054	6 5	6,780	1 14	1,680	75	1,083 2 2	1,065 15 11	17 6 3	....
Meekatharra	1,378	4 2	5,600	1 6	1,720	69	824 8 2	831 8 7	....	7 0 5
Ora Banda	2,911	5 3	14,940	1 10	4,120	72	2,297 10 0	2,198 17 4	98 12 8	....
Sandstone	1,728	4 18	8,200	1 5	2,060	75	1,303 1 0	1,273 16 9	29 4 3	....
Yarri	952	3 10	3,240	1 0	940	71	488 17 5	496 1 10	....	7 4 5
	26,659	4 7	114,060	1 1	28,260	75·2	18,241 18 0	17,986 19 0	445 4 5	190 5 5

Net shortage: £254 19s. 0d.

Head Value .... 4 dwts. 7 grains.
Tail Value .... 1 dwt. 1 grain.
Theoretical Recovery .... 75·2%
Actual Recovery .... 74·2%.

SCHEDULE No. 3.

Cyanide Yield, 1953.

Battery.	Tons.	Fine Ozs.	Value.	Premium.	Total.
Coolgardie	3,744	550·69	2,339·163	6,191·876	8,531·039
Cue	1,372	162·93	692·144	1,831·821	2,523·965
Kalgoorlie	9,840	1,299·00	5,519·024	14,605·681	20,124·705
Linden	....	2·10	8·737	22·579	31·316
Laverton	3,680	889·85	3,799·384	10,005·449	13,804·836
Marble Bar	1,054	250·80	1,065·795	2,819·873	3,885·668
Meekatharra	1,378	201·52	855·957	2,265·765	3,121·722
Ora Banda	2,911	513·21	2,198·864	5,770·330	7,969·194
Sandstone	1,728	302·01	1,282·870	3,395·824	4,678·694
Yarri	952	120·59	519·561	1,375·007	1,894·568
	26,659	4,292·70	18,281·499	48,284·205	66,565·704

SCHEDULE 4.

Statement of Receipts and Expenditure for Year ended 31st December, 1953.

MILLING.

Batteries.	Tonnage Crushed.	EXPENDITURE.								RECEIPTS.		Profit.	Loss.
		Management.	Wages.	Stores.	Total Working Expenditure.	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	1,120·5	323 7 2	2,198 2 11	692 2 7	3,213 12 8	57 3·7	677 13 2	368 7 4	4,259 13 2	76 ·3	604 16 0	10 9·5	....	3,654 17 2
Boogardie	332	352 16 7	643 11 9	466 2 1	1,462 10 5	88 1·2	227 11 0	393 9 6	2,083 10 11	125 6·1	243 7 4	14 7·9	....	1,840 3 7
Coolgardie	5,045·5	862 8 11	4,772 11 10	2,519 12 4	8,154 13 1	32 3·8	2,204 10 9	1,485 19 9	11,845 3 7	46 11·4	2,538 17 1	10 0·7	....	9,306 6 6
Cue	2,973·75	825 18 8	3,324 10 1	1,516 5 8	5,666 14 5	38 1·3	1,422 16 7	914 17 9	8,004 8 9	53 10	1,727 3 2	11 7·3	....	7,277 5 7
Kalgoorlie	16,833	1,405 9 4	6,527 13 6	5,432 17 6	13,366 0 4	15 10·5	821 13 2	4,176 11 10	18,364 5 4	21 9·8	6,536 17 0	7 9·1	....	11,827 8 4
Lake Darlot	572	371 19 2	1,210 1 10	236 1 9	1,818 2 9	63 6·8	62 8 6	222 9 2	2,103 0 5	73 6·3	365 12 6	12 9·4	....	1,737 7 11
Laverton	3,419·5	389 6 11	3,111 18 3	1,259 14 2	4,760 19 4	27 10·1	635 7 0	918 5 10	6,314 12 2	36 11·1	2,079 9 6	12 1·9	....	4,235 2 8
Marble Bar	....	....	246 15 2	326 3 10	572 19 0	....	264 14 8	100 11 4	938 5 0	....	61 17 11	....	....	876 7 1
Marvel Loch	1,061·75	238 19 0	2,088 19 5	494 13 2	2,822 11 7	53 2	138 14 6	293 12 3	3,254 18 4	61 3·7	588 16 9	11 1·1	....	2,666 1 7
Meekatharra	2,244	803 10 8	2,485 10 1	1,355 13 1	4,644 13 10	41 4·7	1,032 19 1	702 15 11	6,380 8 10	56 10·4	1,229 3 2	....	....	5,151 5 8
Mt. Ida	536·5	174 12 2	570 5 0	....	744 17 2	27 9·2	141 15 2	191 7 1	1,077 19 5	40 2·2	232 16 3	8 8·1	....	845 3 2
Norseman	913·75	119 10 0	1,386 0 8	477 3 7	1,982 14 3	43 4·7	82 18 5	288 7 7	2,354 0 3	51 5·2	479 8 9	10 11·4	....	1,874 11 6
Nullagine	215	132 16 7	803 2 8	338 8 10	1,274 8 1	118 6·5	563 5 1	228 15 5	2,066 8 7	192 2·7	108 2 6	10 0·7	....	1,958 6 1
Ora Banda	2,472·25	468 15 7	2,363 6 7	1,807 1 2	4,641 3 4	37 6·5	1,729 3 7	750 14 2	7,121 1 1	57 7·2	1,125 0 5	9 1·2	....	5,996 0 8
Paynes Find	338·5	....	1,026 15 0	226 18 6	1,253 13 6	74 0·8	127 1 8	233 12 5	1,614 7 7	95 4·6	287 1 1	16 11·5	....	1,327 6 6
Peak Hill	462	64 0 10	467 16 10	96 16 10	628 14 6	27 2·6	72 16 6	120 15 3	822 6 3	35 7·1	173 16 6	7 6·3	....	648 9 9
Sandstone	....	....	....	....	....	....	....	....	....	....	6 17 8	....	6 17 8	....
Wiluna	....	....	15 19 9	....	15 19 9	....	....	....	15 19 9	....	12 6 0	....	....	3 13 9
Yarri	2,412	588 6 8	3,354 8 4	1,229 2 4	5,171 17 4	42 10·6	774 12 1	742 11 4	6,689 0 9	55 5·5	1,454 3 7	12 0·6	....	5,234 17 2
Head Office	....	....	....	....	....	....	....	....	....	....	2 11 6	....	2 11 6	....
	40,952·0	7,121 18 3	36,597 9 8	18,476 17 5	62,196 5 4	30 4·5	10,980 0 11	12,133 3 11	85,309 10 2	41 7·9	19,858 4 8	9 8·3	9 9 2	65,460 14 8
Total Loss	....	....	....	....	....	....	....	....	....	....	....	....	....	65,451 5 6

SCHEDULE No. 5.

Statement of Receipts and Expenditure for Year ended 31st December, 1953.

TAILING TREATMENT.

Batteries.	Tons Treated.	Expenditure.									Receipts.		Profit.	Loss.
		Management.	Wages.	Stores.	Total Working Expenditure.	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	....	48 1 8	28 3 6	164 10 2	240 15 4	....	159 6 5	25 9 1	425 10 10	....	....	....	....	425 10 10
Boogardie	....	42 16 6	18 2 8	6 16 2	67 15 4	....	18 2 8	71 2 10	157 0 10	....	79 3 10	....	....	77 17 0
Coolgardie	3,744	607 19 7	3,563 2 9	1,600 5 10	5,771 8 2	30 9·9	60 6 10	1,043 13 6	6,875 8 6	36 8·7	3,534 16 5	19 5	....	3,340 12 1
Cue	1,372	450 19 8	717 0 8	675 9 10	1,843 10 2	26 10·4	105 8 6	354 3 7	2,303 2 3	33 6·8	1,818 10 2	26 6·1	....	484 12 1
Kalgoorlie	9,840	986 2 0	6,056 18 10	4,232 1 7	11,275 2 5	22 11	431 12 5	2,141 13 0	13,848 7 10	28 1·7	12,776 14 11	25 11·6	....	1,071 12 11
Laverton	3,680	612 12 9	2,145 3 9	1,556 18 8	4,314 15 2	23 5·3	118 11 4	845 3 7	5,278 10 1	28 8·2	5,041 9 4	27 4·7	....	237 0 9
Marble Bar	1,054	688 12 6	1,022 0 10	1,100 2 2	2,810 15 6	53 4	238 17 10	90 11 11	3,140 5 3	59 7	783 5 0	14 10·3	....	2,357 0 3
Marvel Loch	....	71 1 0	6 0 0	24 10 3	101 11 3	....	....	13 5 7	114 16 10	....	....	....	....	114 16 10
Meekatharra	1,378	182 6 7	795 14 6	680 5 3	1,658 6 4	24 0·8	200 9 11	196 10 9	2,055 7 0	29 9·9	1,325 14 7	19 2	....	729 12 5
Mt. Ida	....	....	....	....	....	....	....	....	....	....	70 11 4	....	70 11 4	....
Norseman	....	....	....	....	....	....	....	12 8 3	12 8 3	....	....	....	....	12 8 3
Ora Banda	2,911	609 10 8	2,698 0 1	1,553 4 4	4,860 15 1	33 4·7	450 15 1	659 19 11	5,971 10 1	41 0·3	2,143 5 4	14 8·7	....	3,828 4 9
Sandstone	1,728	561 13 10	1,340 7 10	571 8 10	2,473 10 6	28 7·7	77 7 7	599 12 4	3,150 10 5	36 5·5	1,526 4 7	17 7·9	....	1,624 5 10
Wiluna	....	....	....	....	....	....	....	....	....	....	21 1 5	....	21 1 5	....
Yarri	952	350 4 5	750 10 5	420 1 1	1,520 15 11	31 10·3	454 3 5	345 18 3	2,320 17 7	48 9	1,253 1 10	26 3·9	....	1,067 15 9
	26,659	5,212 1 2	19,141 5 10	12,585 14 2	36,939 1 2	27 8·5	2,315 2 0	6,399 12 7	45,653 15 9	34 3	30,373 18 9	22 9·8	91 12 9	15,371 9 9
Interest Paid to Treasury	....	....	....	....	....	....	....	....	....	....	2,588 1 1	....	....	2,588 1 1
	....	....	....	....	....	....	....	....	....	....	27,785 17 8	....	....	17,959 10 10
	....	....	....	....	....	....	....	....	....	....	....	....	....	91 12 9
Net Loss	....	....	....	....	....	....	....	....	....	....	....	....	....	17,867 18 1

DIVISION IV.

Annual Progress Report of the Geological Survey Branch of the Mines Department for Year 1953.

Contents.

List of Plates.

List of Figures.

Division IV.

Annual Progress Report of the Geological Survey of Western Australia for the Year ended 31st December, 1953.

The Under Secretary for Mines,

Sir,—I have the honour to submit, for the information of the Honourable the Minister for Mines, my report on the operations and progress of the Geological Survey for the year ended 31st December, 1953.

Staff.

Strength as at 31st December:—

			Total.
Professional.			
Ellis, H. A., B.Sc., A.O.S.M.	Government Geologist		6
Berliat, K., D.Sc.	Acting Senior Geologist		
Sofoulis, J., B.Sc.	Acting Geologist, Grade 1		
de la Hunty, L. E. B.Sc.	Geologist, Grade 2		
Low, G. H., B.Sc.	Geologist, Grade 2		
Noldart, A. J., B.Sc.	Geologist, Grade 2		
Clerical.			
Connolly, R. R.	Clerk		3
MacNamara, T. H.	Clerk		
White, S. V.G.	Typist		
Laboratory.			
Fimmell, L. H.	Laboratory Assistant		1

Promotions, Resignation, Appointments.

Mr. S. A. Tomich joined the staff on the 12th January as senior Geologist, but at the end of his probationary period his appointment was not confirmed, and he left the department on the 21st August, 1953.

Mr. J. H. Lord, B.Ss., resigned from the position of Geologist Grade 1 on the 27th March, 1953, after seven years continuous employment with the Geological Survey Branch. The greater part of this time was spent in supervising Government drilling on the Collie Coal Field, and his work in this field was of the highest standard. Mr. Lord left the department to take up employment with a private coal mining company in Western Australia.

Dr. K. Berliat was promoted to the position of Acting Senior Geologist on the 1st October, and Mr. J. Sofoulis, B.Ss., was promoted to Acting Geologist Grade 1 on the same date.

Professional Staff.

The approved establishment for Professional officers as at 31st December is as follows:—

Government Geologist	H. A. Ellis
Senior Geologist (Acting)	K. Berliat
Geologist, Grade 1 (Acting)	J. Sofoulis
Geologist, Grade 2	L. E. de la Hunty
,, ,,	G. H. Low
,, ,,	A. J. Noldart
,, ,,	*Vacant*
,, ,,	*Vacant*
,, ,,	*Vacant*
,, ,,	*Vacant*

Again this year we were unable to compete for professional staff with private enterprise and Government organisations in other States, resulting in a seriously depleted active strength. In view of the increased interest and demand for work of this type it is considered to be of the utmost importance that the conditions of service in this Branch be brought to a comparable level with those of other similar organisations throughout Australia.

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

Period.	No. of Geologists available, including Government Geologist.	Area of State (sq. Miles).	Square Miles per Geologist.	Population of State.
1953	....	975,920	....	627,305
Jan.-Mar.	8	....	121,977	....
Mar.-Aug.	7	....	139,400	....
Aug.-Dec.	6	....	162,650	....

Activities of Professional Officers.

H. A. Ellis, Government Geologist.

In addition to head-office duties, the following field work was undertaken:—

Places Visited.	Purpose of Visit or Matters Investigated.	Period.
Collie	Coal drilling	Jan.
Capel	Beach Sand claims	
Koolyanobbing	Pyrite Drilling	
Kooyanobbing	Pyrite Drilling	Feb.
Collie	Coal Drilling	Mar.
Koolyanobbing	Pyrite Drilling	
Ravensthorpe	Regional Geological Survey	
Norseman (twice)	Pyrite Mining	April
Collie	Coal Drilling	
Koolyanobbing	Pyrite Drilling	
Bullfinch	Gold Mining	May
Koolyanobbing (twice)	Pyrite Drilling	
Parker's Range	Gold Drill Sites	
Laverton	Manganese	
Linden	Regional Geological Survey	June
Ravensthorpe	Regional Geological Survey	
Norseman	Pyrite Mining	
Collie	Coal Drilling	
Mt. Magnet	Hill 50 Gold Mine	July
Koolyanobbing	Pyrite Drilling	
Ravensthorpe	Regional Geological Survey	
Edwards' Find	Gold Mining	Aug.
Koolyanobbing	Pyrite Drilling	
Koolyanobbing	Pyrite Drilling	Sept.
Collie	Coal Drilling	
Northern Territory	Uranium occurrences	Oct.
Koolyanobbing	Pyrite Drilling	
N. & S. Yilgarn Goldfield	Gold Drilling Sites	Nov.
Koolyanobbing	Pyrite Drilling	
Collie	Coal Drilling	
Dundas	Uranium occurrence	Dec.
Koolyanobbing	Pyrite Drilling	
Collie	Coal Drilling	

S. A. Tomich, Senior Geologist.

January-February: Inspection and report on the Prospects at Sunshine-Reward Amalgamated Gold Mine, Edwards' Find, Yilgarn Goldfield. Report on reputed Titanium deposit on the Coolgardie-Norseman Road. Report on a Spodumene-bearing Pegmatite on Hampton Plains Location 53.

March: Inspection and report on Paringa Wheal Fortune Lead Mine, Northampton.

April-August: A geological survey of the area around the Mt. Ida Mining Centre.

J. H. Lord, Geologist Grade 1.

January-March: Supervision Government Drilling in the Collie Coal Basin. Resigned 27th March.

K. Berliat, Acting Senior Geologist.

January-February: Investigation of possibility of obtaining domestic and stock water supplies in the Yerecoin and Jurien Bay districts.

March: Office work in connection with Linden Area survey.

April: Water supply investigations on East Kimberley cattle stations.

May-November: Geological field work, Linden Area, North Coolgardie Goldfield.

December: Investigation of water supply problems near Watheroo and Coomberdale, and office work in connection with Linden Area survey.

J. Sofoulis, Acting Geologist Grade 1.

January-March: Inspection of mineral claim for Wolfram, Yalgoo G.F. Report writing in connection with geological survey of Phillips River Goldfield.

April-August: Field work Phillips River Goldfield. Inspection of Manganese deposit near Naendip.

August-December: Reconaissance survey Kent District, adjacent to Phillips River Goldfield. Report writing in connection with geological survey of Phillips River Goldfield.

L. E. de la Hunty, Geologist Grade 2.

January: Inspection of mineral claim for wolfram, Yalgoo G. F.

February: Report writing on gypsum deposits.

March: Reconnaissance survey of Linden Area with Dr. Berliat.

April-August: Field work—Linden Survey

September: Report writing.

October: Visited Linden. Visited Koolyanobbing with Mr. H. A. Ellis.

November: Testing phosphate deposits for radioactivity, Dandaragan. Water supply work at Gabbin.

December: Inspection and mapping of radioactive deposits at Dundas.

G. H. Low, Geologist, Grade 2.

January: Preparation of geological plans and reports on the Gypsum Resources Survey.

February-December: Supervision of Failing and Deep Drilling at Collie; the preparation of reports on this drilling and assisting Coal Mining Companies at Collie with general geological problems.

A. J. Noldart, Geologist, Grade 2.

January: Office work in connection with geological survey of Phillips River G.F.

January-May: Geological field work in Phillips River G.F.

May-June: Preparation of report on Mt. McMahon Mining Group, Phillips River G.F.

June-August: Assisting Mr. J. Sofoulis in geological survey of Phillips River G.F.

August-October: Office work in connection with Phillips River G.F. survey.

November: Assisting Government Geologist in selecting diamond drill sites in Yilgarn G.F.

November-December: Preparation of data for diamond drill Gold exploratory programme.

December: Inspections and reports on:—

(a) Shale deposits Mundijong area.

(b) Barite deposits Cranbrook area.

FIELD WORK.

Major Field Work completed during the Year and in Progress as at December 31.

(1) Supervision of Government deep and shallow drilling on the Collie Coal Field continued throughout the year.

(2) A geological survey of the Ravensthorpe District, Phillips River Goldfield, was completed.

(3) A geological survey of the Linden Mining District was commenced, and the regional work completed.

(4) A geological survey of the Mt. Ida Mining District was commenced, and although, due to staff difficulties, it is unlikely that this survey will be completed, some useful information was obtained from the work done, and made available to the mining interests in the area.

(5) A drilling programme to test abandoned gold shows mainly in the Yilgarn field was prepared.

(6) Diamond drilling of the Koolyanobbing Iron Ore deposits continued during the year and revealed the presence of high grade Iron Pyrities at depth.

(7) Further assistance was rendered to certain Kimberley Cattle Stations in their search for underground water supplies.

Field Work for 1954.

(1) Continuation of Collie Coal Field exploratory drilling.

(2) Completion of group work in the Linden Mining District.

(3) Continuation of the Koolyanobbing exploratory drilling.

(4) Diamond drilling to test abandoned gold shows in the Yilgarn Goldfield.

(5) Geological survey of the Mt. Magnet Mining District.

(6) A reconnaissance survey of portions of the Kimberley Division to determine the possibility of occurrence of uranium bearing minerals.

(7) A regional survey of an area between Coolgardie and Dundas.

(Items 6 and 7—provided staff can be obtained.)

TRANSPORT.

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

Vehicle W.A.G.	Make and Type.	Load cwt.	Mileage as at 31-12-53	Mileage for 1953.	Date Vehicle Purchased.	Remarks.
1175	Ford Utility	18	?	12,822	1946 (new)	On loan to University of W.A. from Oct., 1953.
1194	Ford Utility	18	78,709	3,709	1946 (new)	
1307	Chevrolet Utility	15	116,623	7,933	1947 (used)	
1413	Chevrolet Utility	15	72,802	10,217	1947 (new)	
1421	Chevrolet Utility	15	60,029	6,460	1947 (new)	
2044	Dodge Utility	18	35,700	11,862	1950 (new)	
2393	International Utility	14	29,028	13,191	1950 (new)	
2412	International Utility	14	47,696	14,361	1950 (new)	
2608	International Utility	14	31,269	11,273	1951 (new)	
909	Willys Jeep	5	7,230	7,230	1953 (new)	

Total miles : 99,058.

SERVICE TO THE GENERAL PUBLIC, MINING INTERESTS AND GOVERNMENT DEPARTMENTS.

Much information, both written and oral, was given to a variety of applicants during the year, and our publications were frequently sought.

Activities of the Commonwealth Bureau of Mineral Resources.

The Commonwealth Bureau of Mineral Resources maintained several geological and geophysical parties in the field in the North-West and Kimberley Divisions during the 1953 field season, and examined two manganese deposits in other parts of the State which had already been examined and reported on by State Geologists. The Bureau's operations were confined to the sedimentary basins in the northern part of the State, as part of its programme in assisting the search for oil in Australia. This is a suitable opportunity to express appreciation of the spadework done by the Bureau's geologists and geophysicists which laid the foundation for the ultimate discovery during the year at Rough Range, near the southern end of Exmouth Gulf, of crude flow oil, the first flow oil discovered in Australia. Although represented by one geologist in one of these parties for one year, the State Geological Survey has taken no other part in the search for oil, for the simple reason that we have not been able to meet even the normal demand on our services owing to lack of staff.

The Discovery of Oil in Western Australia.

On December 4th, 1953, The Standard Oil Company of California, as principals of the oil search venture in progress at Rough Range, Exmouth Gulf, North-West Division, officially announced to the world that the Rough Range No. 1 Test Well situated near the crest of Rough Range in Lat. 22° 25'S. and Long. 114° 05'E. near the southern end of Exmouth Gulf had struck crude oil between a depth of 3,605 and 3,620 feet.

The crude oil-bearing horizon was actually penetrated on November 1, when a waxy substance was noted in the mud and cuttings coming from the well. This material gave the following results when analysed at the Government Chemical Laboratories in Perth:—

FIRST SAMPLE OF WAXY HYDROCARBON MATERIAL RECEIVED FROM WEST AUSTRALIA PETROLEUM PTY., LTD.

Identification.

Rough Range No. 1 Well 3,603–3,622 ft. .... Exmouth Gulf Area, North Western Australia.

General Characteristics.

Specific Gravity 0·859 .... A.P.I. Gravity 33·2° .... Colour—Dun brown with greenish shade.

* Saybolt Universal Viscosity at 100°F. 182sec.

Water per cent. v/v 8·7.

Dehydrated Crude Distillation, Bureau of Mines Hempel Method.

Stage I. Dry distillation at atmospheric pressure. First drop 139°C. (282°F.).

Fraction No.	Fraction cut at °C.	°F.	Per cent.	Sum Per cent.	Sp. Gr. 60/60°F.	°A.P.I.	Correlation Index.	S.U. Viscosity 100°F.	Cloud Test °F.
8	225	437	2·8	2·8	0·762	54·2	6·0	....	16
9	250	482	5·6	8·4	0·778	50·4	8·2	....	28
10	275	527	9·1	17·5	0·784	49·0	6·4	....	36
Stage II. Dry distillation at 40 mm. Hg.									
11	200	392	12·3	29·8	0·798	45·8	10	38	52
12	225	437	8·4	38·2	0·811	43·0	11	43	70
13	250	482	12·5	50·7	0·828	39·4	16	50	93
14	275	527	12·3	63·0	0·854	34·2	25	....	115
15	300	572	11·4	74·4	0·858	33·4	24	....	124
Residuum	....	....	25·0	99·4	0·934	20·0	....	....	....
Distillation Loss	....	....	0·6	100·0	....	....	....	....	....

* Viscosity of dehydrated crude.

Base of crude—paraffin.

Parraffin wax in dehydrated crude (solvent method) 40·0 per cent. w/w.

Note.—The method used in the analysis was that adopted by the U.S.A. Bureau of Mines as described in their Bulletin 490.

Approximate Summary.

	Per cent.	Sp. Gr.	°A.O.I.	Viscosity.
Light gasoline	....	....	....	....
Total gasoline and naphtha	....	....	....	....
Kerosene distillate	17·5	0·778	50·4	....
Gas oil	33·2	0·813	42·6	....
Non-viscous lubricating distillate	}	}	}	50–100
Medium lubricating distillate		Indeterminate		100–200
Viscous lubricating distillate	}	}	}	above 200
Residuum	25·0	0·934	20·0	....
Distillation loss	0·6	....	....	....

J. C. HOOD.
Deputy Government Analyst.
Lab. No. 17742/53.

This horizon was cased off in the normal drilling processes and drilling ahead was continued, until on November 27th, the oil bearing horizon was subjected to a routine test, and the operating company, West Australian Petroleum Pty. Ltd., subsequently reported that the well flowed steadily a light green waxy crude oil through a ¼" orofice in the testing tool for a total of 578 barrels (20,212 Imperial gallons) during a period of 25 hours.

The crude oil was described by the company as a "high grade crude with a paraffin base."

The following is the report submitted by the Government Chemical Laboratories, Perth, on a sample of this crude flow oil:—

SECOND SAMPLE OF WAXY HYDROCARBON MATERIAL RECEIVED FROM WEST AUSTRALIAN PETROLEUM PTY., LTD.

Identification.

Rough Range No. 1 Well 3,603–3,622 ft. .... Exmouth Gulf Area, North Western Australia.

General Characteristics.

Specific Gravity 0·839 .... A.P.I. Gravity 37·2° .... Colour—Greenish brown.
Saybolt Universal Viscosity at 100°F. 62 sec.

Distillation, Bureau of Mines Hempel Method.

Stage I. Dry distillation at atmospheric pressure. First drop 222°. (432°F.).

Fraction No.	Fraction cut at. °C.	°F.	Per cent.	Sum Per cent.	Sp. Gr. 60/60°F	°A.P.I.	Correlation Index.	S.U. Viscosity 100°F.	Cloud Test °F.
9	250	482	5·7	5·7	0·776	50·9	7·3	....	31
10	275	527	7·7	13·4	0·785	48·8	6·9	....	45
Stage II. Dry distillation at 40 mm. Hg.									
11	200	392	17·2	30·6	0·797	46·0	10	38	57
12	225	437	8·0	38·6	0·809	43·4	11	43	72
13	250	482	12·0	50·6	0·824	40·2	14	50	95
14	275	527	15·0	65·6	0·859	33·2	28	....	115
15	300	572	15·3	80·9	0·865	32·1	28	....	127
Residuum....	....	....	18·5	99·4	0·922	22·0	....	....	....
Distillation loss	....	....	0·6	100·0	....	....	....	....	....

Base of crude—parraffin.

Parriffin wax in crude (solvent method) 47·5 per cent. w/w.

Note.—The method used in the analysis was that adopted by the U.S.A. Bureau of Mines as described in their Bulletin No. 490.

Approximate Summary.

	Per cent.	Sp. Gr.	°A.P.I.	Viscosity.
Light gasoline	....	....	....	....
Total gasoline and naphtha	....	....	....	....
Kerosene distillate	13·4	0·781	49·7	....
Gas oil	37·2	0·808	43·6	....
Non-viscous lubricating distillate	}			50–100
Medium lubricating distillate	}	Indeterminate		100–200
Viscous lubricating distillate	}			above 200
Residuum	18·5	0·922	21·9	....
Distillation loss	0·6	....	....	....

J. C. HOOD,
Deputy Government Analyst.
Lab. No. 17980/53.

Drilling of the deep test well commenced on September 5th and it penetrated Tertiary limestones and shales and entered the Cretaceous at a depth not yet known to this branch. The oil horizon consisted of a glauconitic greensand some 15 feet thick, and was situated in the BIRDRONG FORMATION at the base of the Mesozoic (Cretaceous) at or very close to the unconformity between the Cretaceous and Permian, if not actually at the unconformity.

The Test Well is still in progress, and had reached a depth of 5,322 feet by the end of the year without encountering any further showings of oil. At this depth the rocks would be of Permian age.

No other wells were being drilled in the structure as at the end of December, 1953, and it is not yet possible to say whether crude oil exists in commercial quantities in the Rough Range Dome.

The following is a description of the oil-bearing sandstone from No. 1 Rough Range Test Bore, supplied by the Commonwealth Bureau of Mineral Resources:—

Description of Sample of Oil-Bearing BIRDRONG Sandstone from Rough Range No. 1 Test Bore.
Depth 3620 ft. approx.

Microscopically this is a light grey, porous, moderately friable, sugary, medium-grained sandstone, consisting principally of quartz. Glauconite is the only other mineral distiguishable in the handspecimen. As a whole the rock is even-grained, but a few larger quartz grains measuring up to 4mm. are present.

In thin section the rock is found to consist of approximately 80 per cent. quartz. The grains were originally subangular to rounded, but most of them now show secondary outgrowths of quartz

in optical continuity with that forming the detrital grain. Numerous grains have a narrow shell of secondary quartz easily distinguishable by virtue of the fact that it is clear, whereas the detrital grains contain fluid inclusions. In some cases small crystals of authigenic (?) brookite have formed along the borders of the original grains, and are now enclosed in the shell of new quartz. Many, but by no means all, of the enlarged grains show crystal edges, and most of the pore-spaces in the rock appear to be due to incomplete meeting of the outgrowths.

Whether any other substance formerly filled these pore-spaces is not known; in some parts of the slide dark brown, argillaceous material fills or partly fills the interstices between the quartz grains, and some of this has been lost during grinding; whether such material has completely disappeared in other places in the slide is indeterminable. In addition, there is the possibility that some relatively soluble mineral, such as a carbonate, was the original cement, but has now been dissolved away.

The average size of the quartz grains is now 0.4 to 0.5 mm., though some considerably exceed this figure.

The growth of secondary quartz has not (as implied above) proceeded to the stage where closely interlocking grains have been produced, and so it has not been as instrumental in cementing the grains as one might at first expect. The fact is that the quartz grains have gently curved or straight boundaries, and this condition accounts for the sugary texture and porous nature of the rock.

Glauconite makes up, perhaps, three per cent. of the rock; pyrite cubes are associated with some grains of this mineral.

Accessory constituents are argillaceous material, detrital grains of chert or chalcedony, acid plagioclase, microcline, (?) brookite, and tourmaline.

The rock is a *medium-grained, slightly glauconitic quartz sandstone."*

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Issued during 1953.

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Bulletin No. 107: A Re-Survey of the Coolgardie District, W.A., by J. C. McMath, B.Sc., N. M. Gray, B.Sc., and H. J. Ward, B.Sc.

Bulletin No. 103, Atlas No. 2. (Text and Atlas No. 1 already issued.)

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Bulletin No. 108: The Geology of the Irwin River and Eradu Coal Basins, by W. Johnson, B.Sc. (Hons.); J. S. Gleeson, B.Sc., and L. E. de la Hunty, B.Sc.

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Mineral Resources of Western Australia Bulletin No. 8: Gypsum, by L. E. de la Hunty, B.Sc., and G. H. Low, B.Sc.

In Course of Preparation.

Bulletin No. 110: A Geological Survey of the Ravensthorpe District, Phillips River Goldfield, W.A., by J. Sofoulis, B.Sc.

H. A. ELLIS,
9th February, 1954. Government Geologist.

REPORT ON A SPODUMENE-BEARING PEGMATITE ON HAMPTON PLAINS LOCATION 53, SOUTH OF KALGOORLIE, W.A.

Approx. Latitude 31° 03' S.
Approx. Longitude 121° 28' E.

By S. A. TOMICH, B.Sc.

Introduction.

An inspection of a pegmatite outcrop was made at the suggestion of the Manager of the Hampton Plains Syndicate. The purpose was to examine for occurrence of any rare minerals of commercial value.

Locality and Access.

The pegmatite occurs in hilly moderately timbered country about one mile S.S.W. of Mt. Marion trig. Its actual map location is 22½ miles practically due south from Kalgoorlie, but is reached by winding bush track for which the car speedometer reading is 23 miles from the Boulder Post Office, i.e. 26 miles from Kalgoorlie. Actually it is only 3½ miles from the Coolgardie-Norseman road at its nearest point, but there is no connecting track.

Extent of Workings.

At the time of the writer's visit two men were engaged in trenching and costeaning with the aid of a portable compressor and drilling machine. A road grader had been used effectively to expose pegmatite in places where obscured by soil cover. However the workings were of very limited extent, by far the largest excavation being an irregular costean 20 ft. long, five to six feet wide, and about five feet deep.

Geology and Mineralogy.

The rock enclosing the pegmatite is a coarse-grained greenstone of gabbroid appearance. Honman's[1] map shows an outcrop of granite two miles distant. He records the presence of a pegmatite[2] "dyke" intrusive into greenstone schists, presumably close to the granite. Flatly dipping granitic dykes are recorded in the locality, intruding greenstone. Other pegmatites conformable with metamorphosed sediments are also mentioned, so they are by no means rare.

The deposit examined is a very coarse-grained pegmatite occurring on one side, and near the top, of a low hill. Its average strike is N. 40° W., but the dip could not be determined definitely, although considered likely to be at a low angle to the South-West. The exposed length is about 12 chains; true width is unknown, although the surface width varies irregularly from half a chain to two chains. Quartz rubble extends beyond the limits of the pegmatite to the bottom of the hill, giving the outcrop at first glance the appearance of a quartz "blow", for which it probably was often mistaken in the past.

Besides the normal quartz, felspars and mica common to all pegmatites this one contains in addition spodumene, beryl and columbite in that order of abundance. The main costean is on a spodumene-rich section, in which there is a suggestion of mineral zoning. Large, well developed spodumene crystals are found in association with very coarse quartz. Crystals up to 18 inches long and four inches across were observed, although some are reputed to have been two feet six inches in length. In this section 40% by volume of the pegmatite is occupied by spodumene. This is flanked by a spodumene-beryl-quartz portion. The beryl is of irregular distribution. It is a fractured, bluish-gray variety up to two inches across. Near the bottom of the same costean the spodumene zone gives way to a quartz-albite-mica section, followed by very coarse albite felspar with some sugary quartz.

[1] 1914 Honman, C. S.: The Geology of the Country between Kalgoorlie and Coolgardie. *G.S.W.A. Bulletin No. 56.*

[2] op. cit p. 32.

Close to the concentration of coarse spodumene is another mass of smaller spodumene crystals. More remote is a large mass of pure quartz, occasionally with striations left by the "weathering out" of spodumene crystals. Although the evidence is not conclusive it is suggestive of zoning, with the quartz mass thus to be regarded as the core of the pegmatite.

A little columbite in small grains is associated with the spodumene and beryl. Large "floaters" of columbite (crystals to two inches in length) have been found on the surface along the eastern margin of the pegmatite, well away from the main spodumene area. A search for this columbite in situ has not yet been successful.

Mica (muscovite) is of rather small size, but the quality appears fairly good.

Another pegmatite outcrop about a half mile along the track back to Kalgoorlie contains spodumene and small columbite "floaters" on the surface. Several others in the district are reported to contain minor quantities of these same minerals.

Lithium Content of the Spodumene.

A determination by the Government Chemical Laboratory gives the Lithia (Li_2O) content as 6.08%. This figure compares with those given for representative samples of spodumene from a pegmatite in the Ravensthorpe[3] district, which are quoted as 6.20% and 6.18% Li_2O respectively.

Conclusions.

Insufficient work has been done yet to assess the full potentialities, or to determine the characteristics, of this pegmatite. The potential value depends on a ready market for spodumene and the finding of sufficient concentrations of beryl and columbite, particularly the latter mineral. Prices for beryl and columbite are attractive and a ready market for spodumene would encourage prospecting, as there may well be a belt of such pegmatites in the district.

REPORT OF PROSPECTS AT SUNSHINE-REWARD AMALGAMATED GOLD MINE, EDWARDS FIND, YILGARN GOLDFIELD.

by S. A. Tomich, B.sc.

CONTENTS.

Summary.

The ore bodies at the Sunshine-Reward Amalgamated Gold Mine are steep quartz reefs of variable width, occurring in sedimentary greenstones of the Yilgarn System. Ore formation is accompanied by certain characteristic mineralogical changes in the immediate host rock.

Shearing mainly and folding to a less extent have been responsible for the emplacement of quartz reefs. A pattern of ore distribution is indicated by the underground mapping. This can be readily verified by driving from easily-accessible locations.

Only limited disruption of ore bodies has been effected by faults, as observed so far. Pegmatite "bars" cut through the reefs. The effect on mining operations can be serious when the pegmatites are of considerable width.

[3] Sofoulis, J.: Report on Cattlin Creek Spodumene Pegmatite, Ravensthorpe, W.A.—*Annual Progress Report, G.S.W.A., 1952.*

The mine has by no means been developed to its full potential. There is scope for more intensive development and exploration. A campaign of work is outlined, a campaign of promise which could be better put into effect by a company with more substantial resources.

Introduction.

Edwards Find is situated 27 miles by road south from Southern Cross, and lies about 9½ miles south-west of Marvel Loch.

General information concerning the mine, locality, and geological setting can be found in G.S.W.A. Bulletin 97 by H. A. Ellis. A detailed examination of the workings, made in 1935 by R. S. Matheson, is recorded in G.S.W.A. Bulletin 99. Ellis and Matheson examined the mine in its infancy. After it had been a recognised producer for a number of years another examination was made by J. H. Lord and J. Sofoulis, who advanced sound suggestions about future development. Their report appears in the Report of the Geological Survey for 1949. The underground workings were mapped by the writer in January, 1953.

Lease Information.

Underground work at present is concentrated on G.M.L. 3942 (Reward) and G.M.L. 3943 (Sunshine), originally designated G.M.L. 11PP and G.M.L. 12PP respectively. Other leases are held by the Syndicate, in particular one north and one south of the above two. Adjoining the Sunshine lease on the east is G.M.L. 13PP (Cricket), held by another party. From this there was good-grade production in the past, but no systematic work has been attempted in recent years.

General Geology.

The immediate country rock of the mine workings is an amphibolitic greenstone, considered to be a highly metamorphosed basic sediment. On the No. 1 (100 ft.) level, which is in the oxidised zone, there can be observed a well-defined schistosity, which is in reality bedding. Folding is not conspicuous, but the shape of the workings in certain sections suggest that some of the ore followed bends in the schist. Original bedding has been doubtless accentuated by oxidation, as on lower (unoxidised) levels the rock appears massive with little, if any, evident sign of schistose or gneissic structure. The change might also be due to the presence of beds of different composition in a tightly folded sequence, although much detailed examination is required to confirm this view.

Reliable strikes of the country rock can be obtained only in oxidised ground. Average direction of schistosity is north-north-west, but there are local variations of many degrees from this strike. Dips invariably are to the west at very high angles. The underground works suggest that the major ore bodies mostly run "parallel to the country," but not entirely so.

The ore bodies are essentially very steep quartz reefs of overall lenticular habit. Quartz ranges in width from a few inches up to 15 feet, the larger width usually found at junctions of two or more reefs of divergent strikes.

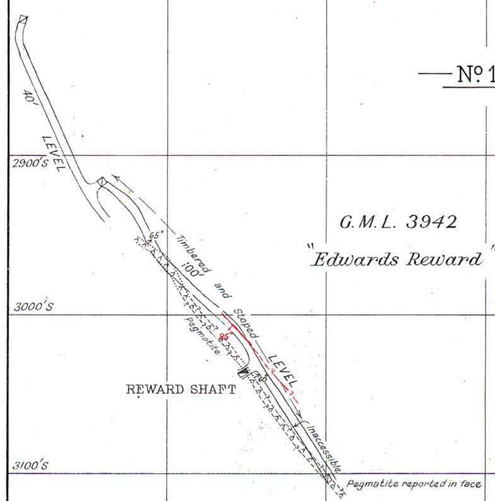
In the narrow sections the quartz shows some evidence of a banded or ribbon structure. Instead of a single vein there may be a number of closely spaced veinlets comprising a small "vein channel." The intervening space may be composed of highly biotitic material and veinlets of lustrous, pale-green diopside replacing the normal amphibole found in the enclosing rock. It appears that the development of biotite and diopside is a feature of ore formation. Both minerals, particularly biotite, are frequently observed in the walls of reefs, and therefore are of some diagnostic value.

Sulphides are notably absent from the ore, which is free milling. Gold is seldom visible, and it is stated that even very rich quartz contains gold no larger than pin-head size.

Narrow intrusive pegmatite bodies occur, aligned in two directions—(1) almost parallel to the quartz reefs but with opposite dip, and (2) across the

PLATE I

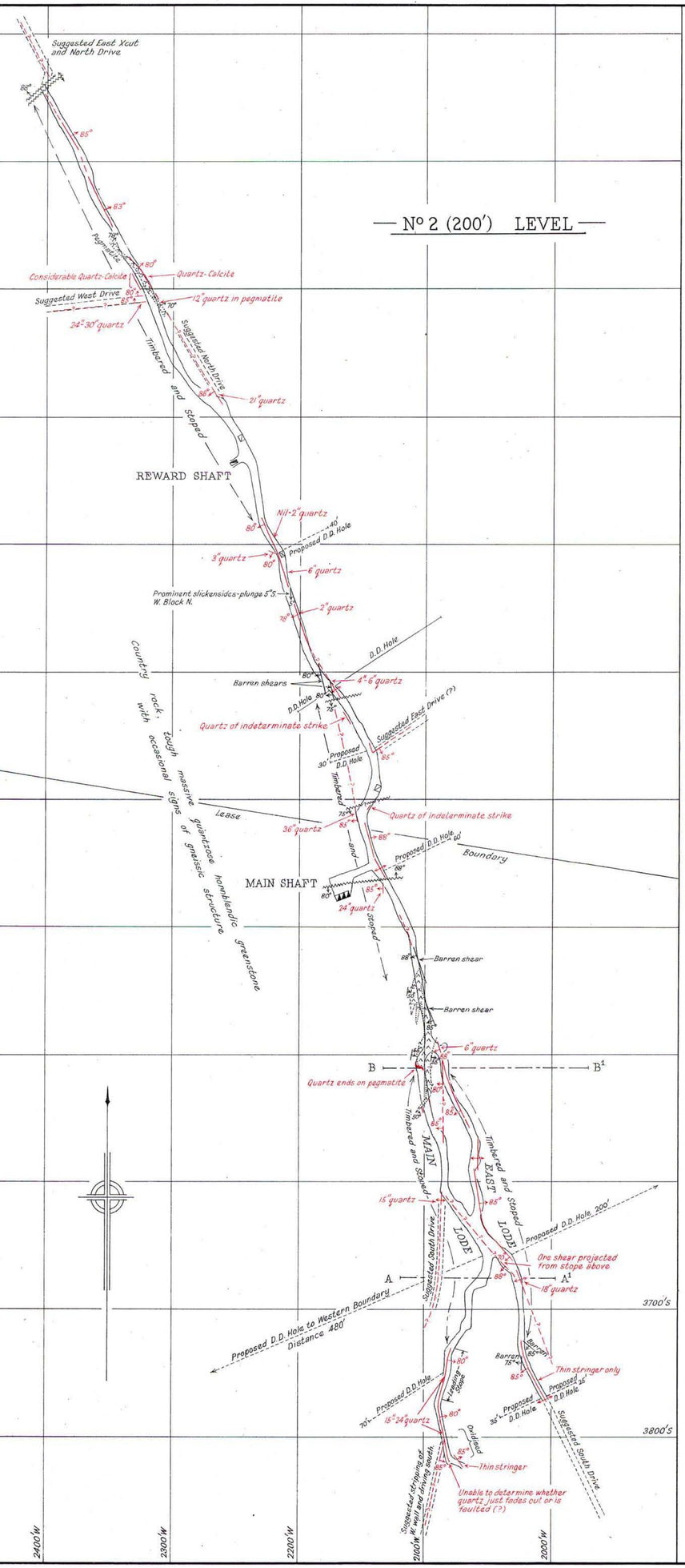
Nº 1 (100′) LEVEL



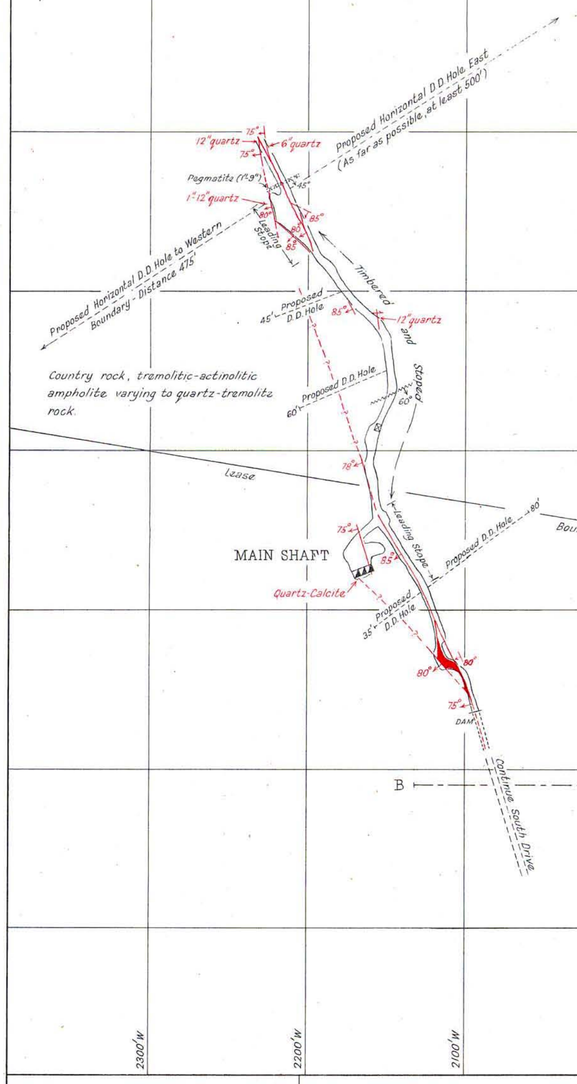
G.M.L. 3942

"Edwards Reward"

Nº 2 (200′) LEVEL



Nº 3 (300′) LEVEL



G.M.L. 3943

"Sunshine"

REFERENCE

- Lode shear (with quartz) showing dip
- Lode shear (barren) showing dip
- Fault showing dip
- Vertical dip
- Strike and dip of schistosity
- Observed geological boundary
- Assumed geological boundary
- Pegmatite
- Main shaft
- Accessible shaft
- Head of rise or winze
- Foot of rise or winze

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

GEOLOGICAL PLANS OF Nos 1, 2 & 3 LEVELS G.M.Ls 3942 & 3943 SUNSHINE REWARD AMALGAMATED G.M. EDWARDS FIND YILGARN GOLDFIELD

Scale : 60 feet to an inch

60 0 60 120

Geology by S.A. Tomich, Jan., 1953.

Suggested work shown in dotted lines

Fig 1

TRANSVERSE SECTIONS

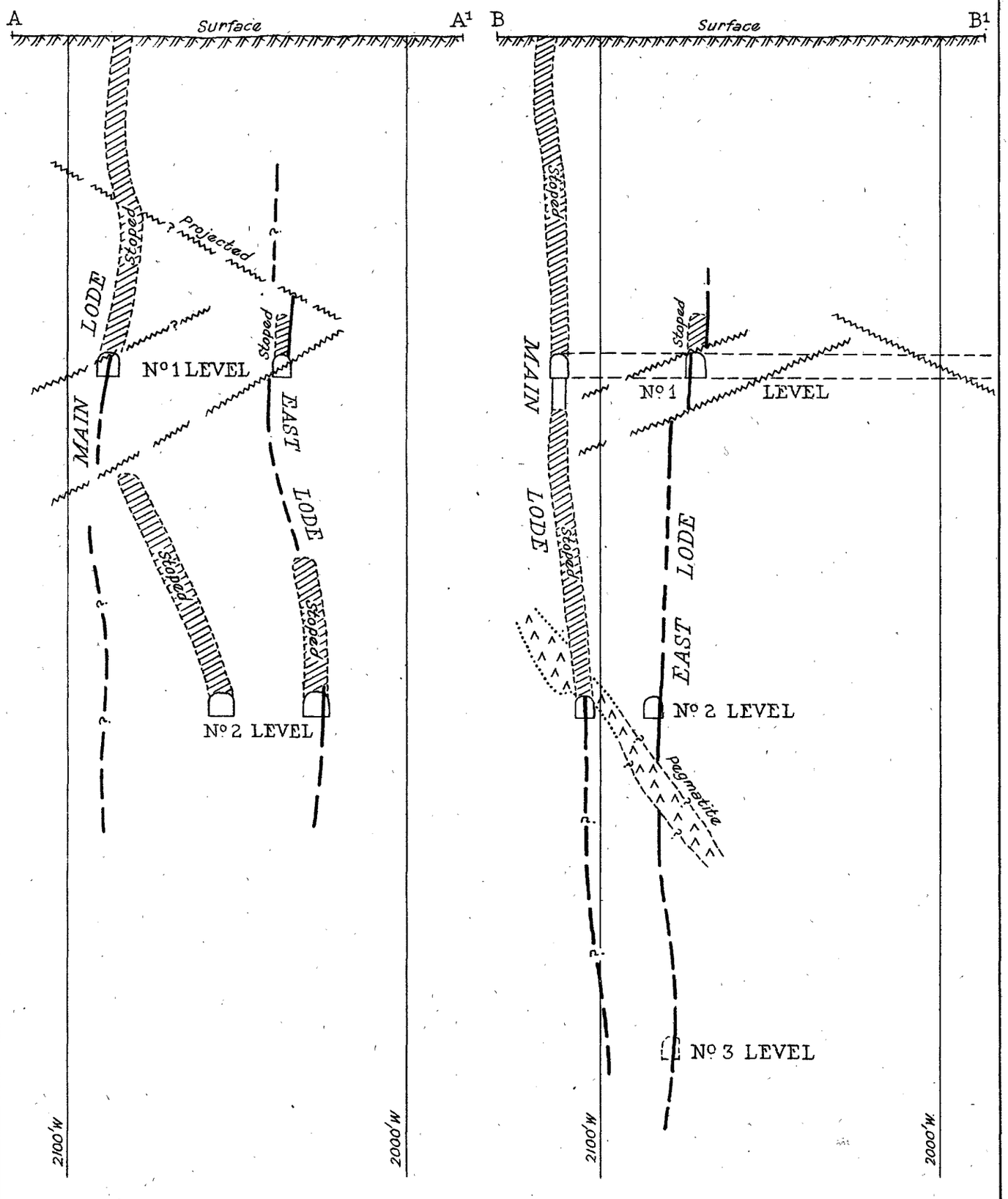
G.M.Lˢ 3942 & 3943

SUNSHINE REWARD AMALGAMATED G.M.

EDWARDS FIND

YILGARN GOLDFIELD

Scale : 40 feet to an inch



major reef at right angles, dipping south at 45°. Pegmatites are later than ore as they clearly cut through quartz reefs. No quartz core is developed in these intrusives, as a rule. However, in the stope above the No. 3 level, immediately north of the main shaft, a "cross dyke" was observed with a pronounced central quartz core where it transgressed the ore, suggesting that some assimilation of the reef had taken place.

Structural and Economic Geology.

A. Ore Distribution.

The two principal ore bodies which have been mined, up to the present, are referred to as "Main Lode" and "East Lode". Although some of the "Main Lode" appears to be folded along with the enclosing country, the most prominent structural feature is the steep, well-defined shear on which the "East Lode" reef has formed. See geological level plans. This shear traverses practically the full length of workings from north to south, and thus the "Main Lode" really should be regarded as a branch of the "East Lode."

Makes of ore in other directions have been observed, although little mining has been done on them. These additional directions are three in number—one oblique and two "cross lode" strikes. A programme of testing is suggested for these, as they all appear to be part of a pattern of ore distribution. See Fig. 1. Similar makes apparently have been tested in the past and found lacking in continuity, but one or two of these may respond to development over substantial lengths. If they do so, it means at least one other ore body.

The last 110 feet of the "Main Lode" south drive, No. 1 level, has taken a sharp swing to an "Oblique Lode" direction, viz. N 40°W. From the outline of the workings it is likely that the Northern portion of the 100 ft. level, Reward shaft, has the same oblique strike, but the condition of the workings does not permit confirmatory mapping. A short length of reef on N 40°W strike has been mined in the south end of No. 2 level, between "East Lode" and "Main Lode."

"Cross Lode" exposures in N 70°W direction are limited to the ground between "East Lode" shear and "Main Lode." The other crosslode strike is N 75°E.

In all, a miniature pattern of ore distribution appears to be present in this deposit, which may be a replica of a larger district pattern. In view of this and the nature of the principal shear it does not seem unlikely that there are other parallel shears in the district, which have not been discovered owing to paucity of outcrops.

B. Faulting.

Flat strike faults and steep cross faults have been observed. With neither type is the displacement of very great magnitude. Strike faults dip both east and west at average angles of 20°-25°. Movement is reverse, i.e. the hanging wall has moved up. See transverse sections. The amount of displacement is of the order of several feet, usually insufficient to hinder seriously mining, although disruption of a few tens of feet has been reported in past operations.

Steeply dipping to almost vertical fractures running right across the principal ore body constitute the other fault type. As a rule, lateral offset is practically negligible but vertical movement may be more important. The effect is shown in sharply different widths of quartz appearing abruptly on opposite sides of a cross fault. In the extreme north end of the No. 2 level occurs the strongest cross fault so far observed. The reef has been displaced probably to the east no great distance, although the exact amount cannot be predicted.

Mining Methods.

Shrink stoping is employed below the zone of oxidation, where the massive greenstone provides good standing ground. In oxidised ground the cut-and-fillrill system is in use; walls do not appear to be particularly bad, but would certainly be weak in the vicinity of flat faults. Old battery sands are run from the surface through passes and used as stope filling.

Recommendations.

A campaign of development, exploration and diamond drilling is outlined hereunder. The work proposed is both immediate and long-range in scope, devolving on the view that there exists a pattern of ore distribution which has not been opened up sufficiently. On the basis of the probable existence of a larger, overall pattern a long-range programme of lateral exploration and prospecting is warranted.

LIST OF SUGGESTED UNDERGROUND WORK.

Sunshine-Reward Amalgamated G.M.

Edwards Find.

Level.	Lode.	Co-ordinate Position.	Type of Work.	Order of Priority.	Remarks.
No. 1	....	3510 S, 1975 W	X Cut East	2	Search for possible "Cricket" line (?)
No. 1	"Main"	3750 S, 2120 W	Drive N.W.	1	Develop "oblique lode."
No. 1	"Main"	3830 S, 2090 W	Drive S.E.	2	Exploration.
No. 1	"Main"	3490 S, 2105 W	Drive N.W.	1	May yield ore on "oblique" strike.
No. 1	"Cross"	3550 S, 2085 W	Drive East	1	Worth opening up to see if it can be incorporated in "East Lode" stope.
No. 1	"East"	3735 S, 2035 W	Drive South	1	Drive on flat west-dipping fault a few cuts for possible extension of "East Lode" (?).
No. 1	"East"	3740 S, 2005 W	X Cut East	1	Precautionary. To make sure no ore left in wall.
No. 2	"East"	3775 S, 2005 W	Drive South	2	Attempt to find extension of ore. May be preceded by short D.D. holes.
No. 2	"Main"	3815 S, 2085 W	Drive South	1	Strip W. wall of present drive and push drive on south.
No. 2	"Main"	3610 S, 2085 W	Drive South	1	Probably is same "Main lode" as worked on No. 1 level.
No. 2	"Cross"	3260 S, 2140 W	Drive East	1	Test "cross lode" in wall of North drive.
No. 2	"Main"	2985 S, 2260 W	Drive North	1	Develop branch lode.
No. 2	"Cross"	2905 S, 2320 W	Drive West	1	Develop "Crosslode" in wall of North drive.
No. 2	"Main"	2740 S, 2405 W	X Cut East	2	To explore for continuation of reef on North side of cross fault. If no success within four cuts, then diamond drill both ways.
No. 3	"Main"	Main South Drive		1	Continue past dam.

Note.—The main north drive on the No. 3 level is in progress at the present time.

(4)—88619.

LIST OF SUGGESTED DIAMOND DRILLING.

Sunshine-Reward Amalgamated G.M.

Edwards Find.

Level.	Lode.	Co-ordinate Position.	Direction.	Distance.	Order of Priority.	Remarks.
No. 2	"Main"	3105 S, 2215 W	N 64°E	40 ft.	1	To probe for possible "oblique" shear (?).
No. 2	"Main"	3260 S, 2145 W	S 73°W	30 ft.	1	To test branch reef in W. wall of drive.
No. 2	"Main"	3355 S, 2130 W	N 64°E	60 ft.	1	To explore E. wall of drive.
No. 2	"East"	3660 S, 2030 W	N 64°E	200 ft.	2	To test for possible continuation of "Cricket" line.
No. 2	"Main"	3660 S, 2055 W	S 67°W	480 ft.	3	Exploratory.
No. 2	"Main"	3755 S, 2085 W	S 57°W	70 ft.	1	To search for "Main Lode" proper (?) and "oblique lode."
No. 2	"East"	3770 S, 2005 W	N 66°E	25 ft.	1	To make sure there is no ore in walls before continuing with south drive.
No. 2	"East"	3770 S, 2010 W	S 66°W	35 ft.	1	
No. 3	"Main"	3135 S, 2210 W	N 57°E	500 ft.+	3	Exploratory.
No. 3	"Main"	3145 S, 2225 W	S 57°W	475 ft.	3	
No. 3	"Main"	3200 S, 2180 W	S 70°W	45 ft.	1	To test branch reef in W. wall of drive, as on No. 2 level.
No. 3	"Main"	3250 S, 2150 W	S 67°W	60 ft.	1	
No. 3	"Main"	3385 S, 2125 W	N 53°E	80 ft.	1	To explore E. wall of drive, as on No. 2 level.
No. 3	"Main"	3390 S, 2130 W	S 53°W	35 ft.	1	To test possible oblique reef.

Total Footage—2,135 ft.

The recommendations fall into the following broad categories:—

(i) Testing of exposures which constitute elements of the postulated pattern. Oblique and cross lodes are involved. This work can be done readily and inexpensively from existing workings, and merely entails driving on the most promising looking exposures. What proportion of the work will bear fruit is problematical, but seeing it can be done so easily it should not be left unattempted.

(ii) Length exploration involving north and south extensions of known ore bodies. Priority undertakings in this group are driving north on the 200 ft. level to pick up continuation of reef on the other side of cross fault, and driving south on both East and Main Lodes on Nos. 1 and 2 levels in an attempt to link up with old workings in the south end of the Sunshine lease.

(iii) Lateral exploration, chiefly by diamond drilling, for parallel shears.

(iv) A fourth category arises by virtue of the need to continue driving south on No. 3 level. A very heavy flow of water encountered in the south drive, and dammed back in a rather dangerous manner, has proved beyond the resources of the Syndicate to cope with. An important ore shoot is thereby tied up. Fortunately, mining carried on in the north end of this level is maintaining output sufficient to keep the treatment plant in operation.

Depth exploration is not mentioned above, as this work will automatically follow in the normal course of events. There is no reason to believe that the ore will not live to depth.

Note.—All proposed diamond drill holes are horizontal. Of the total footage, 680 ft. represents drilling ahead of normal development and consists of comparatively short "stabs" in the walls of present workings. The remaining 1,455 ft. is for purely exploratory drilling. The footage figures are the minima for each category. In the case of a "strike" confirmatory holes may be required.

CONCLUSIONS.

It is considered that the mine would respond favourably to a more vigorous campaign of development and exploration than has been attempted in the past. To implement the full programme of work suggested would be beyond the resources of the present owners, but there is plenty of scope for a company of average size.

Promising exposures of oblique and cross lodes in the walls of present workings await immediate tackling. At least one or two of these could turn out to be new ore bodies.

Equipment is urgently needed to cope with the heavy flow of water from the bottom, No. 3, level to enable mining operations to proceed further south.

REPORT ON REPUTED TITANIUM DEPOSIT ON THE COOLGARDIE-NORSEMAN ROAD, 3½ MILES SOUTH-WEST OF HIGGINSVILLE.

By S. A. Tomich, B.Sc.

As the result of publicity given to a sample of titaniferous iron ore containing 40% TiO_2, an examination was made of the area alleged to be the site of a deposit of the material.

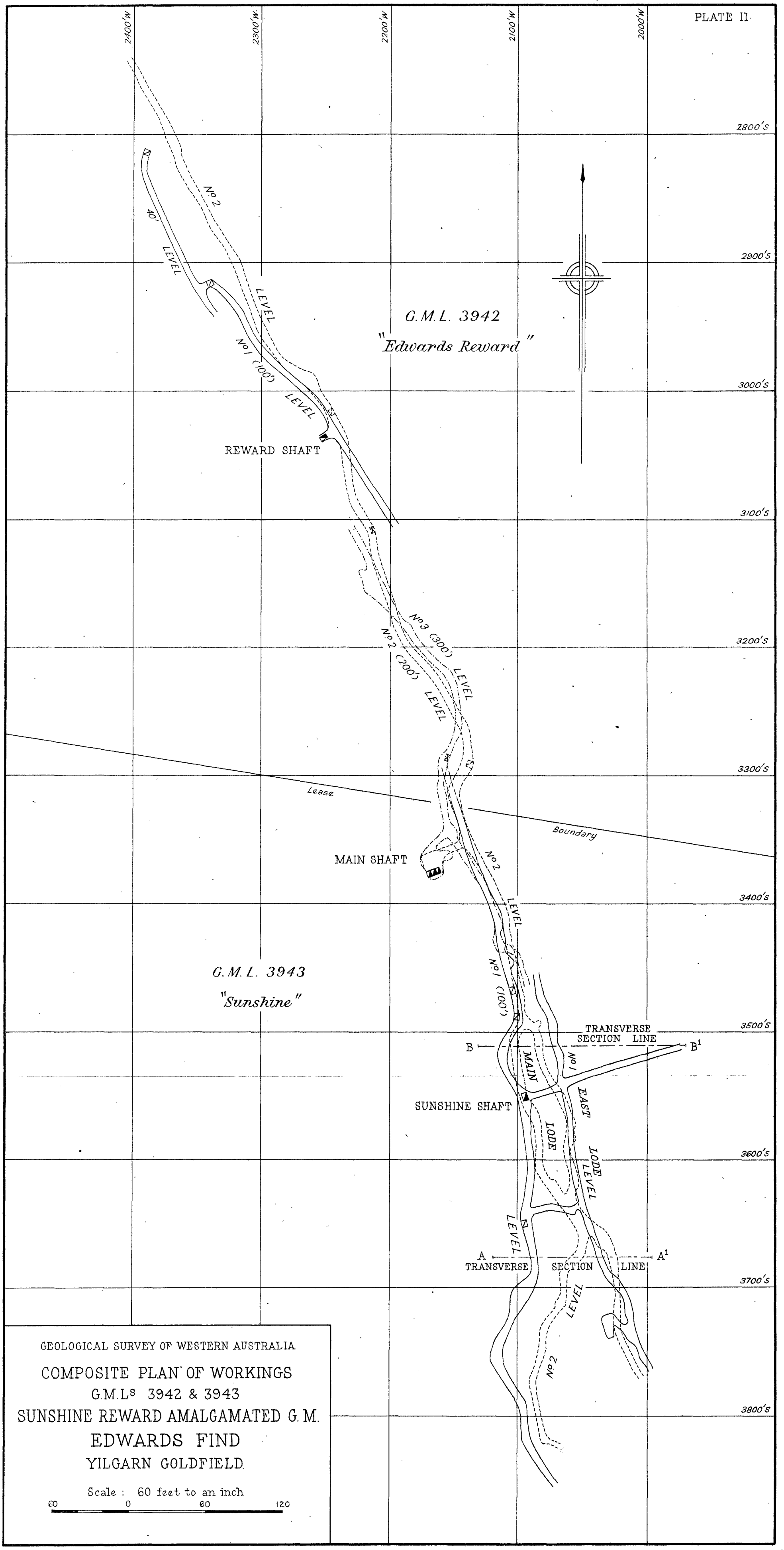
According to information supplied by the Mining Registrar at Coolgardie, the original "discovery" is situated 3½ miles from a position opposite the Higginsville railway station along the road to Norseman. The distance from Coolgardie is 72½ miles by motor car.

A number of prospecting areas, each of 24 acres, have been pegged straddling the road. Topographic features embraced are two hills, one of them rather prominent, connected by a saddle. Only a few corner pegs were observed, but it appears that some of the P.A.'s must be on the surrounding flat, soil-covered country.

The hills, which doubtless are included in the main prospecting area, are composed of ferruginous laterite gravel, in part pisolitic—much the same material as can be found on most laterite hills of the goldfields. At the time of the visit (19/2/1953) the only signs of prospecting activity were recent car tracks and remains of camp fires by the roadside. No excavations were observed other than gravel pits from which road-making material has been produced in the past.

Road cuttings indicate that the rock underlying the laterite capping may be either a bleached, fine-grained greenstone or porphyry (?), highly oxidised. This is not a suitable environment for the occurrence of a titanium mineral such as ilmenite, FeO. TiO_2, deposits of which usually are found as segregations in basic and ultra-basic igneous rocks.

PLATE II



GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

COMPOSITE PLAN OF WORKINGS

G.M.Ls 3942 & 3943

SUNSHINE REWARD AMALGAMATED G. M.

EDWARDS FIND

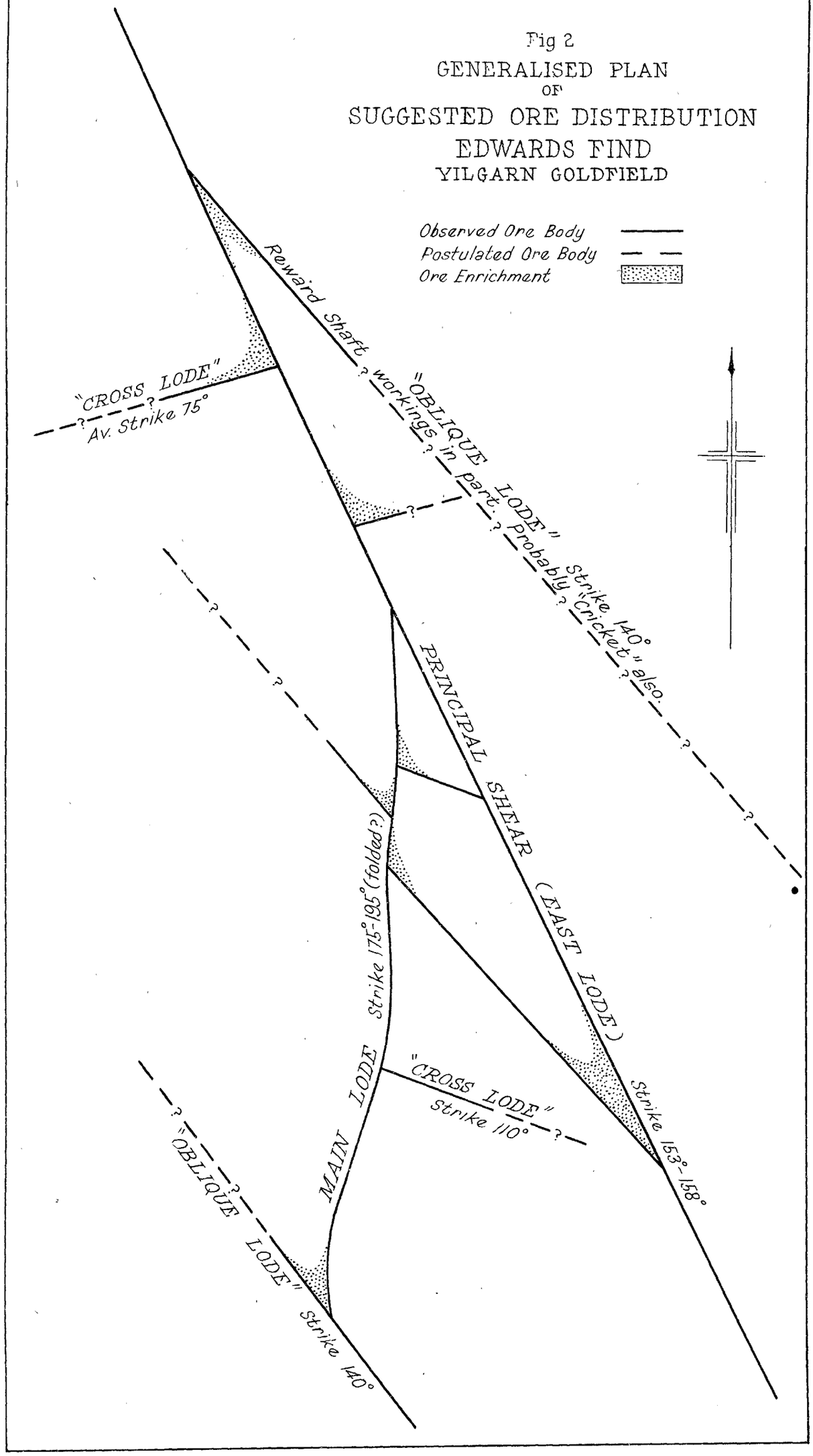
YILGARN GOLDFIELD

Scale : 60 feet to an inch

60 0 60 120

Fig 2

GENERALISED PLAN
OF
SUGGESTED ORE DISTRIBUTION
EDWARDS FIND
YILGARN GOLDFIELD



The original sample submitted for analysis is described by the Government Chemical Laboratories as an "exceedingly fine-grained, brownish black rock consisting mainly of oxides of iron and titanium, with a little quartz and a small quantity of manganese oxide". The quartz is in small scattered grains. A secondary origin is suggested by the appearance of the rock. It is impossible to ascertain the source of the titanium. Nothing like the specimen was observed in the field.

Other samples have been sent to the Kalgoorlie School of Mines. These appear merely to be highly ferruginous laterite, the iron being mostly in the form of limonite and some hematite.

Conclusion.

The sample with the abnormal titanium content must have come from a locality other than the above. It is an unusual and interesting rock, but its exact location cannot be determined.

REPORT ON PARINGA WHEAL FORTUNE LEAD MINE, NORTHAMPTON, W.A.

by S. A. Tomich, B.S.c.

Introduction.

This mine is under the joint ownership of the Paringa Mining and Exploration Company, which holds a 60% interest, and private parties, which share the remaining 40%.

Owing to unwillingness on the part of the Paringa representative to secure professional geological advice, it was deemed advisable by the Geological Survey that an examination be made to obtain information about the nature of the deposit which otherwise might never be recorded. Accordingly the writer was assigned to the task.

Formerly known as the Wheal Fortune Extended the mine is situated three miles West of Northampton on Victoria Location 436, and is freehold property under Imperial grant. Adjoining it on the West and south-west is the old Wheal Fortune mine property, also freehold, which was a prolific producer of copper and lead when first opened up. Of this no plans exist, but the main shaft is reputed to be 300 feet in depth with a level some 500 feet in length[1]. It has been worked for 85 years, and despite the prevailing high prices for base metals no attempt has been made to reopen the mine.

Access.

A very rough road over hilly country connects the property with the township of Northampton, which is 31 miles North of the port of Geraldton.

The mine lies in a gully and water gravitates to it a short distance from a nearby well.

General and Structural Geology.

Actually not a great deal is known about the structural set-up of the Northampton district. Maitland[2] states in a general way that the basement rocks consist of granites, gneisses, mica schists, quartz schists, etc., intersected by pegmatites. These are presumed to be all Pre-Cambrian age, probably Archaeozoic. Intruding this complex is a large number of remarkably persistent basic dykes with uniform north-easterly trend. Many lead and/or copper lodes occur along dyke contacts. There are also quite a number that are not intimately associated with dyke.

These rocks are overlain by a series of sub-horizontal shallow water sediments of Jurassic age, which form prominent tablelands.

Although the mines are small and scattered they are numerous. Many are abandoned, but some are being worked at present. There is no idea as to how the deposits may fit into the regional framework. The Anglo-Westralian company is believed to have completed a comprehensive regional survey of the district, but its findings are not yet for publication. Dr. K. Berliat[3] of the Geological Survey recently made a general inspection of all the active mines with a view to collecting length, breadth and depth data. Time did not permit him to undertake any detailed geological studies.

Average strike of the majority of the metalliferous deposits is north-east, although the mining belts have roughly a meridional orientation. What the reason is must remain purely speculative, in the light of present lack of geological information.

The greatest intensity of mineralisation, as inferred from the number of old workings, is centred around Northampton itself. According to Maitland's[4] map of the area a few lodes strike north-south, whilst there is at least one cross lode shown. Apparently there is no concentration of mineralisation at junctions of lodes striking in different directions, and, as individual ore bodies are commonly narrow the mines have been characteristically small. No deposit capable of being worked on a large scale has been yet discovered.

Mine Geology.

The country rock is a massive garnetiferous gneiss, of probable sedimentary origin, in which the direction of gneissosity is not readily discerned underground. Outcrops in the vicinity of the mine indicate a North-North-West strike and a dip of 45° to the East, but the rock is still not conspicuously foliated.

Pegmatites with defined walls, and undoubtedly intrusive, occur. There appears to be also some evidence of pegmatisation of gneiss. Narrow pegmatite veinlets, numerous in some sections, show ptygmatic folding in surface exposures.

Pegmatitic material can be observed underground in the walls of drives and stopes. With few exceptions it is not possible to delineate the attitude of this material. Rather it appears that an irregular incipient pegmatisation of country rock has taken place—portions of the gneiss give way to segregations, variable in size, of either quartz or felspar alone or in combination.

The ore-body occurs along a strong zone of closely spaced shears with an over-all North-East strike and a dip to the South-East ranging between 70° and 88°. Within the zone of shearing ore is found on shears of N. 40° E. and N. 30° E. strikes, in a type of echelon or link arrangement. Another prominent set in a N. 50° E. direction carries little ore as a rule and, although pre-mineral, appears to fault ore on the other strikes. Such is the story obtained from level mapping, but in the stope the reverse condition was observed. There rich ore on N. 50° E. strike turned along a N. 40° E. shear which was barren where it came out of the stope wall. The full story will only be revealed as mining proceeds. Owing to the closeness in strike this mutual interplay of shears has little adverse effect on stoping operations, but development and exploration may require close attention.

Virtually only one lead ore-body has been exploited so far. However there are parallel and branching seams in the South end of the working level, where there is also a prominent though barren cross shear.

About 120 feet West of the main shear zone is a parallel shear carrying some quartz and pegmatitic material and moderately mineralised with pyrite, chalcopyrite and zinc blende.

No conclusive structural or other evidence was obtained in the course of underground mapping to enable the plunge of the ore shoot(s) to be determined, although a probable Southerly plunge is indicated on the longitudinal projection.

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[1] Wilson, R. C., 1926. The Northampton Mineral Field.

[2] Maitland, A. Gibb, 1903: W.A. Geological Survey Bulletin No. 9. (The Geological Features and Mineral Resources of Northampton.)

[3] Berliat, K. 1952. Report on Northampton Mineral Field. G.S.W.A. File.

[4] op. cit.

Ore Characteristics.

The ore consists of fairly coarse cubical galena in a gangue of white granular quartz. In places the galena seems to pepper the quartz. Seams and bunches of practically pure galena occur in the richer sections. Occasionally small patches of brown zinc blende are observed, and a very minor amount of chalcopyrite is also present scattered through the galena.

Ore varies in width from a few inches to an observed maximum of five feet, with an average of 2½ to three feet. It is not distinctively banded nor conspicuously vuggy. The walls are not everywhere sharply demarcated, as in places stringers of galena make out on either side.

The richest sections are said to be found near pegmatite contacts, but good grade ore is also obtained where there is no pegmatite.

No pronounced alteration of wall rock was observed, although the development of clayey material may be an accompaniment of ore formation rather than be due to circulation of ground waters.

Mining at deeper horizons will help to clarify this point.

Extent of Underground Workings.

Galena ore of varying grade and width has been opened up for a length of 660 feet on the present bottom level, 174 feet from the surface. Stoping length is 400 feet.

Mining.

Owing to the presence of strong puggy shears in the ore body stope walls are weak, necessitating the use of fill. A flat back cut and fill system of stoping is in use, with ore passes at 25 feet intervals. Sand-reject from the mill is used for filling stopes.

Production.

Figures supplied by the management show that the recent average rate of production has been of the order of 900 tons of ore per period of four weeks, yielding 163 tons of 75 per cent. lead concentrates with a little silver. Included in the average figures is one period of very low yield. On several occasions production has reached the 1,000 ton mark. The intention is to improve on this figure in the near future.

Up to date the mine has milled 14,640 tons of ore for 2,383 tons of lead concentrates.

Ore reserves are quoted as 28,000 tons at a grade of 14.2% Pb.

Recommendations.

Exploration along the strike in both directions is recommended. An added incentive in the South-Westerly direction is provided by the presence of the old Wheal Fortune workings, which probably lie in the same shear zone or perhaps a parallel one. The presence of water in that mine constitutes a mining hazard.

Depth exploration is certainly warranted and strongly recommended. Faults may be encountered, although the ore-body so far has been free from faulting.

A mineralised shear about 110 feet West of the main body, exposed in the cross-cut connecting with No. 2 surface winze, merits investigation. Although galena is not showing there is present some chalcopyrite and zinc blende, and it should be opened up.

Ore on cross strike has not been revealed but the structures exist. Their possibilities ought not to be overlooked.

Lateral prospecting is to be regarded as a routine procedure, though not of immediate priority.

As the ore body is somewhat lenticular in habit temporary diminutions in width are to be expected in driving. Another characteristic requiring attention is the tendency of ore to make from one shear to another of slightly different strike in the same system. A loss of ore in driving should be the signal for lateral investigation, as appears to be necessary in the North-East end of the 174 feet level. Temporary set-backs of this nature are the norm in mining and ought not to be taken necessarily as definite proof that there is no more ore in a certain section.

Conclusions.

This mine, though not a large one, has excellent prospects so long as the price for lead remains high. The intention of opening up another level off the new vertical main shaft is sound. It will enable improved mining methods to be effected.

A REPORT ON A MANGANESE DEPOSIT ON M.L.22T IN TEMPORARY RESERVE 1225H. NEAR LAVERTON, W.A.

Approximate Latitude 28° 47′ S.
Approximate Longitude 122° 30′ E.

By S. A. Tomich, B.Sc.

Introduction.

The Manganese deposit occurs a little over twelve miles in a direct line running S. 30° E. from Laverton. The nearest good road runs in a south-easterly direction to Burtville. From a position on this road eleven miles from Laverton the manganese lease is reached by a track on an average south-south-westerly bearing for a distance of somewhat over four miles. This is the only feasible means of access. Several other tracks connect with Laverton, notably one through Euro to Jerusalem, but none of these are recommended for use.

A 6-acre lease, M.L.22T, has been taken up in Temporary Reserve 1225H. The reserve was originally of 300 acres and is believed to have been regranted recently. As it has not yet been surveyed its position as shown in Plate IV is only approximate.

A geological survey of the Mount Margaret Goldfield, embracing the area under investigation, was undertaken during the years 1937 to 1941. The occurrence of manganese was not noted, which is not surprising as it is hardly likely that a deposit of this nature would be stumbled upon in the course of a regional survey, without a large element of luck. Soon after its discovery the deposit was reported on by Lord and de la Hunty in the Report of the Geological Survey for 1948. At the time of their examination there were no workings apart from some surface "scratching." Costeans and, particularly, the test holes sunk since then have altered the picture appreciably.

Location and Excavations.

Manganese ore has been found cropping out on the N.E. slope of a rounded ridge which rises about 30-35 feet above the level of surrounding soil-covered country. Vegetation in the district is sparse and consists mainly of mulga, with occasionally blue-bush and kurrajong. Bush has been cleared from the site of the manganese outcrop and the clearing roughly delineates the outline of the ore body, as shown in Plate V.

About half of the present-exposed outcrop was originally covered by reddish soil and rubble, to a depth of 12 to 18 inches, which has been stripped exposing manganese ore in situ. A number of costeans and shafts have been put in the lower portion of the deposit, the greatest depth from the surface being 17½ feet in Shaft A. See Plate VI.

PLATE III

49,500'E 49,600'E 49,700'E 49,800'E 49,900'E 50,000'E

49,800'N 49,700'N 49,600'N 49,500'N 49,400'N 49,300'N

OLD MAIN SHAFT (Underlay)

Reputed nc ore only shear

Fall

85°

Sump

stoped

Open cut

85°

88°

arid

No 1 Pass

Timbered

Pegmatitic material

Pegmatitic material in wall

65°

No 1 Surface Winze (Underlay)

85°

One appears faulted by barren shear

A little galena

75°

75°

1" scattered quartz, galena sphalanite

Galena on wall

65°

Fine-grained felsitic-rock, maybe dyke (?)

80°

No 2 Pass

Winze 50' and

174' LEVEL

staining

D.D. Hole 339 (No ore) Water

18" Quartz and pegmatitic material and some pyrite, chalcopyrite, and zinc blende

Wall

88°

Slight galena and chalcopyrite and pegmatitic material

No 2 Surface Winze

Puggy shear

75°

70°

Pegmatite (Av. 6")

55°

60°

Some Galena and chalcopyrite

70°

Timbered

copper

80°

Irregular pegmatitic material

88°

Prominent puggy shear

green

NEW MAIN SHAFT (Vertical)

Ore Bin

60°

12"

85°

Prominent puggy shear (No ore)

stoped

Abundant

Barren shear

75°

No 3 Pass

85° 6"–9"

85° 3"–9"

Timbered not

80°

12"

75°

75°

6"

Prominent barren Cross shear

S.W. No 3 Pass No 2 Surface Winze NEW MAIN SHAFT No 2 pass No 1 Surface Winze No 1 pass OLD MAIN SHAFT N.E.

71' LEVEL

174' LEVEL

100' 200' 300'

— REFERENCE —

- Shear with ore (80°)
- Barren shear (80°)
- Pegmatite
- Main Shaft
- Accessible shaft or pass
- Head of winze
- Foot of rise or winze
- Stoped

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

GEOLOGICAL PLAN AND LONGITUDINAL PROJECTION OF PARINGA WHEAL FORTUNE LEAD MINE

NORTHAMPTON VIC. LOC. 436

Scale 60 feet – 1in

60 0 60 120

Survey plans supplied by Management.
Geology by S. A. Tomich, March 1953

Geology.

The ridge on which manganese occurs is composed mainly of ferruginous laterite or limonite boulders and red clay soil. No ore was observed on, or near, the top of the ridge. The nature of the underlying rock can only be guessed at.

More or less surrounding the lower portion of the ore body are scattered boulders of brownish massive "jasper," or jasperoid, with pronounced conchoidal fracture. A bed of gray "jasper", with approximately meridional trend, occurs a short distance from the south-east corner of the main manganese deposit. The same kind of rock can be observed cropping out in places both to the north and south of the above ridge.

The "jasper" is not banded or laminated and the writer, at present, is loth to assign it to the jaspilite formations which are prevalent in the Laverton district.

Source of the manganese remains a mystery.

Ore Bodies.

The ore appears to comprise mostly dense black psilomelane with some pyrolusite, and is usually massive, hard and heavy. Occasionally patches of pisolitic and gravel-like material with high iron content are observed near the surface. Concentric structure is sometimes seen, in which rings of manganese occur around a limonitic core. Thin seams of manganese also occupy fractures in limonite. There is other evidence of irregular replacement of ferruginous material by manganese. On the whole, though, the ore appears fairly uniform and massive. In the main body manganese ore gives way, on the margins, to manganiferous ironstone with perhaps 5% manganese.

The best ore in appearance is towards the bottom of the deeper shafts. To what depth ore will extend cannot be estimated, but there is certainly no sign of weakening yet at the bottom of shafts A and C, which are the deepest of the excavations. It is considered very likely that a vertical six ft. machine drill hole in the bottom of shaft C is, as reputed to be, still in manganese ore.

Vughs occur in the ore, sometimes lined with a layer of white, sugary quartz(?) They are not large and probably occupy only a very small percentage of the total volume.

The relict pisolitic structure and other replacement features already mentioned indicate a secondary origin for the manganese ore, but there is no visible horizontal or sub-horizontal stratification. Nor is there any sign of layers cropping out on the other (western) side of the hill.

Mention can be made here of another manganese body on a low rise between a quarter and half of a mile away in a direction S. 35° W. from the above. This crops out at intervals over a length of nearly 500 feet and a width of 25 feet, and it also is closely associated with "jasper" on the east side. There might be a greater extent of manganese here beneath the surrounding soil cover, which can be easily confirmed by a little costeaning. The surface of the soil at quite a few places in the vicinity of the outcrop has the characteristic bluish bloom, which does not necessarily imply the existence of underlying manganese but which is a useful prospecting guide.

The latter occurrence, with the "jasper" association, raises the question as to whether there may not be a bed of manganese tilted like other formations in the area and extending, with breaks, for quite some distance. In support is the presence of isolated small outcrops of manganese in the fairly flat country to the north of the main deposit.

On the other hand, the obvious secondary nature of the ore where examined in situ lends colour to the conception of a rather flat deposit of quite some thickness and unknown lateral extent, at least in certain directions, under a cover of soil.

The weight of evidence seems to be in favour of a secondary origin for the manganese.

This question cannot be definitely resolved until more exploration is done or excavation of ore is in progress, but naturally its early solution will have a profound effect on the nature of ore-breaking operations and future prospecting. In either case, in the writer's opinion, the deposit possesses great potential, even under admittedly rather meagre evidence.

Sampling.

The following is a list of samples taken and the results of analyses carried out by the Government Chemical Laboratories. Reference to Plate VI will show the position of samples in the ore body.

SHAFT SAMPLES.

Sample No.	Location.		Depth.	Per cent. Metallic Manganese. Mn.	Per cent. Metallic Iron. Fe.	Per cent. Insolubles.
	Shaft.	Wall.				
			ft.			
M1 + M3	C	South	0— 6	42·37	7·92	6·36
M2 + M4	C	East	0— 6	46·04	8·48	5·58
M5 + M7	C	South	6—12	43·45	12·11	5·23
M6 + M8	C	East	6—12	40·99	13·61	6·86
M29	C	South	12—14½	45·57	12·00	3·59
Weighted Average of samples in Shaft C				43·62	10·78	5·59
M9 + M11	D	West	0— 6	27·41	24·41	9·78
M10 + M12	D	South	0— 6	43·18	14·46	3·13
M13	D	West	6— 9	38·37	15·47	8·49
M14	D	South	6— 8	34·81	17·05	7·88
Weighted Average of samples in Shaft D				35·58	18·38	7·04
M15 + M17	B	East	0— 6	8·40	47·32	7·60
M16 + M18	B	South	0— 6	36·54	18·22	5·54
Weighted Average of samples in Shaft B				22·47	32·77	6·57
M19 + M21	A	East	0— 6	31·44	21·42	7·49
M20 + M22	A	South	0— 6	43·81	9·83	5·82
M23 + M25	A	East	6—12	46·78	9·05	5·16
M24 + M26	A	South	6—12	43·40	11·89	5·10
M27	A	East	12—16	45·34	11·28	2·91
M28	A	South	12—16	42·15	14·55	2·78
Weighted Average of samples in Shaft A				41·96	13·02	5·09
Weighted Average of all Shaft Samples				38·66	15·97	5·83

SURFACE SAMPLES.

Sample No.	Location.	Width.	Per cent. Metallic Manganese. Mn.	Per cent. Metallic Iron. Fe.	Per cent. Insolubles.
		ft.			
M30	No. 1 Costean	E.—10	22·51	32·73	5·48
M31	do.	10—20	31·31	22·29	5·79
M32	do.	20—30	21·90	33·09	6·01
M33	No. 2 Costean	E.—10	37·39	18·43	3·10
M34	do.	10—20	31·02	25·52	4·55
M35	do.	20—30	32·95	23·79	4·59
M36	No. 3 Costean	E.—10	42·61	13·98	3·46
M37	do.	10—20	34·64	19·37	5·67
M38	No. 4 Costean	E.—10	31·99	23·70	3·33
M39	do.	10—20	35·44	19·49	4·61
M40	do.	20—30	31·43	20·55	8·14
M41	No. 4A Costean	E.—10	36·34	19·20	3·98
M42	No. 6 Costean	E.—14	40·48	14·43	3·98

MISCELLANEOUS SAMPLES.

Sample No.	Location.	Per cent. Metallic Manganese. Mn.	Per cent. Metallic Iron. Fe.	Per cent. Insolubles.
M43	Bulk of fines from Shaft A ore dump	38·09	17·19	4·06
M44	Bulk of fines from Shaft C ore dump	42·65	11·06	6·08
M45	Outcrop about ½ mile S.W. of main deposit	49·42	9·57	2·55

Obviously the most reliable samples cut are those from the various shafts, of which the average manganese content is 38.66 per cent. The costeans were sampled over large widths merely to confirm the presence of sufficient manganese, as only the first few top inches of ore were exposed in each case. Bulk samples of broken ore probably provide the best means of assessing grade, although those taken from shafts A and C ore dumps were not all-embracing as only the fines were collected.

Tonnage Estimates.

All the shafts are in manganese ore throughout, although the ore in shaft B is patchy in appearance.

(i) The surface area of virtually proved ore, see Plate VI is 11,700 square feet; at nine cubic feet per long ton this is equivalent to 1,300 tons per vertical foot.

Assuming an average depth of ore of 16 feet, the quantity of *ore proved* is thus

20,800 tons

which is a very conservative figure for the tonnage available, as the bottom of the deposit has not yet been plumbed.

Judging by appearances in the bottom of the deepest shafts it is not too risky to assume an additional three feet depth of ore which increases the estimate by 3,900 tons.

(ii) In addition, there is a still larger area of untested outcrop ore (Plate VI), the surface area of which, excluding the small exposure in the S.W. corner of the clearing, amounts to 17,100 square feet. This is equivalent to 1,900 tons per vertical foot.

An average (conservative) depth of ore of only eight feet gives a figure of

15,200 tons of *untested ore.*

The deposit is thus estimated to be capable of yielding 3,200 tons of manganese ore per vertical foot. The total amount of ore available, on the basis of present exposures plus reasonable assumptions, is little short of 40,000 tons. It would not surprise if the actual tonnage proves to be considerably more than this figure.

Some of the assumptions made may be liable to criticism, but the writer believes they are entirely justified and that the estimates err well on the side of conservatism.

Recommendations.

Before any attempt be made to quarry the deposit it is recommended that shaft A be sunk further to determine the depth to which ore extends. Light might also be thrown on the actual nature of the ore body, enabling a systematic programme of ore breaking to be instituted from the outset. The deposit and the location lend themselves to a method of quarrying with power-driven shovels, but the details of approach and dimensions of excavation would be more wisely left until after shaft A is sunk, even if it were to reach 50 feet in depth.

The southern outcrop is also worthy of attention. Some preliminary costeaning, beyond the exposed lateral limits at least, is certainly warranted at the present time. Test holes could be sunk later.

It is noted that the sample with the highest percentage of manganese was taken from this outcrop.

Prospecting for further manganese deposits in the district is recommended.

Conclusions.

The proposed lifting by the Australian Government of the export embargo on manganese will make this deposit an attractive proposition, as the price offered by American buyers apparently is much in excess of that offered by the Broken Hill Proprietary Coy., Ltd., plus the added attraction of freedom from penalties for iron content, etc. The price quoted by B.H.P. at the present time is more generous than hitherto, but there is still a penalty on iron in excess of 10 per cent.

It appears from the exposures already made that the main body will yield some ore of battery grade, if selection were practised.

Owing to closeness to a railhead, road haulage costs will not be too high. The railway connects direct with the port of Fremantle, a distance of 600 miles.

SUMMARY REPORT ON THE GEOLOGY OF PORTION OF THE MT. IDA DISTRICT, NORTH COOLGARDIE GOLDFIELD.

By S. A. TOMICH, B.Sc.

Introduction.

This report summarises the findings of a geological examination of the Mount Ida mining district in the North Coolgardie Goldfield. Use was made of aerial photographs, supplemented by chain and compass traverses and plane table surveys in the vicinity of mining groups.

Approximately 100 square miles of country around the Timoni mine was examined. The present Copperfield township has been built on the mine leases and is somewhat over 60 miles to the north-west of Menzies, the nearest rail centre.

The area investigated, though providing useful information of some economic value, is too small to give a really reliable picture of broad structures and geological relationships, owing to paucity of outcrops in some critical areas. In the hilly eastern greenstone section outcrops are excellent as a rule, but elsewhere large tracts of flat to slightly undulating country are almost completely covered by alluvium or soil and ironstone rubble. To the west of the Timoni mine the percentage of rocks outcropping would not be 10 per cent.

Granite country usually provides fair to good outcrops and grows a distinctive mulga vegetation.

Topography.

The monotony of flat to slightly undulating country is relieved in certain sections by fairly prominent hills and ridges. Greenstone hills are uniformly round, and reach up to 100 feet in height above the level of surrounding country. Prominent razor-back ridges are formed by jaspilites.

Immediately south of the Timoni mine there are several break-aways standing out in bold relief which form part of a distinct topographic feature with an average north-west trend. This is a mile-wide zone of round lateritic hills and sharp break-aways forming ampitheatre-like valleys, bounded on the west by a natural divide of steep cliffs. Numerous drainage channels run north and north-east from the divide.

Low hills of large areal extent are formed by granite, though they are not so large or bare as the granite rock outcrops in other parts of the West Australian goldfields or the wheatbelt.

The most prominent topographic feature is a high range of scarp-like hills of ferruginous quartzite, which forms approximately the western boundary of the area examined.

General Geology.

Viewed broadly the district is one of greenstones (clastic and igneous), basic intrusives, porphyries, jaspilites and erosion sediments "intruded" by three more-or-less separate masses of granite. The interbedded rock formations are steeply inclined and strongly folded, and exhibit a high degree

PLATE IV

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

— PLAN OF —

MANGANESE DEPOSIT

NEAR LAVERTON, W.A.

By

S.A. Tomich, April, 1953

LOCATION AND GEOLOGICAL SETTING

— Scale : 1 mile to an inch —

General geology after Hobson, Miles and Matheson - G.S.W.A. Bulletin 103.

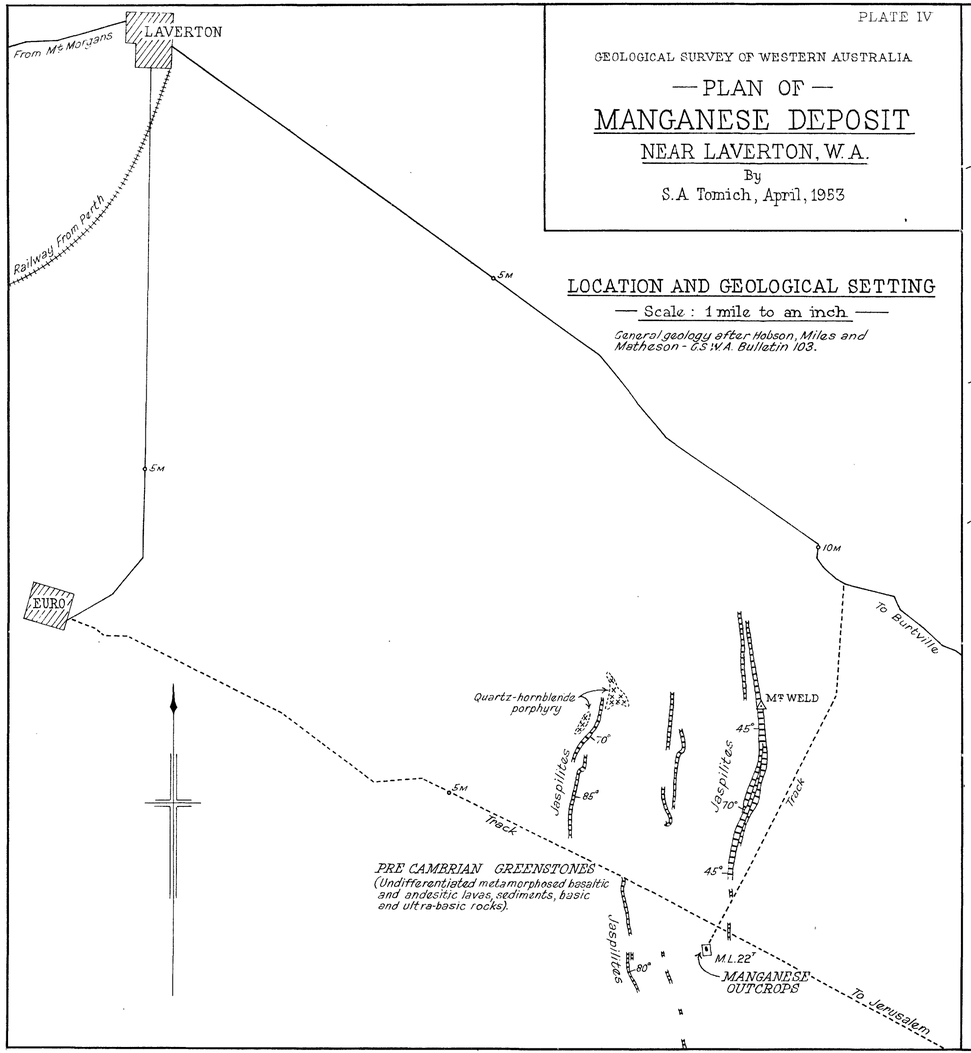


PLATE V

RELATION OF DEPOSIT TO TOPOGRAPHY

— Scale: 2 chains to an inch —

Form Lines ——— – – –

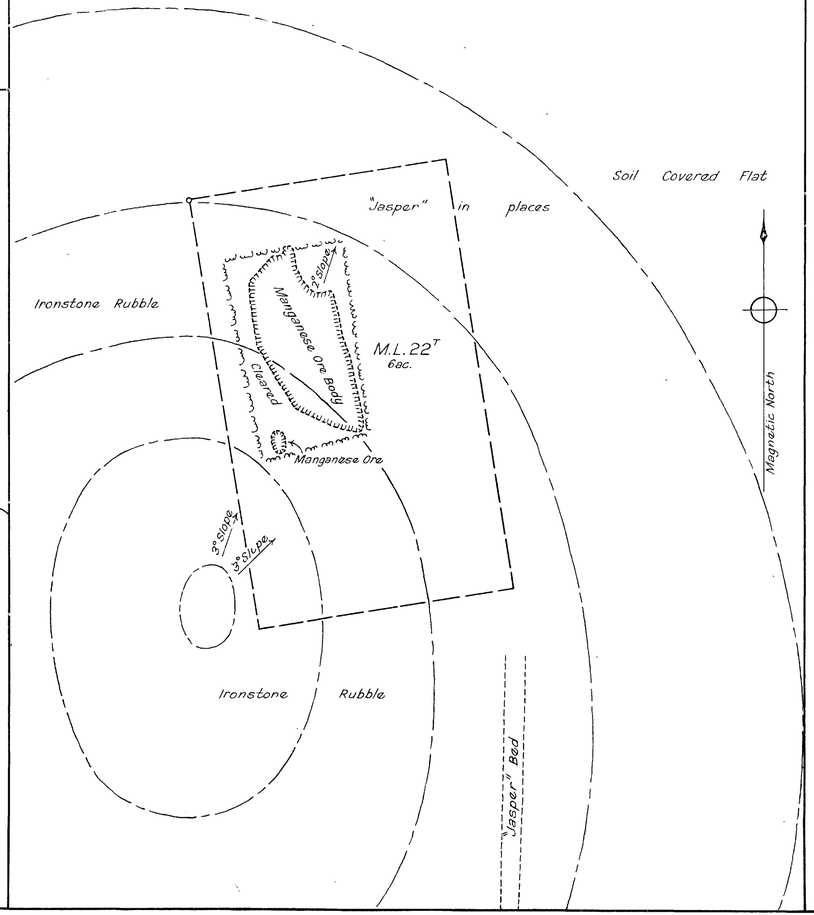
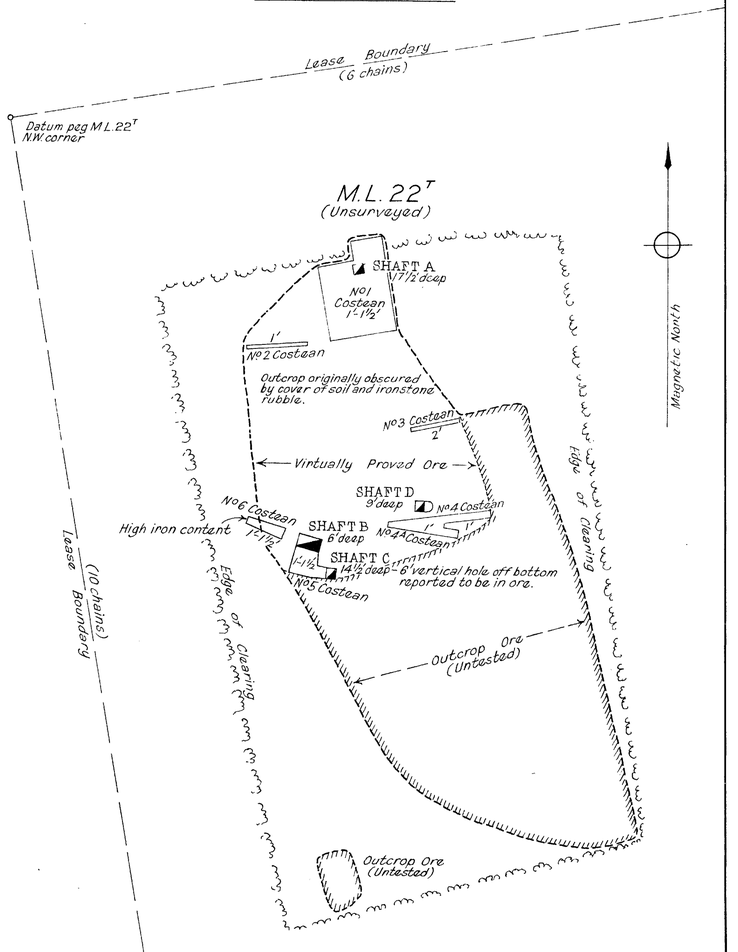


PLATE VI

ORE LIMITS AND TEST HOLES

— Scale : 40 feet to an inch —



of metamorphism, although the metamorphic grade varies, raising the question as to whether two different Systems of rocks are not involved. This point cannot be definitely determined in the field.

A.—The oldest rocks are a series of meta-sedimentary and basic flows or tuffs of high metamorphic grade, akin to the rocks of the Yilgarn System. Garnet schists, andalusite and staurolite schists, spotted schists, banded quartzite (or "jasper"), green slaty schists and quartz-hornblende gneiss are represented, also bands of foliated felsite which may be metamorphosed acid sediments. Widths of individual sections are comparatively narrow, with some rapid variations across the strike of beds. Basic to ultra-basic rocks of either flow or tuffaceous origin comprise actinolite schist, talc and chlorite schists, soapstones, etc.

Interbedded and folded with this series is a wide band of a unique, very coarse-grained hornblende-felspar rock, in which individual felspar crystals reach 1½" in size. It is the only massive member in an otherwise conspicuously schistose series, and there is some doubt about its origin although on field relationships it is considered to be an igneous sill. As a competent member it has developed in it fracture patterns and is intruded by basic dykes of doleritic or gabbroid type with N.E. to N.N.E. trend. These basic intrusives, which may even have gone beyond the epidiorite stage, occur amongst the greenstone schists also, but without the above evidence their dyke character would be scarcely suspected there.

This series of metamorphic rocks strikes between north and north-north-west and lies sandwiched between the central and eastern granites, the influence of which may account for the high degree of metamorphism. Away from the granites the sediments are less highly metamorphosed, but owing to extensive soil cover in the intervening country it cannot be determined positively whether they are the same beds or those of another series.

Two varieties of basic intrusive are recognised in the field, on colour and grain size, although they may prove variants of the one type. Intrusives are commonly massive, but show evidence of shearing, and weather into rectangular or rhomb-shaped blocks, greenish to blackish in colour when not decomposed.

Close to the eastern granite there are found both narrow and wide bands of felspar porphyry and quartz-felspar porphyry running parallel to the greenstone formations. These are undoubted granitic derivatives.

All the known auriferous deposits occur in this series of greenstone schists.

B.—There occurs another series of interbedded igneous greenstones and sediments, strongly folded along N.W.-N.N.W. axes.

The greenstones are thick flows or sills of massive amphibolite with fine-grained and occasionally ophitic margins, and are coarsely actinolitic in the centre. Margins are also vesicular in places but pillow structure is not seen. Fine-grained sections weather into small angular fragments, while weathering of the coarser-grained portions results in large rounded or sub-rounded boulders. In places these basic rocks are not unlike the above-mentioned intrusive dykes in appearance and might even prove related to them.

Interbedded with these greenstones are comparatively thin bands of sediments of shaley type, white cherty beds, dark laminated cherts, slaty quartzites and jaspilites, felsitic slates, and limestone. The sedimentary members of this series are Kalgoorlie-type in appearance, and exhibit a grade of metamorphism distinctly lower than that of the above series.

Intricate drag folding with pronounced southerly plunge is indicated by the jaspilite members, which are more ferruginous and less massive than their counterpart in the more highly metamorphosed series.

Granites.

The central and eastern granites are concordant, foliated or gneissic types in which the foliation is parallel to that of the enclosing greenstones. This is particularly evident in the southern, closed, portion of the central granite in which the foliation swings in strike to conform with the contact. Away from the margins this granite becomes progressively less gneissic and eventually becomes a massive, medium-grained, grey biotite granite. The margins are pinkish and coarser-grained than the centres.

Although narrow bands of greenstone schist are found included in granite there is no hybridization, as in the Southern Cross district, or any of the other evidence usually sought by proponents of granitisation. The presence of the coarse hornblende-felspar rock so close to, and apparently encircling, the central granite cannot be cited as evidence because of the greenstone schist in between and its sharp contact with it, as seen in mine dump specimens.

The western granite, unlike the others, is massive throughout and appears to be definitely discordant as it underlies and intrudes the jaspilite formations at the contact. No ore mineralisation has been found associated with this granite.

Veins of barren quartz up to 30 ft. in width occur in and near all the granites. These quartz "blows" run both transverse and almost parallel to the strike of the greenstones. Narrow transverse pegmatites and aplites, also concordant porphyries, occur in greenstone close to the contact of the eastern granite. Narrow transverse dykes of porphyry are intrusive near the western granite. A few small pegmatites have been observed in greenstone at some distance from the central granite.

Transverse Basic Dykes.

There is a number of persistent dykes with uniform E-W strike transgressing all rock formations including granite. Their outcrop is invariably marked by a conspicuous line of very large, rounded boulders. The dykes are of fresh olivine dolerite.

Laterites.

Occasional hills surmounted by blackish, highly ferruginous, pisolitic laterite occur at a number of isolated places. This is a duricrust capping of varying thickness overlying brown limonitic material which in turn usually covers decomposed greenstones and sediments. In the zone of dissected breakaways and hills immediately south of the Timoni mine brown laterite is seen in a few places to be capped by thin residual layers or fragments of the black laterite.

The laterites represent the Old Plateau which is undergoing denudation to the level of the New Plateau. Some of the residuals of erosion are buttes and mesas, equally as well formed over steeply inclined sediments as over lavas.

Breakaways with vertical cliff faces up to 25 feet high are well developed near the Timoni mine. These are composed entirely of small round to large angular fragments of decomposed medium-grained and fine-grained greenstones, meta-sediments, porphyry (?) and quartz. The irregular and ill-assorted character of the gravel and boulders indicates laying down by the action of rapid streams or even glacial action. Viewed from a position north of the mine the impression is gained of a steep scarp and dip slope with flat dip to the west. The thickness of the gravel bed is 25 feet.

CLASSIFICATION OF ROCKS FROM THE MT. IDA DISTRICT.

Age.	Description.	Remarks.
Recent to Sub-Recent	Soil, alluvium, ferruginous laterites, travertine, ferruginous creek-bed cement	
Unknown	Breakaway bed (glacial ?)	Possibly glacial character inferred from unsorted nature of gravel and boulders.
?	Fresh olivine dolerite	Post granite.
Pre-Cambrian	Acid intrusives :— Granite, gneiss, porphyries, pegmatites, aplites, quartz reefs (barren and auriferous)	Pegmatites and aplites are discordant. Porphyries are concordant but are not considered to have taken part in the folding of the enclosing rocks.
	Basic Intrusives :— Medium- and coarse-grained epidiorites and amphibolites, actinolitic amphibolites and hornblendites Extrusives (?) :— Fine-grained massive greenstones (ophitic in places)	Some definitely intrusive dykes ; others appear to be pre-folding sills.
	Erosion sediments :— Shaley types, felsitic slates, white cherts, dark cherty slates, jaspilites	Low grade of metamorphism.
	Recrystalised rocks :— Clastic greenstones (tuffs), meta-sediments and metamorphosed flows, *viz.*, quartz hornblende gneisses, slaty greenstone schists ; garnet schists, andalusite and staurolite (?) schists, quartzite and banded felsites ; talc, chlorite and actinolite schists and hornblende-felspar rock	This is the auriferous series characterised by a high grade of metamorphism which may be due to thermal effects of granite on above rocks, but more probably represents an older series akin to Yilgarn Rocks.

Structural Geology.

In this area there is sharp folding of the metamorphic rocks. The central granite occupies the core of a southerly plunging anticline with steep limbs. Folds and drag folds as well as lineation in both greenstones and granite all plunge to the south at angles varying between 30° and 40°.

Repetition of some formations, or beds, in the eastern greenstone section is probably due to isoclinal folding.

No large faults have been recognised though there is relatively small-scale faulting along the line of some transverse barren quartz veins.

Mapping of a few of the old mines of the eastern section, which are all in hornblende-felspar rock, has revealed the existence of a shear pattern which has influenced the deposition of the ore-bodies. The shears also fault the epidiorite (amphibolite?) dykes.

Economic Geology:

The major auriferous deposits are grouped on the flanks and round the nose of the central granite, and at a short distance from it. On the western side they occur in tuffs, talc schist and hornblende-felspar rock. Very steep shears nearly parallel to the granite contact have localised ore bodies in massive hornblende-felspar rock on the eastern side.

Several deposits occur in platy chloritic and actinolite schists running parallel, and close to, the contact of the eastern granite mass.

Quartz reefs transverse or oblique to the run of the country are barren. These vary in appearance from a white or milky colour, and almost sugary form, to brownish jasper-like with drusy structure. A few quartz reefs parallel to the strike of the schists have proved auriferous, including the Golden Vale laminated quartz which dips south around the plunging nose of the central granite.

Ore bodies are classified as follows:—

(a) Vein channel in greenstone tuff-quartz veins and coalescing veinlets enclosed in a biotitic schist channel parallel to the schistosity. e.g., Timoni mine.

(b) Replacement bodies (lodes) with vein quartz, accompanied by some silicification and bleaching of walls in hornblende-felspar rock. Ore shoots are formed at shear intersections.

e.g., Forest Belle, Forest Belle South Extended mines and others near the old Mt. Ida townsite. Probably also Copperfield mine.

(c) Lenticular quartz veins in highly fissile, in places contorted, talc schist. e.g., unexpected mine.

(d) Narrow quartz vein of lenticular habit emplaced along a well-defined shear in massive clastic greenstone, probably parallel to formation contact. e.g., Federation mine.

(e) Large veins of striated quartz probably parallel in strike and dip to enclosing schists. Only auriferous in parts. e.g. South Golden Vale Workings.

(f) Workings in micaceous/talcose schists and slaty sediments. e.g. North Golden Vale Workings and line a quarter of a mile to the east.

Prospecting Recommendations.

1. Between Timoni and Unexpected mines, as the ore-bodies are affected by transverse faulting.

2. South of the Unexpected mine, because of the transverse faulting.

3. North and South of the Federation line of workings on other side of transverse quartz reefs.

4. Around the nose of the central granite on the westerly continuation of the South Golden Vale line, and along the swing in strike to a north-west direction heading towards the Unexpected mine.

5. In the flat country adjoining the North Golden Vale workings for parallel and/or faulted bodies.

6. Along the Quinn Hills line and Golden Ridge line (particularly south), and also lateral search for parallel bodies.

On the Timoni mine diamond drilling east of the present bottom level (976 ft.) for the Copperfield line is recommended. Likewise the Forest Belle, Forest Belle South Extended (so-called Boudie Rat) and South Nell mines appear to be good prospects for surface diamond drilling which takes into account the plunge of the ore shoots.

General Observation.

The district is not noted for large ore-bodies, although some rich gold crushings have been obtained in the past from narrow veins of quartz. The presence of copper in some of the mines has been a handicap in treatment.

REPORT ON WATER SUPPLY, YERECOIN DISTRICT.

By K. Berliat, D.Sc.

The Problem.

Yerecoin, a small town, with school, store, and post office, is on the Clackline-Miling railway, 32 miles by road south of Miling, and 96 miles north-east of Perth, via Bindoon and New Norcia. The district has undergone settlement since 1925, and at present carries a good number of sheep and wheat farms. The main obstacle for further development is the provision of suitable and sufficient water supplies, both for the town and the various farms. Many bores and wells have been


G. S. W. A.
GENERAL GEOLOGY AND TOPOGRAPHY
OF
Mt IDA AREA
Scale: 40 chains to an inch
40 0 40 80
Compiled from geological information by S.A. Tomich, 1953, and Air Photos.
-REFERENCE-
Mining holdings existing
Mining holdings void
Assumed geological boundaries
Strike and dip of foliation
Strike and dip of bedding
Breakaways
Faults, probable
Roads and tracks
Wells
Drainage channels
Formlines
Fences
Principal point of air photos, showing run and number
Greenstone Areas
Granite Areas
Jaspilite
Quartz
MT. IDA
COPPERFIELD
TREGURTHA
OBERWYL HILL
GOLDEN RIDGE
GOLD ROCK
GOLDEN VALE
WHITE QUARTZ HILL
SPOTTED DOG HILL
LEONORA ROAD
To Leonora
State Battery
Melville Well
Alluvium
Track and fence

sunk over the past 28 years, but a good number of them have since become too salt to be of any use, or their original supplies have cut out altogether. This was particularly noticeable during the last three dry years. The position is now that water has to be carted from the remaining good wells to the town, and from farm to farm. The purpose of the writer's visit was to select, if possible, additional bore sites, both for the town and the individual farms.

Ground Water Conditions.

The whole of the district is underlain, at more or less shallow depths, by granitic rocks. The topography is predominantly flat or very broadly undulating to the east of the railway line, but generally more differentiated to the west. Clearing of the higher ground, and of catchment areas has increased the salinity of the water, and today hundreds of acres are useless through an excess of salt in the soil. This is due to the greater leaching of the soil by the increased quantity of rainfall penetrating it, and transferring the entangled salts to lower levels. In time, however, this excess salt must be removed, and a new state of balance will be established, with the result that ultimately both the quality and the quantity of the ground water will be benefited by clearing.

The Bore Sites.

In very many cases the bores and wells have been sunk in the wrong places, namely on low ground and in depressions. In selecting additional bore sites the geological principles governing the occurrence and distribution of ground water in saline country have been applied, and explained to the interested parties. According to these proved principles any, or additional supplies cannot be expected on some of the farms. Other areas are more favourable, and 23 sites have been marked on the ground. It is considered highly improbable that a town supply of at least 5,000 gallons a day will be obtained from one single well or bore.

FURTHER REPORT ON WATER SUPPLY FOR EAST KIMBERLEY CATTLE STATIONS.

By K. BERLIAT, D.Sc.

Introduction.

The first essential in the problem of ensuring the full utilisation of the land, and therefore of expanding the pastoral industry in the Kimberleys, is the provision of adequate and reliable subterranean water supplies. The urgent necessity for more extensive dependence upon the underground waters has been stressed particularly during the severe drought conditions of the last two years; but the matter is of equal importance during normal seasons, in order to rest the eaten out, and eroded country near the natural surface waters.

Following governmental approval of a scheme for increasing water points on Kimberley cattle stations, the writer was, in 1951, assigned to the task of selecting bore sites for pastoralists taking advantage of that scheme. Many of these sites have since been drilled with satisfactory results, particularly in the East Kimberleys, where interested pastoral companies kept the Geological Survey informed of the progress of their drilling operations, and submitted bore logs, together with details of supply and quality of water for each hole. However, during the writer's visit in 1951 only the most urgent requirements on the various stations could be met with, and the Geological Survey has again been requested by a number of pastoral companies, controlled by Australian Investment Agency Pty. Ltd., to give further assistance in the search for water, and in the selection of additional bore sites.

Between April 14 and May 4 the writer visited the following stations:—Spring Creek, Ord River, Nicholson, Turner, Flora Valley, Gordon Downs, Sturt Creek. The approximate positions of the proposed bore sites on these properties are indicated on the accompanying map. (Plate viii).

Lithology.

The broad geological elements of the Kimberleys, the dominating rock types and their hydrological characteristics have been described in the Annual Report of the Geological Survey for the year 1951. The area concerned in this report contains an extensive development of sub-horizontally bedded sedimentary rocks (quartzites, sandstones, shales, slates, limestones) of Nullagine age, and of lower Cambrian basaltic rocks. Limestones and sandstones of lower and middle Cambrian age respectively are well developed on Ord River Station.

Hydrological Aspects and Recommendations.

It is essential to remember that in a large region, such as the one under consideration, there are no brief generalisations applicable to the whole area. The conditions of occurrence of underground water vary with every change in geology and topography, and the choice of each new site must be governed by considerations adapted to the particular case. In this connection the importance of maintaining full and detailed records of previous bores, successes and failures, cannot be stressed too strongly. The critical review of the data obtained from previous bores has been of substantial help in selecting the new sites; but the information on record is still too meagre for a vast region like the East Kimberleys, and an unfailing success at every site can obviously not be expected under such conditions. It is possible, however, for the geologist to reduce the proportion of failures and to prevent wasteful expenditure by pointing out those areas which lack the conditions necessary for obtaining supplies.

Such areas are represented in the East Kimberleys by the vast, featureless plains, underlain at shallow depths by solid basalt. Typical examples are "Nigger Plain," and the belt of country between the Marella water hole and the Lighthouse Creek yard on Nicholson, or the country to the West of Roy Creek, and between Roy Creek and Scrubby Creek on Gordon Downs. Here the main rock body is impervious, and storage can in most cases only be effected in joint-plains and crevices. Unless there is strong evidence of fracturing down to an appreciable depth, and in the absence of volcanic agglomerates, which may act as aquifers, boring is too hazardous in this type of country. This fact has been amply proved in the East Kimberleys. In the majority of cases boring in basalt country must be confined to alluviated portions along the main drainage lines, and as closely as possible to the channels. Sites of this nature are Nos. 1, 2, 3 (Spring Creek), Nos. 8, 9 (Nicholson), No. 11 (Turner), and No. 15 (Flora Valley). Similar conditions are non-existent in the Roy Creek area, on Gordon Downs.

With the exception of two narrow belts in the North-West and South-East, the whole of Ord River Station is underlain by limestones and sandstones of lower and middle Cambrian age. These rocks have proved to be good aquifers. The same applies to the limestone and sandstone horizons which are frequently interbedded with the shales and slates of the King Leopold Group (Nullagine). In all cases, however, due attention must be paid to the local topography, and whenever possible, the sites have been selected close to the major drainage lines. All the sites on Sturt Creek, as well as Nos. 12, 13, 14 on Flora Valley are situated in rocks attributed to the King Leopold Group. Those recommended on Ord River are in the Cambrian Succession.

In concluding this report, expression is given to one remaining suggestion, concerned with the exploration of the vast black soil plains underlain by basaltic rocks. As far as geological knowledge goes, these rocks have a thickness varying between

800 feet and 3,000 feet, and are apparently composed of successive flows. It is of importance to note that the groundwater potentialities in this huge succession are unknown below a depth of approximately 600 feet. The Government Geologist (Mr. H. A. Ellis) has drawn the writer's attention to instances in parts of the Northern Territory where intraformational horizons in basalts of the same geological age yielded excellent supplies. It is reasonable to expect that similar horizons, separating successive flows, exist in the Kimberley basalts; but the elucidation of this problem calls for deep exploratory drilling, if necessary through the whole thickness of the basalt complex. Such a venture is obviously beyond the responsibilities of the individual pastoralist, and the earlier references, regarding the water possibilities in basalt country, have been made with this conception. It is strongly felt, however, that every attempt should be made in the future to utilise fully the vast, magnificent grasslands of the black soil plains. To one who is familiar with the conditions in the East Kimberleys, it is obvious that the expansion of the pastoral industry hinges to a large extent upon this problem. Exploratory boring under circumstances as outlined above, is clearly a function of the Government. The writer earnestly recommends to take action at an early date, and to sink a bore in the Antrim Plateau volcanics, in an area situated about 20 miles as the crow flies E.N.E. from Flora Valley homestead. The expenditure involved in such an undertaking is certainly negligible, when compared with the possible benefits, not only for pastoral industry, but, in the long run, for the State as a whole.

AN OUTLINE OF THE GEOLOGY OF THE COUNTRY ABOUT LINDEN, MT. MARGARET GOLDFIELD, W.A.

By K. BERLIAT, D.Sc.

CONTENTS.

Introduction.

General Information and Purpose of the Survey.

The area dealt with in this report is situated approximately between longitudes 122°20′ E. and 122°40′ E., and approximately between latitudes 29°10′ S. and 29°30′ S. It occupies roughly 500 square miles between Lake Carey in the north-east and Lake Raeside in the south-west, and forms part of Yundamindera Station.

Linden townsite can be reached from Kalgoorlie by road, either via Kanowna and Yarri (147 miles), or via Menzies, Leonora and Murrin Murrin (231 miles).

Official records show that between 1897 and 1952 the area as a whole produced 102,662 oz. of gold from 95,918 tons of ore. Some of the mines have been extremely rich.

At the present time the district is deserted, and all that remains of Linden town are a few abandoned shanties. However, operations with a view of re-opening an old mine ("The Second Fortune") were started during August, 1953, and a first parcel of ore from this mine has since been crushed at the Yarri State Battery, 43 miles south of Linden.

The area has been previously examined by C. Sydney Honman, and reported upon in G.S.W.A. Bulletin No. 73 (1917).

The ultimate object of the re-survey was to discover and explain the relationship, if any, of the geological structure to the occurrence of gold, and then to suggest other places where gold might occur, but in which it has not yet been discovered.

Field Work.

Initially two geologists, Mr. L. E. de la Hunty and the writer, comprised the field party. Geologist de la Hunty arrived in the field towards the end of April. For the first few weeks his efforts were concentrated on topographical survey work, and later on the detailed mapping (five chains to one inch) of selected mining groups. At the end of August it became necessary to withdraw Mr. de la Hunty for work elsewhere, and as a result much of the group work had to be delayed until the next field season.

Fieldwork was commenced by the writer towards the end of May, and continued to the end of November. He was responsible for the general geological investigations and for the regional mapping on a scale of 20 chains to 1 inch. The latter was carried out by all the known methods of plane table surveying.

General Description of the Area.

Generally the area can be described as flat to broadly undulating, Mulga covered country. The most striking topographical features are a number of very conspicuous, parallel jaspilite ridges, rising abruptly from the surrounding country, and running from north to south through the central part of the area. A number of less conspicuous hills and ridges consist of massive, basaltic lavas.

The central jaspilite ridges form the divide between the two main drainage basins in the area, Lake Carey and Lake Raeside. The drainage channels are fairly well defined in their upper and middle reaches, but are lost in the extensive alluvial flats adjoining the dry lakes.

The climate with its extremes of temperature between summer and winter, and during the winter between day and night, is typical of the interior of Western Australia. The average annual rainfall is 8 inches or less. Practically all of it falls during the winter months, from about the beginning of May to the beginning of October.

Acknowledgments.

The writer is indebted to Mr. H. A. Ellis, Government Geologist, for offering valuable suggestions and advice throughout the survey, and for guiding the writer's early work in the field.

The survey information supplied by Mr. de la Hunty has been of great assistance in the regional work and is here fully acknowledged.

The geological map was drafted by the Drafting Branch of the Mines Department.

Opportunity is also taken here of acknowledging the ready assistance offered by Mr. W. Smith, Manager of Yundamindera Station, during the course of the survey.

General Geology.

Classification of the Rock Types.

As a result of the year's field work the following rock classification is put forward:—

Recent to Sub-Recent.

Soil, alluvium, sand dunes, siliceous and ferruginous laterite.

PLATE VIII

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

MAP OF PORTION OF KIMBERLEY DIVISION

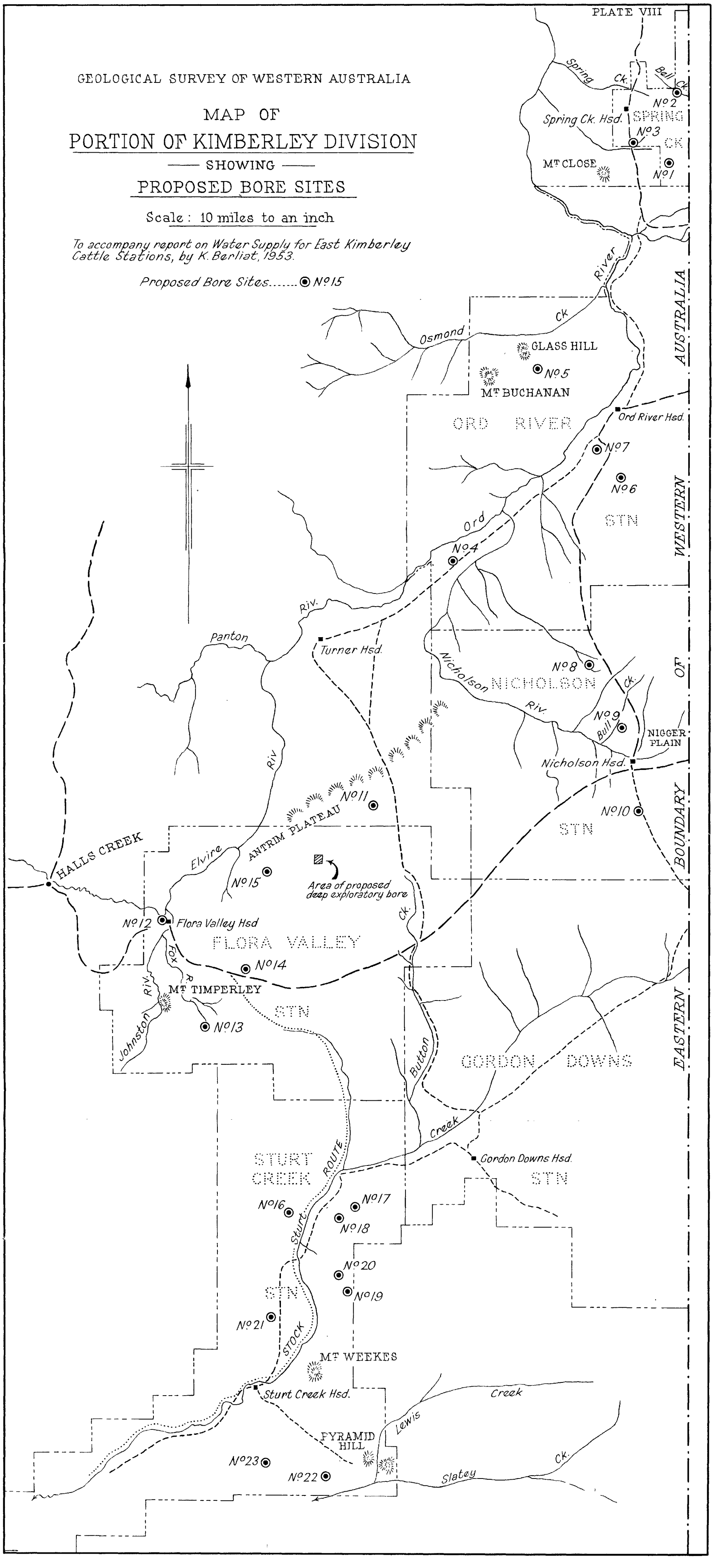
— SHOWING —

PROPOSED BORE SITES

Scale : 10 miles to an inch

To accompany report on Water Supply for East Kimberley Cattle Stations, by K. Berliat, 1953.

Proposed Bore Sites..... ⊙ *No 15*



Pre-Cambrian.

Granitic Series:—
Granite, gneiss, aplite dykes, porphyry dykes, auriferous and barren quartz reefs.

Greenstone Series:—
(a) Sedimentary phase—argillaceous and arenaceous sediments, sedimentary tuffs, jaspilites.

(b) Predominantly igneous phase—basic greenstone schists, basic lavas, ultra-basic rocks, medium and coarse grained basic intrusives.

Description of the Rock Types.

Basic Greenstone Schists.

These rocks range from light grey-green to dark green in colour, and are often remarkably fresh in appearance. They are usually fairly fine grained, and show a marked fissility or platy cleavage. Their chief mineral constituents are hornblende and intermediate or basic plagioclase. Talc schists and chlorite schists have a large development around Linden townsite, but are also met with in many other places.

The greenstone schists are found occupying flat, undifferentiated country, frequently covered by salt bush and low scrub. At the surface there are frequent nodules and scattered patches of magnesite.

The greenstone schists are almost certainly of mixed origin. Their conformability and close association with the basic lavas in the western half of the area suggests a derivation from basic volcanic rocks, but other parts may well have been derived from basic sediments. The talc-chlorite schists near Linden have been found to contain small amounts of chromite, intimately associated with magnetite. The presence of the former mineral is sufficient to justify conceding to these varieties an intrusive habit.

Basic Lavas.

These rocks are generally dense, fine grained, dark green to black basalts, characterised by a typical blocky fracture. Vesicular and amygdaloidal structures are common. The vesicles are normally stretched out in the direction of flow and filled by secondary products—mostly aggregates of feldspar, quartz and calcite.

Within the main lava belt, stretching from Eucalyptus in the north to Murphy's Well in the south, there are considerable variations in the character of the lavas. Coarse grained amphibolites are met with at a number of places east and south-east of Eucalyptus, while porphyritic layers occur about ½ mile south-west of the 12-mile post on the Yundamindera road. There is no field evidence pointing to an intrusive nature of these types; the coarse grained varieties must be considered as original flows having suffered partial recrystallisation.

Due to their hardness and resistance to erosion the basic lavas form a number of rounded hills, the most outstanding of which can be seen south of the Yundamindera road, between the 18 and 19 mile pegs.

Ultra-Basic Rocks.

These rocks are most typically developed in the north-western sector of the area, where they form a conformable band in basic lavas. This band can be traced from the vicinity of Eucalyptus to an area about three miles east of Murphy's Well, a total length of approximately ten miles. At the surface there is usually a chocolate brown, mottled ironstone capping with frequent fragments of opaline silica. Whenever the fresh rock is exposed it can be seen to be serpentine, carrying small, black specks of chromite. This would suggest an original rock of ultra-basic composition, probably intruded as a sill in pre-folding times.

The continuation of this band further to the south is somewhat uncertain. Fresh rock outcrops are entirely absent, and the fragments of opaline silica, so frequent in the north, disappear. But a band, consisting of hard, brown or yellow jasperoid rocks, can be followed for another six miles. These rocks show sometimes traces of banding, and can then easily be mistaken for jaspilites.

A band of serpentinous rocks associated with opaline silica has also been observed east of Mt. Howe, where it can be traced for a distance of about two and a half miles, and other patches occur approximately half a mile north-east of Mt. Linden.

Basic Intrusives.

It has been found to be extremely difficult to get really first class confirmatory evidence concerning the intrusive nature of a dark coloured, massive coarse grained rock suite. Greenstones of this description have frequently been noted within the basic lava belt, but in no instance was there sufficient evidence to justify conceding to them an intrusive habit. It is thought, that in most of these occurrences the comparative coarseness of crystallinity is the result of a process of re-crystallisation. As pointed out by H. A. Ellis[1] the intrusive nature of any of the greenstones has to be established "by the actual finding of transgressive intrusive contacts in the field, or by the distribution of a particular rock type in such a manner that its transgressive nature can be reasonably inferred."

The only occurrence where the general distribution of medium and coarse grained greenstones is suggestive of a transgressive intrusive habit has been found between Lake Carey and Linden townsite. The rocks in this area are predominantly plagioclase amphobolites. They are generally equigranular, but in places feldspar phenocrysts up to half inch in diameter have developed.

The contact relations with the greenstone schists are obscured, but in the writer's opinion an intrusive origin can be inferred with reasonable certainty from the areal distribution of the rock suite, particularly from its transgressive nature in the south-east.

The parallelism of the incipient schistosity in the coarse grained greenstones with that of the adjoining schists, and the auriferous nature of the former, suggests the conclusion that the intrusion was pre-folding and pre-granite in age.

At this juncture it must be mentioned that, as far as the writer's observations go, basic intrusive rocks of post-folding or post-granite age appear to be entirely absent within the limits of the area.

Sediments and Associated Rocks.

Throughout the central part of the area there is a vast distribution of fine grained, schistose rocks which have all the appearance of argillaceous sediments, slightly altered by low grade regional metamorphism. They are interbedded with arenaceous types, that include in places numerous water-worn pebbles of quartz, up to half inch in diameter. Other members of the series are sedimentary tuffs.

Exposures are scarce, and even when they exist the rocks are found to be extremely weathered to white, grey, and red colours. The best outcrops can be seen in the following places:—

(1) About 20 chains south of the 16 mile post on the Yundamindera road.

(2) Half-way between the 20 and 21 mile posts on the Yundamindera road.

(3) Near the 24 mile post on the Yundamindera road.

(4) Half a mile west of "Top Box" well.

(5) One mile north-east of the "Camel Back Soaks."

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[1] H. A. Ellis; The Geology of the Yilgarn Goldfield, South of the Great Eastern Railway. *G.S.W.A. Bull. 97, 1939.*

The writer is not inclined to think that the sedimentary series can be correlated with the Whitestone Series of the Yilgarn Goldfield. The high grade metamorphic minerals, andalusite, garnet, kyanite, sillimanite, staurolite, etc., predominant in the Whitestone Series, are entirely absent at Linden, where the metamorphism is of much lower grade. The placing of the sedimentary series above the ingeous greenstone series is based on the fact that nowhere in Western Australia has a predominently sedimentary series been found as the proved lowest member of the Pre-Cambrian Succession.

Jaspilites (Banded Ironstones).

Due to their extensive areal continuity, their sedimentary origin, and their topographic prominence, these rocks can be used as key horizons for the determination of the structure, and therefore all their outcrops have been carefully mapped. One of the most striking features of the jaspilites is their more or less uniform banded character, which is due to the arrangement of their mineral constituents in alternating layers of differing composition.

There are two varieties of jaspilites. The ferruginous types consist of red or black layers of magnetite and magnetic hematite, separated by grey or yellow bands of fine, dense, cherty quartz. The siliceous types, which have a fairly wide distribution in the north of the area, particularly between Mt. Florence and the Camel Back Soaks, are grey, yellow or whitish banded cherts, with occasional limonitic layers.

It is interesting to note the different reaction of the two types under conditions of stress. The siliceous types yielded by brecciation, while the ferruginous types are minutely drag folded. This difference in competency is obviously due to the lubricating action of the iron-rich layers in the latter type.

The jaspilite beds were found to be confined to one major stratigraphical unit, the sedimentary series. The only exception is at Linden, where they are associated with schistose greenstones.

Granite, Gneiss, Acid Dykes, Quartz Reefs.

There is no fundamental mineralogical difference between the main granite masses outcropping in the south-eastern and south-western corners of the area. The granite is a medium to coarse grained, massive, biotite granite, but both the amount of quartz and of the ferromagnesian are subject to variations.

East of Linden, in the vicinity of Lake Carey, there are quartz-poor, synitic varieties. They always occur very close to the greenstone contact, and are possibly hybrid types, resulting from an absorption and digestion, by granitic magmas rather deficient in quartz, of blocks of greenstone.

Field observations show that granitisation has taken place along the western granite boundary, particularly in the area centred around Larkins. There is a belt of peripheral replacement gneiss, similar in mineralogical composition to the granite, but with an abundant admixture of muscovite and pyrite. Undigested remnants and small patches of undoubted greenstone schist are common.

A narrow band of medium grained biotite granite occurs between serpentines and basic lavas, two miles east of Eucalyptus. This may represent the apex of an underlying pluton.

Near the 17 mile peg on the Yundamindera road there is a small area of hard, silicified grits, identical to those overlying in places undoubted granitic rocks. No fresh rock exposures can be observed, but for the abovementioned reason it is suggested that these grits are the decomposition product of an underlying body of granite.

Porphyritic and aplitic dykes, auriferous and barren quartz reefs, both parallel and transverse to the regional schistosity are well developed in the greenstone schists near the main granite masses. On account of the lack of necessary exposures and contacts, no evidence could be obtained to aid the elucidation of the problem of the interrelationship of these various rock types to each other and to the granite. The field distribution of the dykes and quartz reefs clearly suggests a connection with the granite, but nothing is known about their age relations.

An interesting feature worth mentioning is the complete absence of pegmatite dykes within the limits of the area.

Superficial Deposits.

These consist of soil, lake alluvium, sand dunes and laterite, and cover by far the greater portion of the area.

Structural Geology.

Regional Structure.

A broad conception of the geological structure has been obtained from the areal distribution of the major rock types. Reduced to basic facts the geological map shows a large central belt of sediments and associated rocks, including jaspilites, flanked on either side by older greenstones, which in turn are limited to the east and west by major granitic plutons. The only satisfactory way in which such rock distribution can be accounted for is by regional folding, producing a large synclinorial structure. The exact position of the axis of this major fold is somewhat indefinite, but is almost certainly represented by the central banded ironstone formations, and follows a line passing through the Camel Back Soaks, Mt. Florence, Mt. Hornett and Mt. Howe. It has a north-north-westerly trend, coinciding with the regional schistosity and the strike of the jaspilite beds. Strong evidence pointing to overturning of the eastern limb, and to a more or less isoclinal nature of the structure, comes from the persistently steep easterly dips of the schistosity throughout the whole area, and also from easterly dips of most of the jaspilite bands. A regional southerly plunge can be inferred from the plunge of the numerous drag-folds in the jaspilites, particularly from those in the major bands between the Camel Back Soaks and Mt. Howe.

A considerable amount of dip faulting on a minor scale was observed, but no conclusive evidence of widespread, large scale faulting was obtained, nor does it appear likely that such exists.

Minor Structures.

The area as a whole presents the picture of a synclinorium in which tight, subsidiary folding has occurred. The existence and the nature of this minor folding is evidenced by the shape of the outcrop lines of the banded ironstones. The convergence and divergence of the jaspilite beds, the existence of undoubted structural noses, and the interpretation of the numerous drag folds points to two sets of minor folding. The more prominent of the two is the one that took place along axes having a generally north-north-west trend. It has resulted in the production of a number of subparallel minor anticlines and synclines, the axes of which are well defined, and can be followed in some cases for distances up to five miles and more. All the folds are tightly compressed and overturned, the limbs dipping between 55° and 80° to the east. They are mostly of the chevron type, and have a strong plunge either to the north-north-west, or to the south-south-east.

Evidence pointing to the extremely tight and intricate nature of the folding is brought forward by an analysis of the shape of the drag-folds in the jaspilites. Although it cannot be definitely stated whether or not there is more than one horizon of jaspilite, such considerations demonstrate the fact that repetition of these beds has occurred. Examples supporting this statement are:—

(1) North of Mt. Howe there are from two to four closely spaced (15ft.-50ft.), subparallel jaspilite bands, exposing an abundance of drag folds. An analysis of these drag folds clearly shows that there has been repetition of the beds.

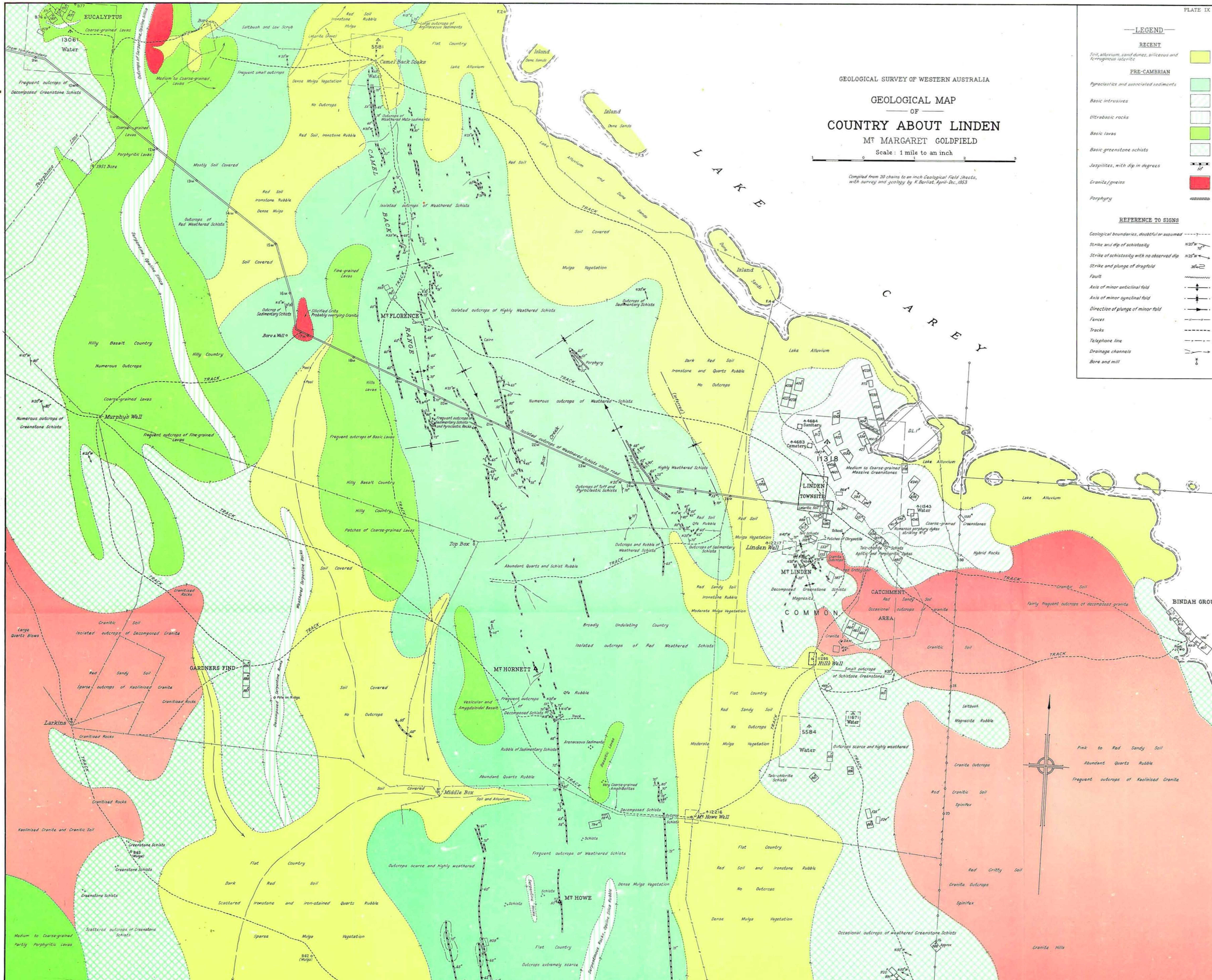


PLATE IX
GEOLOGICAL SURVEY OF WESTERN AUSTRALIA
GEOLOGICAL MAP
OF
COUNTRY ABOUT LINDEN
MT MARGARET GOLDFIELD
Scale: 1 mile to an inch
1 0 1 2 3
Compiled from 20 chains to an inch Geological Field Sheets, with survey and geology by K. Berliat, April-Dec., 1953
LEGEND
RECENT
Soil, alluvium, sand dunes, siliceous and ferruginous laterite
PRE-CAMBRIAN
Pyroclastics and associated sediments
Basic intrusives
Ultrabasic rocks
Basic lavas
Basic greenstone schists
Jaspilites, with dip in degrees
Granite/gneiss
Porphyry
REFERENCE TO SIGNS
Geological boundaries, doubtful or assumed
Strike and dip of schistosity
Strike of schistosity with no observed dip
Strike and plunge of dragfold
Fault
Axis of minor anticlinal fold
Axis of minor synclinal fold
Direction of plunge of minor fold
Fences
Tracks
Telephone line
Drainage channels
Bore and mill
LAKE CAREY
EUCALYPTUS
Camel Back Soake
CAMEL BACK RANGE
MT FLORENCE
Murphy's Well
LINDEN TOWNSITE
MT LINDEN
Linden Well
CATCHMENT AREA
COMMON
BINDAH GROUP
Hills Well
MT HORNETT
GARDNERS FIND
Larkins
Middle Box
Top Box
Mt Howe Well
MT HOWE
Hilly Basalt Country
Lake Alluvium
TRACK

(2) A major jaspilite line crosses the Yundamindera road about half-way between the 21 and 22 mile posts. North of this point there are three bands, 12 ft. to 15 ft. thick, and about one chain apart. The jaspilites are here of the more siliceous, competent type, and drag folds are scarce. However, and exposure eight chains north of the road shows that the central band is actually a tightly compressed anticline. Indications of a synclinal fold are also noticeable on the eastern band, a few chains further to the north. The three bands are obviously formed by the same horizon.

(3) Another band that is clearly made up by the two westerly dipping limbs of an anticlinal fold runs north-east from the 19 mile post.

(4) The ridge between the Camel Back Soaks and the old workings to the west of Mt. Florence, consists of two jaspilite beds, that are actually the easterly and westerly dipping limbs of an anticline.

(5) Duplication by drag folding has also occurred in the conspicuously red and white banded jaspilites crossing the Yundamindera road between the 24 mile and 26 mile posts.

Apart from this intricate, minute folding there are five well defined, minor folds belonging to the north-north-west trending system mentioned above. Looking at the geological map it will be noted that the outcrop line of the jaspilites in the vicinity of Mt. Lindens forms a semi-elliptical curve, convex to the north. The dips of the jaspilite on the eastern and western halfs are to the east, and vary from 35° to 50°, and from 55° to 70° respectively. On the northern portion of the curve the dip is 45° to the north. This represents the horizontal section of a northerly pitching anticline, whose western limb is overturned. It is of interest to note that on the nose of the fold the bedding planes of the jaspilite (N 80° E) are at nearly right angles to the regional schistosity of the adjoining greenstone schists (N 20° W).

The next anticlinal axis crosses the Yundamindera road about one-quarter mile east of the 24 mile peg. The two tapering jaspilite bands in this locality form a V-shaped nose three miles further north-north-west. The northerly plunge of the fold (and therefore its anticlinal nature) is indicated by the uniform northerly plunge (25°-30°) of the drag folds along the eastern limb. This anticline, like all the other minor folds, is overturned to the east. The average dip along the eastern limb is about 65°, but it is considerably steeper on the western limb.

Considerations of symmetry require a syncline between these two anticlines, but the position of its axis is conjectural for lack of evidence.

Going now further west the existence of another fold is suggested by the convergence of the strike lines towards an area centred around Mt. Florence. Mt. Florence itself is formed by an arc of jaspilites, convex to the north. The many drag folds in this locality have all a strong plunge to the south, indicating a syncline plunging in that direction.

The next succeeding fold to the west is again anticlinal. Its axis is very well defined, and can be traced from west of Mt. Florence to an area one mile south of the 20 mile peg on the Yundamindera road, where the jaspilites of the two limbs join together, and form a distinct nose, plunging to the south. In the northern half this fold is symmetrical, the western limb dipping at 60° to the west, but it becomes overturned towards the south, where both limbs dip steeply to the east.

The extent and the exact nature of the second set of minor folding is not too well defined, but its existence is evidenced by the marked convergence and divergence of the strike lines of the jaspilites. An analysis of these strike lines, and a consideration of the dips show that the folds are both synclinal and anticlinal in nature. Their axial trends are approximately at right angles to the first set of subordinate folds, and they may therefore be classified as "cross-folds." The individual folds do not extend any great distance, but appear to overlap one another "en echelon." The writer had been greatly concerned about this apparent inability of well marked cross-folds to influence the whole structure, until the Government Geologist (Mr. H. A. Ellis) drew his attention to the fact that the cross-folds can have a plunge too, and that their effects may be prominent in one direction and completely disappear in the opposite direction.

The following minor cross-folds have been recognised in the field, and marked on the geological map:—

(1) The Linden cross-fold—synclinal.

(2) The cross-fold two miles north of the 22 mile peg on the Yundamindera road—synclinal.

(3) The Mt. Florence cross-fold—anticlinal.

(4) The cross-fold 1½ miles south of the 20 mile post on the Yundamindera road—synclinal.

In conclusion it must be mentioned that cross-folding on a smaller scale is also indicated by well marked reversals in the direction of plunge of the dragfolds in the banded ironstones. Such minute cross-folding can most clearly be observed about one mile south of Mt. Hornett.

Ore Deposition.

Gold is the only mineral which has been mined in the area, and so far there is nothing to indicate the occurrence of other minerals in commercial quantities, except silver, which is obtained as a by-product during the refining of gold. Most of the gold has been found in quartz reefs, which are associated with practically every rock type, but predominantly with the schistose greenstones, particularly with talc-chlorite schists. Between Linden and Lake Carey, rich deposits have been found to be associated with medium to coarse grained basic intrusive rocks, and at Eucalyptus extensive alluvial deposits have been worked. Half a mile west of Mt. Florence there are some old workings in the younger sedimentary series, and two other small mines, one near the 19 mile post on the Yundamindera road, the other about 1½ miles south-west of Mt. Howe, are closely associated with banded ironstones.

There is a distribution of gold reefs in more or less isolated centres, by far the most important of which is Linden itself. The next important centre is Eucalyptus, followed by smaller mining groups, such as Bindah, Kangaroo, and Gardner's Find. In all these localities the values have been found along "gold lines," the trend of which is parallel to the schistosity of the country rocks. North-east of Linden townsite there is a marked swing of the gold lines from a north-westerly to a northerly direction. This trend coincides with the local schistosity of the greenstones, and follows roughly the outlines of the basic intrusive body mapped in this area.

There is a strong suggestion that the localisation of gold deposition at Linden is influenced structurally by the synclinal cross-fold existing in this area, but at the time insufficient group work had been done to conclusively prove such an association.

The so far isolated gold occurrence west of Mt. Florence (G.M.L.951R and G.M.L.933R) may be cited as another case where an association of gold deposition with minor cross-folding is very suggestive. Unfortunately outcrop conditions are particularly bad in this area.

Within the area mapped there are no other instances where any association of producing centres with cross-folding can be established. The difficulty of correlating the gold occurrences with the local structural conditions lies in the fact that the former, with very few exceptions, are well away from the central belt, where it is possible to determine the nature of the folding with greater detail. Apart from the old workings west of Mt. Florence already mentioned, the occurrences in this central belt

are associated with zones of major drag folding in the jaspilites, and they are as a rule well out on the limbs of the minor folds. It is hoped that the group work still to be carried out will bring to light some information relating to the structural features of the main producing centres situated further to the east and west, but it is anticipated that the extremely poor outcrop conditions, and the inaccessibility of most of the old workings will render investigations along these lines most difficult, and, no doubt, in many cases impossible.

In conclusion one important fact relating to the distribution of the main past gold mining centres must be put on record. Similar to the conditions existing in the Yilgarn and Coolgardie Goldfields, it has been noted that these centres lie never very far from major granite intrusives. The Linden, Bindah, Kangaroo, and Gardner's Find groups are not more than a mile from a major granite body, and the distance from Eucalyptus to the nearest granite is about two miles. Such an association closely points to the granitic magma as the source for the gold, and is of fundamental importance to the prospector. It has already been emphasised that there is no basic difference between the eastern and western granites, and metallisation has taken place in the vicinity of both bodies, although within the limits of the area, more frequently along the eastern contact.

Prospecting Recommendations.

Most of the localities suggested below are in low-lying, extensively soil covered areas, in which prospecting operations must be very largely confined to loaming methods. This applies particularly to the areas near the noses of the structure in the more central parts. It has been shown that these noses indicate the existence of minor cross-folding, and these localities are worthy of attention. This recommendation is based in general on experience gained in other gold fields, and in particular on the gold occurrences north of Mt. Linden, and west of Mt. Florence, both of which coincide with cross-fold axes.

Prospecting is warranted in the following places:—

(1) In the area north, east, and west of Mt. Florence.

(2) In an area situated between one mile and one and a half miles south of the 20 mile post on the Yundamindera road.

(3) In the area about two miles north of the 22-mile peg on the Yundamindera road.

There is scope for further prospecting in a strip of country, about one mile wide, following the western granite contact. It appears especially that the area between Larkins and the southern limit of the map has not so far received sufficient attention.

Prospecting is also warranted in the greenstones and ultra-basic rocks flanking the granite tongue about two miles east of Eucalyptus. As far as can be ascertained this area has received little or no attention from the prospectors.

REPORT ON A MANGANESE PROSPECT NEAR NAENDIP, KENT DISTRICT, S.W. DIVISION, W.A.

Approx. Lat. 34°03′ S.
Approx. Long. 119°39′ E.

By J. SOFOULIS, B.Sc.

Introduction.

Prospecting area P.A. 946H recently taken out by C. J. Turle for Manganese, Galena, and Cobalt, is situated approximately two miles N.E. of Naendip C.G. 12 location shown on the Lands Department Litho. 433/80 adjacent to the Phillips River Goldfield.

An inspection of this area was made during August, 1953, and the geological map compiled (scale five chains to one inch) accompanies this report. (Plate X.)

Access.

The Naendip locality is reached by a moderate to rough track running in south-westerly direction from Ravensthorpe and taking the right-hand track at the triple junction 23 miles out, following the now abandoned overland telegraph line to Naendip, a total driving distance of 50 miles. The pegged area lies south of this track, approximately two miles north-east of the old Naendip copper workings.

General Geology.

Rugged hills of steeply inclined quartzites, schists, dolomites, conglomerates, etc., forming the Mt. Barren Series of sedimentary rocks of younger Pre-Cambrian age, have been thrust over the older Pre-Cambrian basement rocks.

Meta-sedimentary mica schists, slates, dolomites and jaspilitic rocks forming the upper portion of the Pre-Cambrian basement are exposed below the Mt. Barren rocks in the deeper eroded drainage areas of the Fitzgerald and Dempster Inlet vicinities.

Flat lying Spongelite deposits of Miocene age (Plantagenet Series) overlie the lower lying Pre-Cambrian rocks and form prominent breakaway scarps near drainage areas.

The Mt. Barren series of rocks in which quartzites predominate are not mineralised, and have general attitudes which reflect the upper Pre-Cambrian basement trends (N.40°-70°E.) and steep southerly dips (50°-80°.).

Underlying jaspilitic and associated meta-sedimentary schists of this Naendip locality are identical with the jaspilitic succession forming the Ravensthorpe Range in the adjacent Phillips River Goldfield, and are thought to be a westward extension of this same succession.

As appears to be general in West Australian Pre-Cambrian, Manganese deposits are confined to the jaspilitic horizons of the Pre-Cambrian basement rocks. For the Naendip locality and Phillips River G.F. this generalisation applies, and all known manganese deposits here are restricted to the jaspilitic succession forming the upper Pre-Cambrian basement.

Information on some of these deposits is given in the W.A. Mines Department Annual Report for 1949.[1]

Manganiferous deposits occurring within this jaspilitic unit appear to be syngenetic and of a chemical precipitate origin, similar to the formation of the jaspilites themselves. Some secondary redistribution in the form of manganese staining, enrichment, and iron replacement has occurred.

Mineralisation of igneous origin is present within the jaspilitic succession, but to a much lesser degree than shown in the crystalline lavas (greenstones) of the lower Pre-Cambrian basement. No lower basement rocks, gneiss, intrusive granite pegmatites or quartz dolerite type dykes were noted in the area examined. Quartz reefs (barren) seen in the jaspilitic succession and younger Mt. Barren rocks are thought to be of minor fault filling origin.

Geology P.A. 946H Area.

This area lies within the jaspilitic succession and consists in the main of thinly banded jaspilites interbedded with chloritic, muscovitic, graphitic, siliceous, schists and slates, dolomites, and meta dolomitic schists, all of sedimentary origin.

Regional metamorphic effects are expressed in the attenuation of some meta sedimentary bands, giving a pinching and swelling distribution in both

[1] Report on Manganese Deposits in and adjacent to the Phillips River Goldfield. *N. M. Gray and J. S. Gleeson.*

PLATE X

LEGEND

RECENT
- Alluvium and wash
- Superficial

MIDDLE PRE-CAMBRIAN — Meta sedimentary rocks
- Dolomite
- Mica schists
- Graphitic and siliceous slates
- Jaspilites and associated schists

Manganese Ore Body

REFERENCE TO SIGNS

- Observed geological boundary
- Assumed geological boundary
- Approximate geological boundary
- Strike and dip of bedding — N50°E 60°
- Strike of vertical bedding — N40°E
- Strike and dip of schistosity — N60°E 70°
- Strike and plunge of dragfold — 55°
- Track
- Form lines
- Watercourses (non-perennial)

To Ravensthorpe Approx. 48 miles

Line (Abandoned)

Telegraph

Maroon coloured mica schists

Superficial lateritic soil

Quartzitic and schist fragments

Mallee vegetation

Alluvium and wash

Superficial ferruginous schist fragments quartz rubble.

Brown loamy soil

Lateritic brown loamy soil

Schist and quartzite rubble

Superficial laterite soil

Quartzitic and schist fragments

Lateritic schist and quartzite rubble

Undifferentiated, ferruginous and manganiferous Qfe and schists

Contorted banding

Quartz mica schists

Brown loamy soil

Schist and quartzite fragments and rubble

Siliceous carbonaceous slates

Occasional manganese staining

Thin interbedded buck quartz veins

Pyrite casts in schists with some limonite after pyrite crystals

Few scattered magnesite boulders along this line

Siliceous carbonaceous slates

Micaceous schists — occasional garnet development

Undifferentiated Qfe and schists

Manganiferous and iron stained

Scattered manganiferous boulders

Ferruginous and carbonaceous schists

Schist rubble

SEE ENLARGEMENT 'B'

Some vein quartz with manganese

Manganese

Micaceous schists

Abundant quartz (Milky coloured)

SEE ENLARGEMENT 'A'

Undifferentiated Qfe and schists

Superficial lateritic and brown loamy soil

This point situated 60 chains from upper bend in telegraph line.

NW corner Sec. 9 PA. 946H

Scattered manganese rubble

Manganiferous and ferruginous outcrops. High silica content.

Meta dolomitic schist?

Reddish micaceous schist

Brown loamy soil

PA. 946H

Meta dolomites and dolomitic schists

6' Shaft

Quartz veins with rare galena

From Naendip Approx. 2 miles

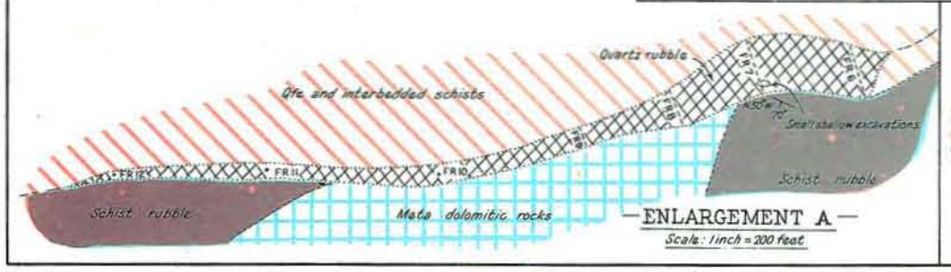
Sampling :-

- FR 6, FR 7, FR 8, FR 9 — Chip samples across strike of ore body, as shown — Group Sample N.1
- FR 10, FR 11, FR 12 — Grab samples from positions shown — Group Sample N.2

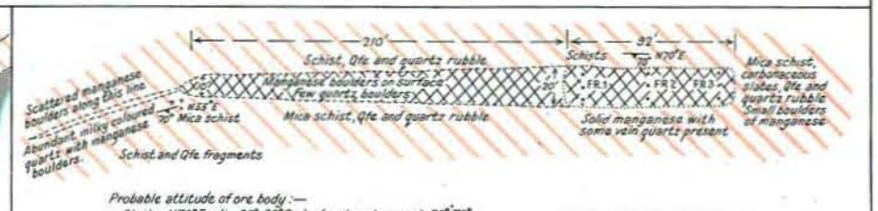
Sample N.3 = Lessee's sample of best ore taken from shallow excavations, east end of main ore body

Economic length of ore body approx. 900'. Average width 28'

Probable attitude of ore body :—
Strike as shown, dip 60°-85°S., body plunging west 50°-70°



— ENLARGEMENT A —
Scale: 1 inch = 200 feet



Probable attitude of ore body :—
Strike N70°E., dip 60°-80°S., body plunging west 50°-70°

Composite grab samples, FR1, FR2 & FR3, made up from positions shown.

— ENLARGEMENT B —
Scale: 1 inch = 100 feet

G.S.W.A.

GEOLOGICAL MAP
OF
MANGANESE OCCURRENCE

P.A. 946H - 2 MILES E.N.E. OF NAENDIP
48 MILES S.W. OF RAVENSTHORPE

Lands Dept. Litho., 433/60

Scale : 10 chains to an inch

10 0 10

Geology by J. Sofoulis
Based on compass and chain survey by J. Sofoulis and J. Noldart, Aug. 1953.

direction of strike and dip. Lesser competent beds have been altered into schists and one schist band showed a garnet development and limonite (after pyrite) pseudomorphs.

Attitudes taken on the comparatively unmetamorphosed dolomite show a more Northerly strike component, N. 10-40° E., but this bed is considered as being more or less conformable with the other meta sediments which strike N.-E. to E.-W. and dip steeply South at 50°-75°. Minor dragfolds present plunge in a Westerly direction at 50°-70°.

Further occurrence of manganese bearing jaspilites in another parallel band suggests a possible repetition by folding, the fold axis being overturned to the North.

Compared with the mid Mt. Barren vicinity, the country is of a milder topography, with the more erosion resistant jaspilite bands forming regional trending ridges and controlling the drainage patterns of the area.

Manganese staining along cracks and as surface coatings is noticeable over the jaspilitic horizons, often associated with limonite and silica. Followed along the strike, this staining often gives way to manganese boulders strewn over narrow belts, and occasionally to solid manganese outcrops.

Rare galena mineralisation in thin quartz veins is present in the dolomite only, and is noticeable in the dump of a shallow shaft (now six feet deep) included in the area pegged.

Manganese Occurrence.

The manganese ore occurs as a definite horizon interbedded with the jaspilites and associated meta sediments.

Solid outcrops of manganese measuring several feet across and rising up to one foot above the general surface level, and a surface of manganese boulders confined to definite limits comprise the deposit.

The actual manganese bearing horizon is traceable over some 60 chains, but of this length the only portions of economic potential are those delineated on the plate enlargements "A" and "B."

Limonite, vein quartz, and barren quartzite veins appear as minor constituents in the outcropping manganese and manganese boulder surfaces.

Pinching and swelling of the manganese body along the strike appear to correspond with attitude changes in the associated metasediments. Thin manganese boulder distribution between the two bodies implies a pinching in this portion and is therefore economically insignificant.

No further manganese outcrops or wide distributions of manganese boulders were seen along the Eastward extension of the manganese horizon.

For the extension West, the manganese horizon broadens again near the main drainage but owing to the high iron and silica content apparent, this body was considered too low in grade to include as a potential ore.

Fall in topography from the small deposit "B" to the East end of the main deposit "A" was estimated as approximately 15 feet whilst the fall over the economic length of the main deposit "A" was estimated as approximately 55 feet.

These estimations are only given to indicate a possible depth extension before the manganese bodies are attenuated.

Manganese Ore Reserves.

Scattered manganese rubble boulders both East and West along the strike lines suggest a continuation of the manganiferous bearing horizon, but the narrow limits of such boulders imply a pinching or attenuation in both directions.

The only manganese ores considered of any importance are those delineated on the accompanying plate.

For the main body, the economic length can be taken as 900 feet and the width varying from 10 to 65 feet. By averaging the widths taken every 50 feet, a figure of 28 feet was obtained, which, for the basis of reserve computations, can be taken as equivalent to the width of the body.

As no work has been done on the occurrence, other than a shallow excavation (max. depth one foot—done earlier in the century), it is reasonable to assume a depth equivalent to the width of the manganese ore distribution, although in testing this deposit a greater extension in depth could be the case.

Taking the dimensions of this main ore body as being 900ft. x 28ft. x 28ft. and using a conversion factor of 10 cubic feet of manganese ore per ton we have:—

For solid manganese outcrop (taken as 25 per cent. of whole body):

Indicated tonnage available =

$$\frac{900 \times 28 \times 28}{4 \times 10} = 17{,}640 \text{ tons}$$

For manganese boulder surface (taken as 75 per cent of whole body)

Inferred tonnage available =

$$\frac{900 \times 28 \times 28 \times 3}{10 \qquad 4} = 52{,}920 \text{ tons}$$

Similarly for smaller body occurring outside the lease and using the dimensions as shown, we have:—

For solid manganese outcrop:

Indicated tonnage available =

$$\frac{92 \times 20 \times 20}{10} = 3{,}680 \text{ tons}$$

For manganese boulder surface:

Inferred tonnage available =

$$\frac{210 \times 15 \times 15}{10} = 4{,}725 \text{ tons}$$

Total indicated tonnage available = 21,320 tons

Total inferred tonnage available = 57,645 tons

Thus for the P.A. 946H area, the total manganese ore available is 78,965 tons made up of 21,320 tons "indicated" ore and 57,645 tons "inferred" ore.

Sampling.

Positions of all samples taken are indicated on the plate enlargements.

Group samples F.R. 1, 2, and 3, from the small manganese body are made up of grab samples taken across the strike.

Samples F.R. 6, 7, 8, and 9, taken as chip samples across the strike of the main ore body were grouped for analytical purposes as sample N.1, and would be representative of the manganese content for the East end of this main deposit.

Samples F.R. 10, 11, and 12, are grab samples only from the attenuated Western end of the main deposit. These were grouped as sample N.2.

A sample N.3, collected by the lessee and considered by him to be representative of the best ore available is also included.

All the above samples have been submitted to the Government Chemical Laboratories for analysis.

Sampling Results.

Chem. Lab. No.	Group Sample No.	Manganese % Mn	Iron % Fe	Silica % SiO_2
13110	N 1	31·23	4·03	31·24
13111	N 2	46·63	4·85	7·78
13112	N 3	39·06	4·47	19·81
12529	F.R. 1	30·59	14·39	16·07
12530	F.R. 2	40·88	5·01	10·73
12531	F.R. 3	43·58	5·53	10·64
		Titanium Dioxide % TiO_2		Remarks.
13113	Composite Sample N1 and N2	0·02		Composite Samples made up of equal portions.
12532	Composite Sample FR. 1, 2, and 3	0·20		

Tenor.

Based on previous analyses carried out on similar deposits of this and adjacent areas, the ore can be expected to give in the vicinity of 30-45 per cent. total Mn.

On the same basis, the cobalt content cannot be expected to be much higher than 0.15 per cent. Co.

The ore would carry a silica and iron penalty.

The hardness and metallic appearance of the manganese ore as seen at the surface, can be expected to alter into a softer powdery "wad" at a comparatively shallow depth, but the total Mn. content would remain much the same as the surface material.

Recommendations.

Should the holder of this prospect wish to test the deposit, the writer would recommend a costeen across the widest development of the main body near the east end. Samping over this channel would give a truer indication of the grade of the ore available, or reveal workable pockets.

Providing such sampling results favour a further testing in depth, a shaft sunk in ore at this end of the main deposit and close to the southern edge is recommended.

From such a shaft with further development of drives and crosscuts, an indication of the body's attitude, dimensions, and tenor at depth would then be obtained.

Conclusions.

(i) Some 80,000 tons of a manganese bearing meta-sediments are contained in the P.A.946H area.

(ii) On present indications based on buyers' specifications, the manganese content is considered too low to warrant development as a major commercial undertaking.

(iii) Alteration into a powdery "wad" at depth would increase handling costs.

(iv) The manganese ore would carry silica and iron penalties.

(v) Cobalt content is not expected to be much higher than 0.15 per cent. Co.

(vi) The ore may be of some use to the small producer for use in trace mineral superphosphates.

REPORT ON THE BROAD GEOLOGICAL STRUCTURE OF THE PHILLIPS RIVER GOLDFIELD, W.A.

By John Sofoulis, B.Sc.

CONTENTS.

Introduction.

Although of little economic result, the information obtained in elucidating the geology of this area should prove beneficial to the further understanding of Pre-Cambrian geological and structural complexes met with throughout the goldfields and granitic areas of West Australia.

Pending the compilation of a bulletin on this area, the report is of an interim nature, and only a brief account of the geological information gathered will be presented.

The report concerns principally the economically significant Archaen basement rocks. Only a brief mention is made of the later Proterozoic rocks, whilst other rocks of obvious Tertiary-Recent origin, also contained within the area, will not be discussed here.

A structural map scale 2 miles = 1 inch accompanies the report. (Plate XI.)

General.

The survey of the Phillips River Goldfield initiated in 1951 was concluded in September 1953. On the resignation of the department's Senior Geologist (Mr. J. C. McMath, September, 1952) it was left to the writer, with the assistance of Mr. A. J. Noldart, to complete the regional investigations.

In view of the past year's field work, it has been found necessary to modify earlier observations and deductions, so that the present interpretations and geological information given are entirely the views of the writer and would supersede the tentative geological and structural conceptions presented in earlier "Progress Reports" for this area.[1] [2]

Geological Succession.

For the Phillips River Goldfield, the following Pre-Cambrian sequence has been recognised:—

Proterozoic—

(vii) Mount Barren meta-sediments. (No recognisable volcanics seen in the area surveyed.)

Archaeozoic—

(vi) E.N.E. trending Quartz Dolerite dyke suite.
(v) N.W.-N.N.W. trending Epidiorite dyke suite.
(iv) Magmatic Granite and Mineralisation.
(iii) Gneisses tnd Migmatites. (granitisation.)
(ii) Jaspilites and Meta-sediments. (Whitestones.)

Greenstones—

(c) Serpentinous Rocks.
(i) (b) Basaltic Lavas.
(a) Basement Meta-sediments.

[1] 1952 Sofoulis, J. Prog. Rept. on The Geological Survey of the Ravensthorp District, Phillips River Goldfield. W.A. *Ann. Prog. Rept. G.S.W.A., 1952.*

[2] 1951 McMath, J. C. Notes on the Progress of the Ravensthorpe (Phillips River G.F.) Geological Survey. *Ann. Prog. Rept. G.S.W.A., 1951.*

Except for a further subdivision here of the greenstone rocks, the fundamental difference in correlating this portion of the Pre-Cambrian shield with that sequence generally recognised in the State lies in the further correlation of the lithologically similar Proterozoic Mt. Barren and Nullagine sediments, and the position in the sequence of the instrusive dyke suites.

Of the above distinct Pre-Cambrian divisions the name "Ravensthorpe Series" is used to denote Archaen rocks, whilst the Proterozoic sediments previously referred to by the writer[3] as "Kundip Series" will for reasons given below be termed "Mt. Barren Series.

Proterozoic Mount Barren Series.

Earlier writers have generally referred to those rocks seen in the south coastal areas of the Eyre, Mt. Barren, Whoogarup Ranges, etc., as the "Mt. Barren Series" of Proterozoic sediments.

Resulting from the present survey, it is now evident that the rocks seen at the base of these ranges are merely a south-westerly continuation of the "Ravensthorpe Series" whilst the upper portion, made up of shallow water sediments (conglomerate, dolomites, quartzites, phyllites, etc.) form portion of those rocks tentatively described by the writer as "Kundip Series," the relationship with the underlying Archaen rocks being one of a low angular thrust unconformity.

It is now proposed to delete the name "Kundip Series" and revert to the original name "Mount Barren Series" but restricting this name to those sediments occurring in the "Ranges" above the unconformity.

With regard to the "Mt. Barren Series" the following conclusions have been formed:—

(1) The Proterozoic Mt. Barren Series have been thrust from the south over the Archaen basement to form a series of E-W trending isoclinal buckles. For the area investigated, the intensity of this thrusting is not considered of such great amplitude, the present position of the series being not far from original.

(2) The Mt. Barren rocks extend in a broad convex south arc from Kundip through the Eyre, Mt. Barren ranges, Red Peak vicinity (on the Fitzgerald River) to link with the Isongerup and Stirling Ranges, the northern edge of this arc being considerably embayed and modified by subsequent erosion.

(3) Mt. Barren rocks are essentially sedimentary—no evidences of igneous dyke intrusion, granitisation, or mineralisation having been noted in the area mapped.

(4) Major structural elements of the "Mt. Barren" series in general reflect Archaen basement structures, such east-west trending elements of the Archaen basement being pre-existent and not the resultant of "Mt. Barren" orogeny.

(5) Further complications of the Proterozoic rocks are suggested by the presence of minor west-north-west trending shears in the western portion of the area (Whoogarup, Hamersley River vicinities) indicating a later thrusting from a south-south-westerly direction with a probable increased metamorphism westwards.

It is possible that this direction of thrusting (which Prider[4] considers to have been a major force in the formation of the Stirling Ranges) may have resulted in a post Proterozoic granite rejuvenation as barite veins of deep seated origin[5] and concordant intrusive dykes[6] have been recorded in the Stirling Range beds.

Archaeozoic Ravensthorpe Series.

(i) Greenstones.

Lithologically the folded and metamorphosed greenstones can be further subdivided into three distinct divisions as follows:—

(a) Lower Basement Meta-sedimentary Unit.

A series composed dominantly of meta arenaceous and argillaceous types, now represented by banded micaceous, graphitic, felspathic schists and slates, quartzites, and occasionally more basic and probably meta-igneous bands.

Rocks of this unit are the most ancient known in the Archaen of this area. No base to this unit is seen, the lower horizons being now represented by granitised rocks (gneisses) and completely enclose the preserved Archaen basement structure.

(b) Basic Lava Unit.

A typical volcanic pile consisting predominantly of basic amphibolitic lavas and agglomerates with minor intercolations of meta-sedimentary lenses and acidic volcanics. A conformable relationship appears to exist with the underlying meta-sediments of unit (a).

(c) Serpentinous Unit.

Serpentinous rocks of irregular distribution, often mantling portions of the lower basement (units (a) and (b)), are thought to be of a volcanic nature of flow and sill forms. Presence of chromite in minute quantities as detected in all serpentine samples collected further suggest an igneous origin. Some of the serpentinous and ultrabasic rocks could well represent the metamorphosed products of basic lavas and intrusive types, as the main areas of serpentine distribution are often associated with recrystallised versions of the metamorphosed lavas of unit (b).

(ii) Whitestones.

Predominantly a series of meta-sedimentary argillaceous and graphitic schists with which are intercolated minor developments of silicified banded iron formations (Jaspilites). As no evidences of a violent unconformity were noted, the relationship of these jaspilites and associated meta-sediments with the lavas and serpentines is thought to be either conformable or disconformable. Manganese horizons of a chemical precipitate origin are also contained within this jaspilitic succession and a dolomite horizon has also been recorded.[7]

(iii) Gneisses.

Peripheries of the greenstone basement rocks are now represented by gneisses, and, as previously stated, form the granitised counterpart of the greenstone meta-sediments.

Localised mobilisation of the gneisses have resulted in minor developments of magmas and migmatites, but in the main the gneissic areas are original sediments granitised in situ, and preserve original banding, foliation and lineal trends.

Some scattered basic remnants are also contained in the gneissic terrains.

(iv) Magmatic Granite.

Occurs within the basement structure and is independent of the gneisses of (iii).

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[3] 1952 Sofoulis, J. Op. cit.

[4] 1952 Prider, R. T. South West Yilgarnia. *Sir Douglas Mawson Anniversary Volume, University of Adelaide.*

[5] 1953 Noldart, A. J. Report on Barite Deposits on MC 487H, Cranbrook, South-West Division. *Ann. Prog. Rept. G.S.W.A 1953.*

[6] 1920 Woolnough, W. G. A Geological Reconnaissance of the Stirling Ranges of Western Australia. *Jour. & Proc. Roy. Soc. N.S.W. Vol. LIV 1920.*

[7] 1953 Sofoulis, J. Report on a Manganese Prospect near Naendip, Kent District, S.W. Division, W.A. *Ann. Prog. Rept. G.S.W.A. 1953.*

The central massive portion of the granite is essentially of a soda-hornblende granodioritic type, whilst the margins and tongue offshoots are merely granitised basement rocks often enclosing large xenolithic blocks in all stages of assimilation, the granite itself being of a supposed palingenetic origin following tectonic movements.

Form and distribution of the granite have been controlled by tectonic trends, pre existing structural grain and lithology, the present shape being roughly a domal ovoid mass elongated along E.-W. tectonic lines.

The usual pegmatitic and other granitic apophyses are associated with this granite and all economic mineralisation of this field is confined to those rocks marginal to the granite.

(v) Epidiorites (Quartz Diorites).

A post granite dyke swarm arranged along north-west to north-north-west lines occurs within the granite and greenstones.

(vi) Quartz Dolerites (Quartz Gabbros).

These are the youngest known dyke system of the basement, and have been noted throughout the greenstone, granitic and gneissic areas. The trend of these dykes is approximately at right angles to the above epidiorite swarm.

For further discussion on the above dyke intrusives, see the writer's "Report on the Cattlin Mining Group".[8]

Tectonics.

The area investigated has been subjected to two periods of pre granite tectonism, one corresponding to the North-West to North-North-West or "Yilgarn" trend and prominent in the Northern sector of the area, the other of South-West to West-South-West trend and prominent in the South coastal sector.

To explain these two divergent tectonic trends, Prider[9] has suggested the existence of two distinct geological provinces and Wilson[10] proposes a major low angle thrust zone separating these provinces, whilst Hills[11] in extrapolating the observed data has linked both trends.

Results obtained from the present investigations favour the extrapolations and theories of origin as offered by Hills.

Structural patterns of the North-West to North-North-West trend form the dominant tectonic grain throughout the Archaen of the central goldfield areas. East-West crossfold structures which have been recorded in such areas appear to be more or less subordinate to this North-West to North-North-West or "Yilgarn" trend. It is not until this South coastal area is reached that the "crossfold" trend becomes preponderant over the "Yilgarn" trend and a deflection in tectonic strike is apparent.

In the area examined, East-West elements in the form of dykes, crossfolds, granite elongation, have been superimposed over the "Yilgarn" trending grain and are reasonably assumed as being the result of a younger tectonic period.

The magmatic granite is regarded as being incidental to the East-West or "South Coastal" tectonics, and not the cause.

Distribution of the preserved greenstones and notably the whitestone jaspilitic succession, together with observed drag folds, lineations (based on megascopic needle mineral orientations), gneiss foliations, etc., further support this unusual phenomenon of major tectonic deflection.

Basically then, the complex tectonic pattern of the Archaen basement as revealed in the Phillips River Goldfield is a resultant of two tectonic periods, the general pattern assuming that of a convex South-East arc, and resolving itself into a syntactic linkage of the North-West to North-North-West (Yilgarn) and South-West to West-South-West (South Coastal) tectonic trends.

Archaen Structure.

As indicated on the accompanying plate, the Northern "Yilgarn" trending portion of the structure forms a South plunging assymetrical syncline which, on the deflection of the tectonic strike in the Kundip crossfold locality, becomes overturned to the North-West and follows the "South Coastal" trend lines, the structure here plunging West-South-West. Minor subsidiary flexures of both trends are as shown.

Whitestone jaspilites and associated meta-sediments which are considered as being infolded with the greenstone basement, form an assymetrically situated belt on the East side of the "Yilgarn" trending structural portion. Granite mobilisation has been confined to the West side of this eccentricity, to form a domal mass which pinches out to the South-West to conform with the arcuate structural distribution. Except for this pinched or attenuated portion, granite foliations indicate an elongation along "South Coastal" trend lines.

Distribution of the jaspilitic succession East of Kundip gives the arcuation as shown. The extrapolated Northern edge of the "South Coastal" trending portion of this succession is based on the presence of a topographic "high" extending from the Kundip locality to No Tree Hill in the Eyre Ranges, the topographic "high" being reasonably assumed as reflecting the South-West subsurface extension of the relatively resistant jaspilitic rocks below the Mt. Barren Series.

The jaspilitic succession has undoubtedly controlled the granite shape to the North, so that it is further reasonable to assume similar conditions below the "Mt. Barren" rocks and the extrapolated subsurface granite boundary would similarly follow the same "high" to link with the granite boundary where exposed in the Eyre Ranges.

On the East side of the structure, arcuation is further indicated by the distribution of the greenstones, and notably a prominent quartzite horizon of the greenstone meta-sediments.

Upper meta-sediments of this greenstone basement have consistently acted as a barrier to the granitisation process, but on this Eastern side both meta-sediments and lavas are lost to the gneiss following the structural roll, the granitising control being then assumed by the relatively inert jaspilitic environment.

In the gneissic terrains external to the preserved structure, the attitudes of bedding in preserved remnants and gneiss foliations (also considered as being original bedding distribution trends) support the arcuation conception, and on this Eastern side were observed as far East as the Oldfield River.

Reconnaissance West of the goldfield boundary showed the trend of gneiss foliations to swing (with minor undulations) and assume the "South Coastal" trend as indicated on the map inset. As such foliations have been noted to faithfully reflect the greenstone structure, it is thought that the extension of the greenstones where lost below the Proterozoic and Miocene beds at the West River, would follow similar lines.

Greenstone lavas were noted to reappear below the Mt. Barren rocks at Mt. Maxwell, so it seems quite feasible that the greenstone extension from the West River, if not absorbed by the gneiss, would swing to assume this "South Coastal" trend.

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[8] 1952 Sofoulis, J. Report on the Cattlin Mining Group, Ravensthorpe, Phillips River, G.F., W.A. *Ann. Progr. Rept. G.S.W.A. 1952.*

[9] 1952 Prider, R.T. Op. cit.

[10] 1952 Wilson, A. F. The Charnockite Problem in Australia.
Sir Douglas Mawson Anniversary Volume, University of Adelaide, 1952.

[11] 1945 Hills, E. S. Some Aspects of the Tectonics of Australia.
Jour. & Proc. Royal Soc. N.S.W. for 1945, Part II, Vol. LXXIX.

This conception is further supported by the distribution of the jaspilitic succession which maintains the "South Coastal" trend as far West as Naendip, eventually being lost below Miocene beds in the Fitzgerald inlet vicinity.

Owing to Miocene distribution, the extension of the jaspilitic succession was not seen in the lower reaches of the Gairdner River, but charnockitic gneisses of the Doubtful Island Bay area may well represent the gneissified version.

Recorded gneiss foliation trends north of this area maintained the "South Coastal" trend, but a deflection in the Jerramongup-Needilup vicinity to reassume the "Yilgarn" trend appears to have resulted in a further granite mobilisation and some mineralisation has occurred in the basic remnants fringing this mass.[12]

A rough indication of this granite's distribution is included in the map inset, and, in this locality, probably marks the northern limit of the "South Coastal" trending structure.

The general impression gained from the recorded foliation trends of the gneissic terrains, in conjunction with structural axes, strike and distribution of Archaen lithologic units, is that the geological structure of the Phillips River Goldfield forms the south-eastern portion of an arcuately arranged geosynclinal belt, circumferentially disposed about, and welded to, a primitive but stable "Yilgarn" trending nucleus located north-west of the Jarramongup-Ravensthorpe Road.

The geosyncline is traceable from Mt. Short to Naendip, with a possible northern granitised extension from Mt. Short through Mt. Madden to link with the "Yilgarn" trending lake line formed by lakes King, Camm, Fox, Gulson, Varley etc., thus appearing independent of the adjacent Yilgarn Goldfield which at Hatters' Hill was noted to swing to a S.E. quadrant.

Regarding the south-western extension of the geosyncline, the known "South Coastal" trend from Naendip is maintained to the Albany district and may possibly represent the same structure.

A zone of weakness appears to have existed along the "South Coastal" trending portion of the geosyncline, as later manifestations through Proterozoic and even Cainozoic times reflect the earlier formed Archaen grain.

Metamorphism.

Generally speaking, the metamorphic grade throughout the whole area is relatively low and has resulted in the development of schistose and foliated structures according to the varied lithologic competences, together with some measure of recrystallisation. Except for those due to thermal effects resulting from granite emplacement, such schistosity foliations are remarkably consistent with the "arcuate structure" and extend far beyond the confines of the Phillips River District.

Detailed petrographic study is outside the scope of the present investigation, but from the recognisable lithologic units the geochemical changes wrought by deformation and metasomatism have been such to produce a complex assemblage of amphibolites and meta-sedimentary schists which often exhibit original lava and sedimentary characteristics.

As stated, metamorphic grade is generally low, but higher garnet, kyanite, and sillimanite grades have been noted.

Thermal metamorphic effects in the form of parallel and echelon shear lines (often garnetiferous and mineralised), are restricted to the immediate granite front. Andalusite development has also been noted along some granite margins.

It is difficult to reconcile the variable thicknesses of lavas and whitestones exposed across different portions of the structure. Diastrophic movements have no doubt been responsible for some thickening, probable bed repetition and attenuation, but the author is also inclined to view the distribution of the greenstone lavas and overlying jaspilitic succession as a function of geosynclinal deposition as well as deformation.

The general sequence of events:—basic volcanics, sedimentation, folding, granitisation, granite emplacement, dyke intrusives, is a normal geosynclinal occurrence, and unlike the lower greenstone metasediments and granitised counterpart, which have a broad distribution, the basic lavas and jaspilitic succession would be confined to, and their distribution controlled by the geosynclinal trough.

Faulting.

No conclusive evidence of widespread large scale faulting was obtained; the supposed faults which are shown are based entirely on jaspilitic displacement and are considered of pregranite age.

Post granite faulting of both "Yilgarn" trend and "South Coastal" trend is known from old mine workings, but such displacements are of minor magnitude only.

Mineralisation.

The principal forms of economic mineralisation known within the Archaen of this goldfield are summarised below.

(i) Gold-Copper Mineralisation.

Of hydrothermal origin, directly due to granite emplacement. Such mineralisation is generally localised in shear lines of the greenstones, at, or close to, and paralleling the granite margins.

Lava amygdaloids appear to have been the most favoured host rocks, with lava agglomerates subordinate. Gold mineralisation has been recorded in the Jaspilitic succession although generally speaking this environment has mainly proved chemically unsuited. The reputed pyritic lode of Mt. McMahon would also lie within this succession.[13]

Although past production statistics from the now abandoned mines show a preference for either gold or copper mineralisation, the alternate mineral is generally present. No zonal distribution, nor two distinct periods of mineralisation were recognised.

(ii) Pegmatite Mineralisation.

Zoned, flatly dipping pegmatitic bodies containing minerals of the lithium-tantalum suites. For further discussion see report on Cattlin Creek Spodumene Pegmatite[14] by the same author.

(iii) Magnesite.

Generally associated with the ultrabasic serpentinous rocks from which they are considered as being chemically derived.

Magnesite here is essentially a superficial deposit, the majority of accumulations favouring a solution redistribution and localisation in relatively flat, or lower lying drainage channel vicinities.

The magnesite deposits of Bandalup Creek have been previously commented upon.[15]

(iv) Manganese.

Of syngenetic origin, restricted to the Jaspilitic succession only. Minor deposits are known to occur in the Mt. Desmond, Kundip, Hamersley River localities.

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[12] 1948 Johnson, W. Report on Calyerup Creek Gold Find, S.W. Division *Ann. Progr. Rept. G.S.W.A. 1948.*

[13] 1949 Gray, N. M. & Gleeson, J. S. Pyrite, Mt. McMahon, Phillips River Goldfield. *Ann. Progr. Rept. G.S.W.A. 1949.*

[14] 1952 Sofoulis, J. Rept. on Cattlin Creek Spodumene Pgmatite, Ravensthorpe, Phillips River, G.F., W.A. *Ann Prog. Rept. G.S.W.A. 1952.*

[15] 1949 Johnson, W. & Gleeson, J. S. Bandalup Creek Magnesite Deposit, S.W. Division. *Ann. Progr. Rept. G.S.W.A. 1949.*

Manganese deposits of economic potentialities in the Naendip area form the subject matter of separate reports. [16] [17] [18]

(v) Other Minerals of Economic Interest.

Lead: Galena mineralisation has been recorded in a dolomitic horizon of the jaspilitic succession at Naendip.[18]

Radioactive Minerals: Rare occurrences of an unidentified radioactive mineral were noted to occur within the "Spodumene" zone of the Cattlin Creek pegmatite.

Isolated specimens containing minor radioactivity (3—4 × B.G.) were located in the southern portion of the old Elverdton workings and dumps.

Radioactive slag from a particular portion of the old Hopetoun Road Smelter dump gave counts as high as 4 × B.G.

Scheelite: Minor development of this mineral has been recorded in the granite area (late GML 115).

Silver: Traces generally present with gold-copper ores. Largest silver production 1,776.4 fine ozs. recorded from the Mozaic Mine.

Prospecting Recommendations.

The mineral potentialities of this field do not appear to be very large. Some good ore bodies have previously been worked in the district so further occurrences can be expected.

All obvious surface indications have earlier been tested and it now remains to investigate such soil covered areas adjacent to the granite margins by deep loaming, drilling, or lateral exploration from past workings.

With this object in view, the following recommendations are given:—

1. On structural grounds, the continuation of the mineralised greenstone rocks below the Proterozoic rocks, east-south-east of Kundip townsite is considered a worthy drilling prospect. As this recommendation will form the subject matter of a later report, no further discussion will be made here.

2. Lateral prospecting, both surface and underground, from known ore channels to pick up parallel lodes is strongly recommended. Plunge of minor dragfolds which may be observed in any development are a useful guide to the probable plunge of an ore body.

3. Only the greenstone areas up to one mile distant from the granite margin are possible hosts for payable mineralisation.

Mineralisation which has been recorded in the greenstones on the east side of the main jaspilitic belt is of a minor nature only, and owing to the absence of granite the area does not look encouraging.

4. Recognisable shear lines in the greenstones fringing the granite, and especially those showing garnet development, are strongly recommended.

5. Sheared lava amygdaloids are considered to be the best hosts for mineralisation. Auriferous mineralisation has been found in the jaspilitic succession (Mt. Iron lease) so that these rocks can also be regarded as potential sources, but only in the close proximity of granite margins.

6. With the exception of some small development in the West River area, the poorly accessible western side of the structure between Cocanarup and West River workings has had little prospecting and could show promise.

7. The south-western extension of the granite from Eyre Range to the Hamersley Inlet area does not appear favourable for mineralisation, owing possibly to the different nature of the granite noted here, and further, to the chemical inertness of the rocks comprising the jaspilitic succession.

8. As stated earlier, the Proterozoic sediments (Mt. Barren Series) in this goldfield showed no evidences of granitisation or mineralisation, so that any prospecting in these rocks would be considered a wasted effort.

9. Although some mild radioactivity has been recorded, the granite is considered "cold" and the area unlikely to contain commercial concentrations of radioactive ores. Should any interest be taken in this direction, however, the writer would suggest the granitic area about the Desmond townsite with special attention being paid to locating and testing recognisable shear lines contained therein.

Conclusions.

The geological structure as determined in the Phillips River Goldfield forms portion of an accurately arranged geosynclinal trough, the northern extension of which follows the general north-west to north-north-west (Yilgarn) trend of the central goldfields, whilst the lower portion is overturned and follows the well known west-south-west to south-west trend of the "South Coastal" area.

A palingenetic granite responsible for the hydrothermal mineralisation of the field has been generated at the nodal zone of the two divergent trends, and is located on the west side of the assymetrical structure.

Structural lines of the overthrusted Proterozoic sediments have been predetermined by the earlier Archaen trends. No forms of hydrothermal mineralisation were recorded in the Proterozoic rocks of this area.

REPORT ON UNDERGROUND WATER SUPPLY PROBLEM AT GABBIN, SOUTH-WEST DIVISION.

Approimate Latitude 30° 48′ S.
Approximate Longitude 117° 40′ E.

By L. E. de la Hunty, B.Sc.

Introduction.

As a result of a request by the Gabbin Branch of the Farmers' Union for geological assistance, the writer was sent to advise on the underground water supply problem in that district.

Gabbin is 181 miles north-east from Perth by rail, on the Wyalkatchem-Bullfinch line. (Distance by road is approximately 175 miles). The principal industry of the district is wheat and sheep farming. Average annual rainfall for Gabbin, based on a 22 year record ending 1947, is 1371 points.

Most of the area south of the railway line is served by scheme water piped from the tank at Waddouring, 14 miles south-east of Gabbin. However, one farmer, (not served by the scheme) recently carted water for 18 months out of a two year period. A considerable amount of boring has been done by the farmers with very discouraging results.

Geology and Water Possibilities.

Basement rocks of the area are granite gneiss with basic intrusives. The basic rocks occasionally form ridges and are distinguished by their cover of soil with magnesite nodules. The gneiss occasionally outcrops on ridges and hilllslopes but is usually concealed by laterite or soil.

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[16] 1949 Gray, N. M. & Gleeson, J. S. Manganese Deposits of the Phillips River Goldfield. *Ann. Progr. Rept. G.S.W.A. 1949.*

[17] 1952 Townley, K. A. Ravensthorpe Manganese Deposits. *Bureau of Min. Resources, Canberra Records 1953/96.*

[18] 1953 Sofoulis, J. Op. Cit.

PLATE XI

STRUCTURAL GEOLOGICAL MAP OF RAVENSTHORPE DISTRICT PHILLIPS RIVER GOLDFIELD

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

Scale : 2 miles to an inch

2 1 0 2 4 6

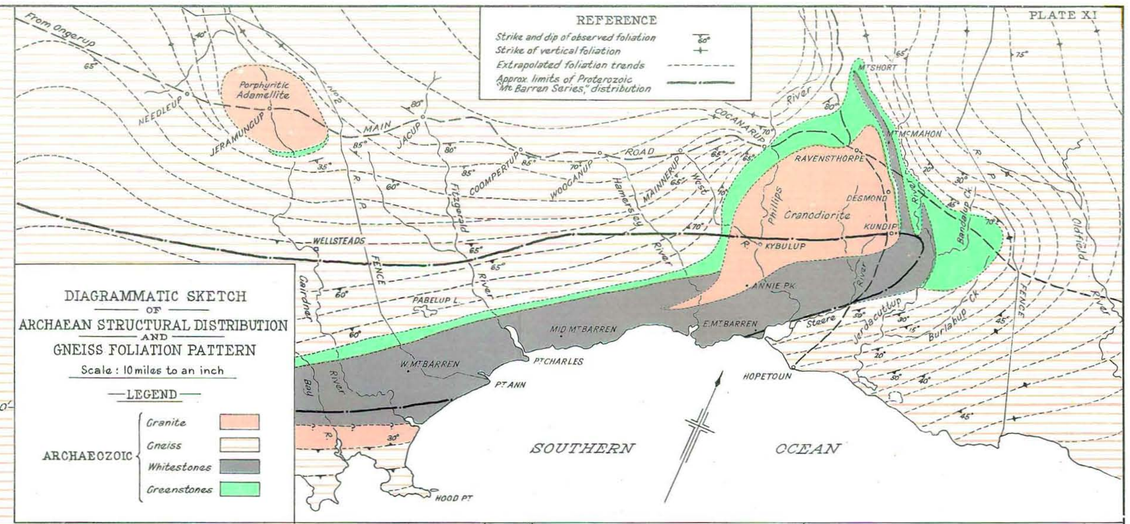
Geology by J. Sofoulis, (Oct. 1951-Oct. 1953), J.McF. Math, (Oct. 1951-Sept. 1952), N. Gray, (Oct. 1951-May 1952) and J. Noldart, (Aug. 1952-Oct. 1953). Structural interpretation by J. Sofoulis.

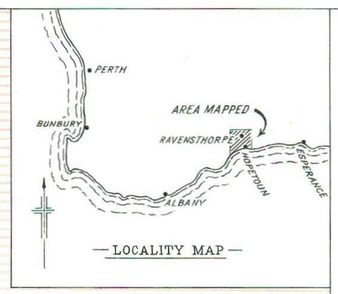
DIAGRAMMATIC SKETCH OF ARCHAEAN STRUCTURAL DISTRIBUTION AND GNEISS FOLIATION PATTERN

Scale : 10 miles to an inch

—LEGEND—

ARCHAEOZOIC
- Granite
- Gneiss
- Whitestones
- Greenstones





—LOCALITY MAP—

—LEGEND—

RECENT - LATE TERTIARY
- Alluvium, Sand Dunes and Sandy Soil
- Coastal Limestone
- Lateritic and Superficial

MIOCENE (Plantagenet Series)
- Spongolite

PRE-CAMBRIAN

PROTEROZOIC (Mt Barren Series)
- Undifferentiated Meta. Sediments

ARCHAEOZOIC (Ravensthorpe Series)
- Quartz Dolerite Intrusives (qd)
- Granite
- Gneiss
- Whitestones — Undifferentiated Jaspilites and Meta Sediments
- Greenstones — Serpentines; Basic Lavas; Agglomeratic Lavas; Meta Sediments

Base of Meta Sedimentary Series now represented by gneisses

REFERENCE

- Approximate geological boundary
- Assumed geological boundary
- Strike and dip of bedding
- Strike of vertical bedding
- Strike and dip of schistosity
- Strike of vertical schistosity
- Strike and dip of foliation
- Strike of vertical foliation
- Bearing and plunge of lineation
- Strike and plunge of dragfold
- Inferred structural axes
- Plunging axis
- Anticlinal axis
- Synclinal axis
- Overturned synclinal axis
- Probable fault
- Watercourse (non-perennial)
- Main roads
- Tracks
- Telegraph line

Results of boring show that there is very little depth of soil in any part of the district. The soil cover, even in the valley flats, passes into kaolin and decomposed gneiss at a dept of 20-30 ft. Except for one case (where the grain size of the quartz was rather large) this decomposed rock has failed to yield any supply. Salt water was encountered in some valley flats but other flats were quite dry. (Depth of decomposition is as much as 120 ft.)

Some of the slopes and ridges are covered with sand. Where this depth of sand is known to be of the order of 20 ft. thick, some successful wells have been established. The quality of this water is good although the yield is small.

Several sites were recommended in the field. Most of these were possible well sites near the lower edges of sand deposits. The others were in depressions in the higher level country—one of these was backed by thin sand deposits on the slopes of the basin.

Conclusions.

1. With few exceptions, sand deposits are the only places likely to yield good quality water in this district.

2. Supplies of this nature will contain less than 300 grains per gallon of sodium chloride and will yield up to 500 gallons per day. Potable water may even be found in this type of deposit.

3. If there are no thick sand deposits on a particular farm, then dams to catch surface run off are the only solution to the problem.

REPORT ON RECONNAISSANCE TESTING FOR RADIOACTIVITY IN PHOSPHATE DEPOSITS, DANDARAGAN, W.A.

By L. E. de la Hunty, B.Sc.

Introduction.

Dandaragan is in the Melbourne District of the South West Land Division and is 22 miles by road west from Moora. Moora is 108 miles north of Perth on the Midland Railway Company's line to Geraldton.

The phosphate deposits occur in Mesozoic rocks in two horizons, called the Upper Phosphate Bed and the Lower Phosphate Bed. Full details of the geology and locality of the various deposits are given in Matheson's bulletin[19].

Places selected for testing were ones of good outcrop, where possible, since soil cover tends to mask any radioactive effects. Tests included readings at various spots and zig-zag walking traverses across the lines of outcrop. The geiger counter used was somewhat erratic but significant readings were checked with another reading 15 minutes later. (Blank periods of as long as 20 seconds were experienced at times. During these intervals no clicks were recorded in either 'phones or meter. Further erratic behaviour was recorded when the instrument gave background counts of 68 and 138 for two successive readings, each of five minutes duration. The counter had not been moved.)

However, results of field tests indicate that four, and possibly five, of the deposits exhibit some radioactivity in places.

Individual Deposits.

For the purpose of description, the deposits are grouped into beds and listed from north to south.

Upper Phosphate Bed.

Matheson[20], p. 18, states:—

> The deposits are the outcropping sections of a phosphate bed occurring between the chalk and the Lower Greensand. The bed is composed mainly of hard, compact, phosphate nodules and phosphatised wood, occurring in a soft matrix which varies from glauconitic chalk to calcareous greensand. The bed has an average thickness of about two feet, and varies in thickness from one foot seven inches to three feet eight inches.

Vine Cottage Deposit.—Location 984 was planted with dry lupins up to five feet in height and location 313 was well grassed. Attempts to trace the outcrop through the lupins were unsuccessful but an increased count was recorded near the east fence of location 313. A maximum rate of 3 x background was indicated on the instrument but a later test on this spot gave only a background count.

Cook's Deposit.—This paddock was well grassed, over a blind outcrop which could not be traced with a geiger counter. However, a pile of boulders, somewhere in the vicinity of pit CA and containing nodules of average diameter five inches, showed a count of 2 x background.

Minyulo Deposit.—The deposit here was practically obscured by soil and lupins. A test at pit BH and at a pile of nodules nearby showed a slight increase over background (1.1 x background).

Lower Phosphate Bed.

Of this bed Matheson says:—

> All the deposits are overlain by the Lower Greensand, and underlain by dufrenite-impregnated ferruginous sandstone, and their average thickness is approximately two feet. With the exception of the "Emu Hill" deposit, the character of the phosphate bed at the various deposits is similar, consisting of phosphate nodules, up to about four inches in diameter, and pieces of phosphatised wood, occurring in a matrix of glauconitic greensand.

Emu Hill Deposit.—There was no evidence of radioactivity at this deposit. The line of outcrop of phosphate nodules, phosphatised wood and sandstone with dufrenite was tested but gave no increase in count. Testing included several stationary readings between pits ED and EA, also zig-zag walks across the outcrop here and over the approximate line of outcrop near pit EK.

Summer Hill Deposit.—There was no outcrop of phosphate visible so slow zig-zag traverses were made across the line of outcrop indicated on Matheson's locality map. No increased count was detected.

Hole in the Wall Deposit.—Tests were made over five chains near the north end of the westerly outcrop, opposite pit AC, but only background counts were noticed.

Tests on the east side of the deposit between pits AQ and AR gave readings slightly higher than background (1 x to 1.3 x background). Only background counts were noticed between pits AR and AS and for some ten chains south of pit AQ. Rocks were phosphate on dufrenite-impregnated ferruginous sandstone.

Despite the fact that the instrument was erratic, the increased count was quite definite here.

Wedges Deposit.—The small area of definite outcrop of phosphate on ferruginous sandstone with dufrenite, near pit NN, showed marked radioactivity. Counts of 1 x, 1.5 x and 2 x background were recorded in a small area of ten yards radius. No other variation from background was found along the outcrop.

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[19] 1948, Matheson, R. S.: The Dandaragan Phosphate Deposits. *Mineral Resources of Western Australia, Bulletin No. 4, Department of Mines, W.A.*

[20] Op. Cit.

A specimen from here registered 2 x background at the Government Chemical Laboratories, Perth.

Caves Deposit.—The instrument gave conflicting background readings near the deposit. The lower value of background was accepted as being normal and a short traverse was done over the phosphate outcrop between pits G and C. There was no count higher than the accepted background.

Yatheroo Deposit.—Test readings along the most easterly "limb" and the "nose" of the outcrop failed to show any variation from background.

CONCLUSIONS.

1. The radioactivity is not confined to either horizon.
2. The radioactive deposits seem to be confined to within a radius of three miles, near Dandaragan townsite.
3. Radioactivity is not strong enough to warrant further exploration.
4. The quantity of radioactive material is very limited (even within a deposit).
5. The deposit is of academic interest only.

REPORT ON RADIOACTIVITY NEAR DUNDAS, DUNDAS GOLDFIELD. W.A.

Approx. Lat. 32° 25′ S.
Approx. Long. 121° 46′ E.

By L. E. de la Hunty, B.Sc., Geological Survey of W.A.

History.

As a result of prospecting done by Mr. J. D. Yorga, four Prospecting Areas for radioactive minerals were applied for, about one and a half miles south of Dundas townsite, in late November, 1953. (See Locality Plan on Plate XIII). The writer was sent to examine and report on the area, and the investigation took place during the period 5-9th December. A further visit was made in the company of the Government Geologist, Mr. H. A. Ellis, on 20-22nd December. These inspections also included M.L. 9 and M.L. 12.

M.L. 9, about 100 chains further south, was pegged by Mr. Yorga on 4th December and M.L. 12 was also pegged by him on 7th December. (M.L. 12 is about 20 chains north-east of M.L. 9). Norseman Gold Mines N.L. than pegged a considerable amount of ground ond secured options on all previous holdings in the area. Before the end of December this company held a block of nearly 4.000 acres. Norseman Gold Mines N.L. are associated in this venture with Uranium Mines N.L.

Location and Access.

The P.A.'s originally applied for (P.A.'s 2286, 2287, 2288, 2289) are 16.4 miles, by road and track, south of Norseman (the nearest town). They are adjacent to G.M.L. 809. A rough track to this deposit, and M.L.'s 9 and 12, leaves the Norseman-Esperance road 13.6 miles south of Norseman and runs south-east to south along the west shore of Lake Dundas. Lake Dundas is a large dry salt lake more than 20 miles from north to south and has a maximum width of about ten miles. Vehicles can be driven over the lake surface in summer.

Dundas is 470 miles by road from Perth and the Perth-Esperance railway line passes within six miles of the deposit. The port of Esperance is 107± miles south of Dundas by road.

General Geology.

The area is one of pre-Cambrian rocks consisting of basic lavas and greenstone schists, quartzites with associated meta-sediments and jaspilite, and granite with some pegmatites. Recent deposits consist of ferruginous laterite and grit, sand, residual clay and lake muds; also some small patches of spicular earth of Miocene age over granite in the lake flat.

The Older Greenstones (basic lavas and greenstone schists) and the Whitestones (jaspilite and meta-sediments) are conformable but overturned. The beds are part of a north plunging structure which is either the west limb of an overturned syncline or the east limb of an overturned anticline.

The lavas have relict pillow structures in the small outcrops mapped. The meta-sediments consist of garnet-mica schists, shales and quartzites. Some of the quartzites contain the chrome-mica, fuchsite.

The granite is radioactive ("hot") and is intrusive into the folded rocks described above. The degree of radioactivity of the fresh granite is something higher than twice background (2 × B).

Ferruginous laterite and grit occurs in small patches on the weathered granite at the edge of the lake, also on the meta-sediments at lake level and in the micaceous lake muds. Laterite also overlies the jaspilite in places and there is a patch of lateritic pebbles on sand on M. L. 9.

The geology and radioactivity of the area near G.M.L. 809, also a locality map are shown on Plate XII. Plate XIII shows the geology and radioactivity of the area near M.L.'s 9 and 12, also an enlargment of portion of the radiometric grid on M.L. 12.

Radioactive Rocks.

Rocks exhibiting radioactivity are—(a) granite, (b) ferruginous laterite (c) spicular earth. Some readings higher than background have also been obtained in places where there is soil cover but these are probably due to close proximity of one of the above rock types.

(a) Granite—The granite rises from the western shore of the lake to a ridge running north-south through Trig. B.27. On this slope, the granite exhibits round, comparatively fresh surfaces, but in the lake flat it is highly weathered. On P.A. 2286 there is a considerable area of decomposed granite which is much higher than lake level. It is a quartz-felspar-biotite granite of fairly even, medium grain size. There are occasional clots of coarser grains and minor developments of pegmatite. Some rather fine-grained pegmatite dykes (or granite apophyses) intrude the greenstone schists just east of G.M.L. 809 and the jaspilite just west of M.L. 12. The paucity of pegmatites in the granite is rather remarkable.

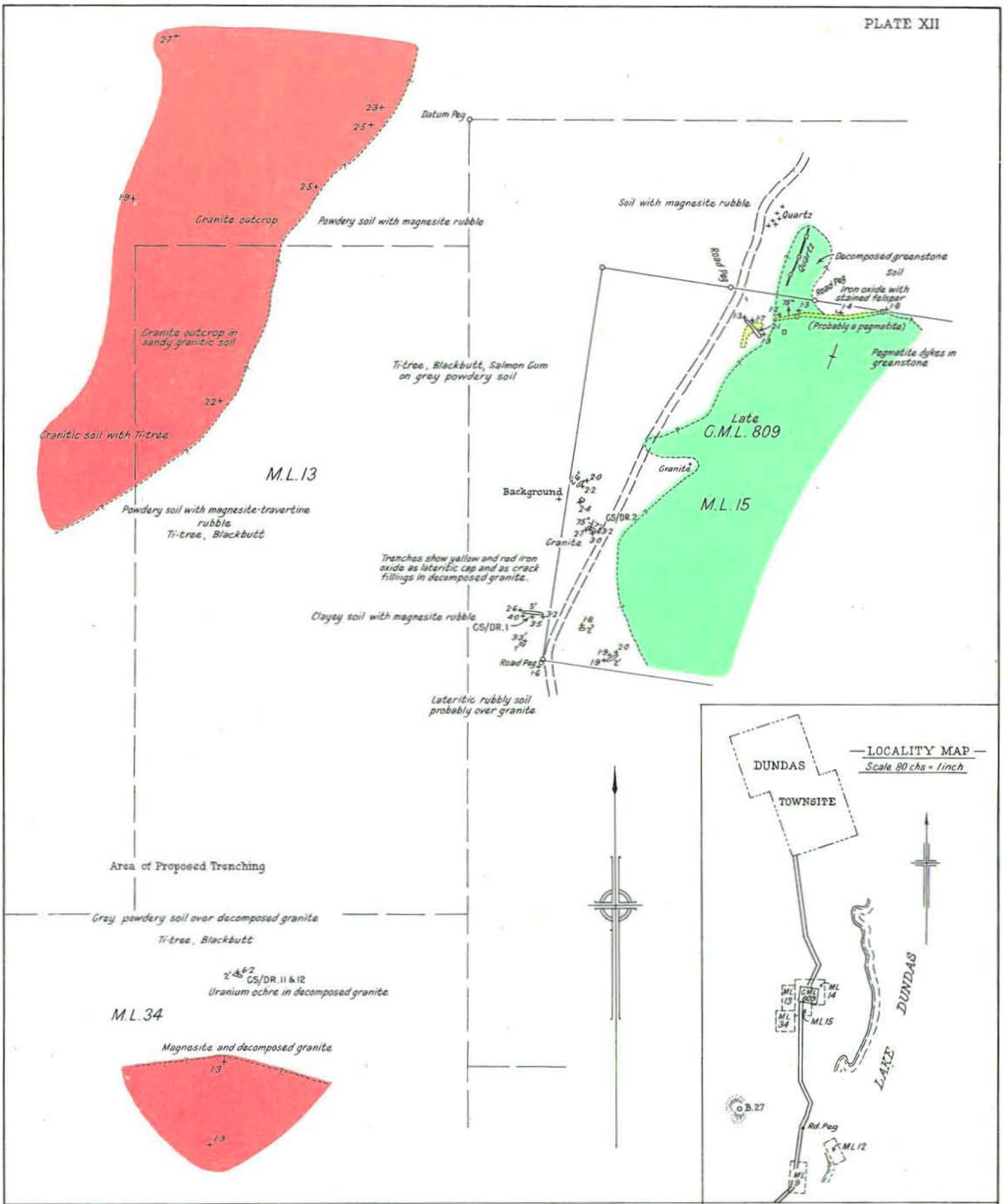
A traverse with a geiger counter, between the lake and Trig. B.27, showed that the granite exhibits radioactivity which is usually more than twice background. Readings were variable up to 4 × B and occasionally below 2 × B. There were no distinct patches of higher radioactivity—nor were any primary uranium minerals seen. Readings on the granite outcrop west of G.M.L. 809 varied 1.9 × B to 2.7 × B. Sample GS/DR/4 was tested for uranium but none was found. (See table of results).

Granite outcrops about 16 chains west of Dundas townsite gave readings of 2.5 × B and 2.6 × B.

Decomposed granite gave fairly high headings in some places. (See "Centres of Higher Radioactivity.")

(b) Ferruginous laterite and Grit—These rocks show radioactivity wherever they overlie granite or are in low-lying parts of the area. Laterite on the ridge of jaspilite is devoid of any radioactivity, as is the jaspilite itself. A laterite-capped dyke on G.M.L. 809, also limonite fillings in the

PLATE XII



LEGEND

- Soil cover
- Laterite
- Granite
- Older Greenstone Series - lavas, schists etc
- Quartz

REFERENCE

- Doubtful or assumed geological boundary
- Strike and dip of bedded rocks
- Dip of outcrops
- Track
- Costean showing depth
- Approximate boundary of Mineral Lease
- Radio-activity expressed as multiples of Background (+2·4)
- Location and number of specimen (GS/DR.2)

G.S.W.A.

PLAN SHOWING

GEOLOGY AND RADIO-ACTIVITY NEAR G.M.L. 809

2 MILES SOUTH OF DUNDAS

DUNDAS GOLDFIELD

Scale : 200 feet to an inch

Plane table and telescopic alidade survey by L.de la Hunty, Dec., 1953. "Austronic" portable geiger counter, Type P.R.M. 200, Serial No 119. Background count = 60 c.p.m.

To Trig B.27

Road Peg

Sand

Sand and clay in samphire flat

Sand

Sand and clay in samphire flat

Sand

Clay

Lake mud

LAKE DUNDAS

Sand and clay

Samphire

Sand and clay

Clay

Old Lavas

Sand and clay

Soil with Blackbutt

Samphire on sand

Datum Peg M.L.9

Grey

Yellow

Samphire

Reddish soil with Blackbutt

M.L. 9

Datum Peg M.L.12

Ferruginous grit on Meta-sediments

M.L. 12

Clay and gypsum

See Enlargement A

Scattered outcrops of cellular ferruginous grit over meta-sediments

Clay and gypsum

Blackbutt with red clay soil on slope

Banded iron formation outcrop and rubble

Ferruginous grit on meta-sediments

Blackbutt

Red clay soil

Odd small outcrops of greenstone schist

Garnet schist, mica schist, phyllite

Sand on shore

Clay and gypsum

Clay with gypsum

Dark red and yellowish ferruginous grit, (Solid but cellular)

Clay and gypsum

Broken ferruginous grit and clay

Clay and gypsum

ENLARGEMENT A
Scale: 20 feet to an inch.

Quartz boulders

Laterite on banded iron formation and meta-sediments

Lateritised banded iron formation

Lateritised banded iron formation and meta-sediments

Clay lake flat

North-plunging Syncline
(Banded iron formation and meta-sediments)

Magnetic North

— LEGEND —

- Soil
- Laterite
- Spicular earth, over granite
- Granite
- Quartz
- Whitestone Series —
- Metamorphosed sediments
- Banded Iron Formation
- Quartzite outcrops
- Older Greenstone Series - lavas, schists etc.

— REFERENCE —

- Doubtful or assumed geological boundary
- Strike and dip of baddad rocks (N — 25°)
- Strike of vertical bedding (N20°W)
- Dip of outcrops
- Track
- Approximate boundary of Mineral lease
- Radio-activity expressed as multiples of Background (+14·0)
- Location and number of specimen (GS/DR.5)

G.S.W.A.

PLAN SHOWING
GEOLOGY AND RADIO-ACTIVITY
NEAR M.L.9 & M.L.12
3 MILES SOUTH OF DUNDAS
DUNDAS GOLDFIELD

Scale: 200 feet to an inch

Plane table and telescopic alidade survey by L.de la Hunty, Dec., 1953. "Austronic" portable geiger counter, Type P.R.M. 200, Serial No 119. Background count = 65 c.p.m.

decomposed granite there, show radioactivity greater than the surrounding rocks. See GS/DR/1, 2.

A type of porous ferruginous grit, which overlies meta-sediments in the micaceous muds of the lake flat, gave some high readings on the geiger counter. Many readings of 15 × B were observed and some readings were much higher. See radiometric grid and Enlargement "A", Plate XIII.

(c) *Spicular Earth*—There is a thin cover of fairly hard, cement-like, spicular earth in two places on M.C.9. A few sponge spicules were also detected in samples from the higher ground near G.M.L. 809. The presence of these is evidence that the area was covered by a marine transgression in Miocene times. Plate XIII shows that the more northerly patch on M.C. 9 is divided into two distinct sections. The yellow earth (6.8 × B) gives a higher count than, and appears to overlie, the grey earth (4.5 × B). The readings quoted were the highest obtained in the respective colours.

Two distinct lenses, about one foot in diameter, were observed within the grey spicular earth. These were darker in colour, had clear-cut edges, and gave counts which were 50% higher than those in the surrounding grey material.

The patch of white spicular earth surrounding GS/DR/7 was originally thought to be a decomposed granite but laboratory examination showed it to contain abundant sponge spicules.

Centres of Higher Radioactivity.

The samples taken were mostly from places showing highest radioactivity within the outcrop of a particular rock type. Duplicates of samples GS/DR/7, 9, 10, 12 are retained in the Geological Survey collection—Nos. ^{2}/4469, ^{2}/4467, ^{2}/4468, ^{2}/4470, respectively.

SAMPLING RESULTS.

Approximate 2 miles South of Dundas Townsite.

Field Sample No.	Locality.	Circumstances of Occurrence.	Field Determination.	Radioactive Strength in Field.	Radioactive Strength in Laboratory.	Results of Examination.
GS/DR/1	P.A.2286(M.L.15)	At 5ft. depth in costean	Laterite over Granite	3·6 x Background	1·2 x Background	Ferruginous rock consisting of limonite, common opal and opalised clay, with a little quartz and an occasional sponge spicule.
GS/DR/2	P.A. 2286 (M.L. 15)	At 7ft. depth in costean	Iron oxide in ? pegmatite	3·2 x Background	1·1 x Background	Ferruginous rock consisting mainly of limonite with some quartz and opalised clay.
GS/DR/3	Approximate 10 chains north of N. W. corner peg M.L. 9	Surface	Laterite over Granite	3·9 x Background	1·0 x Background	Silicified ferrunginous rock consisting of limonite opal and quartz grains.
GS/DR/4	Approximate 10 chains N. W. of N. W. corner peg M. L. 9	Surface Outcrop	Granite	2·8 x Background	1·1 x Background	No uranium detected by bead test.
GS/DR/5	2 chains east of N.W. corner peg M. L. 9	Surface in lake flat	"Cement"	6·8 x Background	1·1 x Background	Spicular yellow ochreous rock. Mainly opal and clay with numerous sponge spicules and a little quartz and limonite.
GS/DR/6	2 chains east of N.W. corner peg M. L. 9	Surface in lake flat	"Cement"	4·5 x Background	1·1 x Background	Soft white spicular earth. Mainly opal and clay with numerous sponge spicules and a little quartz and felspar.
GS/DR/7	Approximate 5 chains east of S.W. corner peg M. L. 9	Surface in lake flat	Decomposed Granite	17·0 x Background	2·6 x Background	Soft white spicular earth. Mainly opal and clay with numerous sponge spicules, some quartz and a little felspar.
GS/DR/8	Approximate 2 chains east of S.W. corner peg M. L. 9	Cover on sandy clay flat	Laterite nodules	2·7 x Background	2·2 x Background	Ferruginous rock consisting mainly of limonite, with some quartz, opal, and clay and an occasional sponge spicule.
GS/DR/9	Approximate 18 chains east of N.W. corner peg M. L. 9	Surface of lake flat (1ft. thick)	Ferruginous grit overlying meta-sediments	53·2 x Background	4·5 x Background	Ferruginous rock. Mainly limonite with a little clay, quartz and opal, and occasional sponge spicules. Uranium, U = trace (less than 0·01 per cent).
GS/DR/10	Approximate 18 chains east of N.W. corner peg M. L. 9	Surface of lake flat (1ft. thick)	Ferruginous grit overlying meta-sediments	19·3 x Background	Not tested	(See Geological Survey collection ^{2}/4468).
GS/DR/11	P.A. 2289 (M.L. 34)	Horizontal channel sample. 18 ins. depth	Uranium ochre in granitic soil	4 x Background	....	Uranium, U = 0·007 per cent.
GS/DR/12	P.A. 2289 (M.L. 34)	Picked specimens from same costean as GS/DR/11	Uranium ochre in granitic soil	....	....	An iron-stained gritty clay carrying small grains of yellow uranium-vanadium ochre.

Analyst's Note:—

No. recognisable radioactive mineral was detected in samples GS/DR/1-9. The uranium content of GS/DR/9, determined by chemical analysis is much less than is indicated by radiometric assay. No thorium was detected. The radiometric count decreases with finer grinding. This suggests that radioactivity is mainly due to radon.

Highest radioactivity was exhibited by the lateritic rock on M.L. 12 (Plate XIII) and a radiometric grid, 100 ft. x 50 ft., was established in this area.

Sample GS/DR/9 represents the material which gave the highest count (53.2 × B). A count of 135 × B was recorded on this spot on the previous day, and a hole about one ft. square and one ft. deep was sunk to water table. The sample was taken from the small dump but the count of 53.2 × B was the highest recorded at that spot on the day of sampling. This indicates that the act of breaking the surprace and exposing to the atmosphere for 24 hours caused a marked drop in radioactivity. The analyst's finding that "radioactivity is mainly due to radon" gas explains this phenomenon.

Enlargement "A" on Plate XIII shows the irregular nature of the radioactive laterite—both as to its distribution and radioactive strengths.

Next in order of radiometric strengths are the spicular earths. Sample GS/DR/7 was taken from the spot giving the highest count in a small area of white spicular earth with kaolin and grains of quartz. The count of 17.0 × B was much higher than those recorded on other parts of this earth (less than 4 × B). Counts of 6.8 × B and 4.5 × B were recorded on the yellow and grey earths respectively. Although the counts (in the field) were fairly high, no uranium was detected in any of these earths. The deposits are also very small and very thin.

Counts on the decomposed granite and laterite on P.A.2286 (now M.L.15) were slightly higher than the nearby fresh granite, and much higher than the greenstone and soil covered areas in that vicinity (See Plate XII). A count of 6.3 × B was recorded on the floor of a small trench about two chains south-south-west of the south-west corner peg of P.A.2286, on P.A.2289 (now (M.L.34). The trench showed rubbly magnesite and kaolin soil to a depth of 12 inches, over a reddish clayey decomposed granite. As a result of this higher count, the trench was later deepened and lengthened by the company's geologist, and some yellow uranium ochre in "paint" form was discovered, on 14th December. Other small trenches on P.A.2289 showed very little radioactivity.

Samples GS/DR/11, 12 were taken from the trench containing the ochre, during the second inspection. Count recorded at the trench, on that occasion, was 4 × B. No. 12 was made up of the best specimens of ochreous material for the purpose of mineral determination. The mineral was found to be a uranium-vanadium ochre. GS/DR/11 was a horizontal channel sample from the south wall of the trench. Sampling length was seven feet and the sample was taken from a depth of 18 inches —being from a half-inch channel. Chemical analysis showed 0.007% U.

Following the discovery of ochre in this soil-covered area of decomposed granite, the company stated they would prospect that particular area with a trench-digging machine. This programme is to be followed up by diamond drilling if the trenching reveals more ochre.

Conclusions.

1. Of all the centres of higher radioactivity discovered in the area, the only one worthy of any further consideration is that on M.L.34—since that is the only place where a recognisable uranium mineral has been discovered.

2. It is well known that no radioactive deposit has proved worthwhile unless "recognisable uranium minerals" were present in abundance. Therefore, it is unlikely that even this prospect will develop into a commercial deposit.

3. It is likely that this ochre has been deposited rom circulating ground waters—the original ource of the uranium being minute grains of uraninite within the radioactive granite. (No uranium was detected in an analysis of this granite.)

PROGRESS REPORT ON DIAMOND DRILLING, COLLIE MINERAL FIELD, W.A. (4).

Bore No. 5.—Site D—Mineral Lease 449.
2 miles South-West of Muja.

By G. H. LOW, B.Sc.

CONTENTS.

Introduction.

Previous reports on the Governmental deep drilling at Collie have given details of the drilling plant and rig, and the technique employed by the operators. The same plant and rig were employed on hole D, and the drilling procedure was essentially similar, therefor it is not proposed to give a detailed outline here. Readers wishing to check these details will find them in the Annual Reports of the Geological Survey for 1951 and 1952.

Core Recovery and Log.

As shown in Fig. 4, the overall total core recovery was 74 %.

This figure compares favourably with earlier Diamond Drill holes, being exceeded only by that at Site J, in which the core recovery was 82½ %. The final depth at Site J was 2340 feet, compared with 2058 at Site D.

A summarised log appears as Appendix 1 of this report, and shows sediments and coal seams (three inches and thicker), intersected in this hole. The complete log, giving details of sediments and coal seams, is available at the Geological Survey office.

Geology.

This hole is the fifth in a series implemented as a result of the Geological and Geophysical Survey of Collie, to test the coal basins at depth. It was sited in what was regarded as the deepest part of the North-eastern Basin. (Fig. 3).

Drilling carried out on Prospecting Area 53, and described by Lord* indicates the existence of two depressions in the north-eastern basin. It is in the most southerly of these that Site D is located.

The depression has the general configuration of the basin in which it lies, being trough shaped and elongated north-west to south-east. The Centaur Colliery, situated near the south-eastern end, is the only colliery working coal seams of this depression.

Coal seams with a thickness of three inches or greater, intersected by this drill, are shown in a columnar section (Fig. 5), which also gives some general information on the strata, and roof and floor conditions.

The topmost seams from the hole at Site D represent an horizon which previously was unknown. This includes a 37 feet seam of good quality coal at 380 feet, which is by far the thickest encountered on the Collie field.

From the surface to 948 feet, eight seams of three feet and greater thickness were encountered, and the angle of dip, averaging about seven degrees in the core, was normal.

Below 948 feet to a depth of 1528 feet, dips were abnormally high, ranging to a maximum of 70 degrees at 1152 feet. In this section the core showed four seams of coal, three feet or more in thickness.

*1948—Lord, J. H.; Report of Prospecting Area 53 at Collie, Western Australia. *G.S.W.A. Ann. Rept. 1948.*

Fig 3

POSITION OF DIAMOND DRILL HOLE Nº 5

SITE D - C.M.L. 449 - COLLIE

Scale: 40 chains to an inch

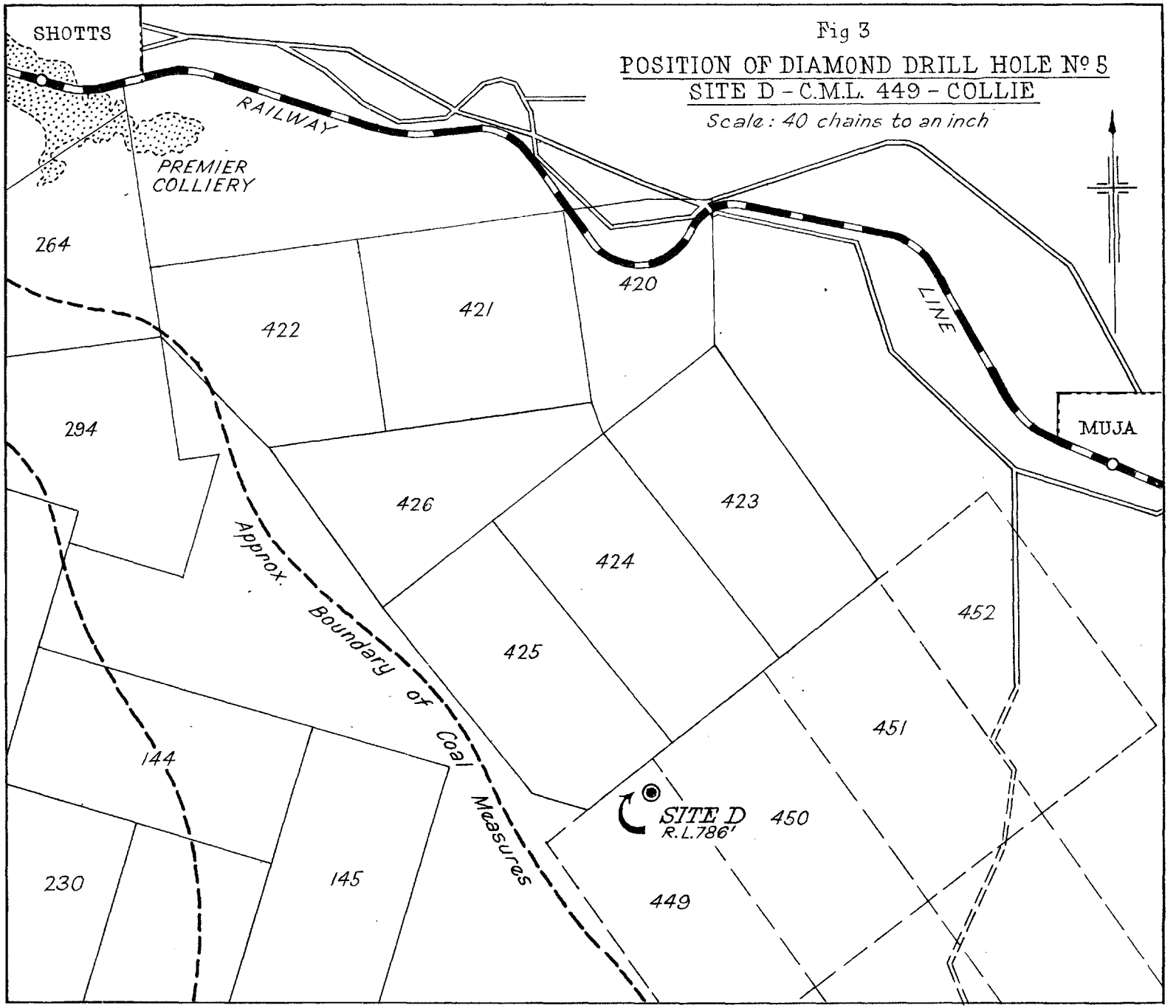
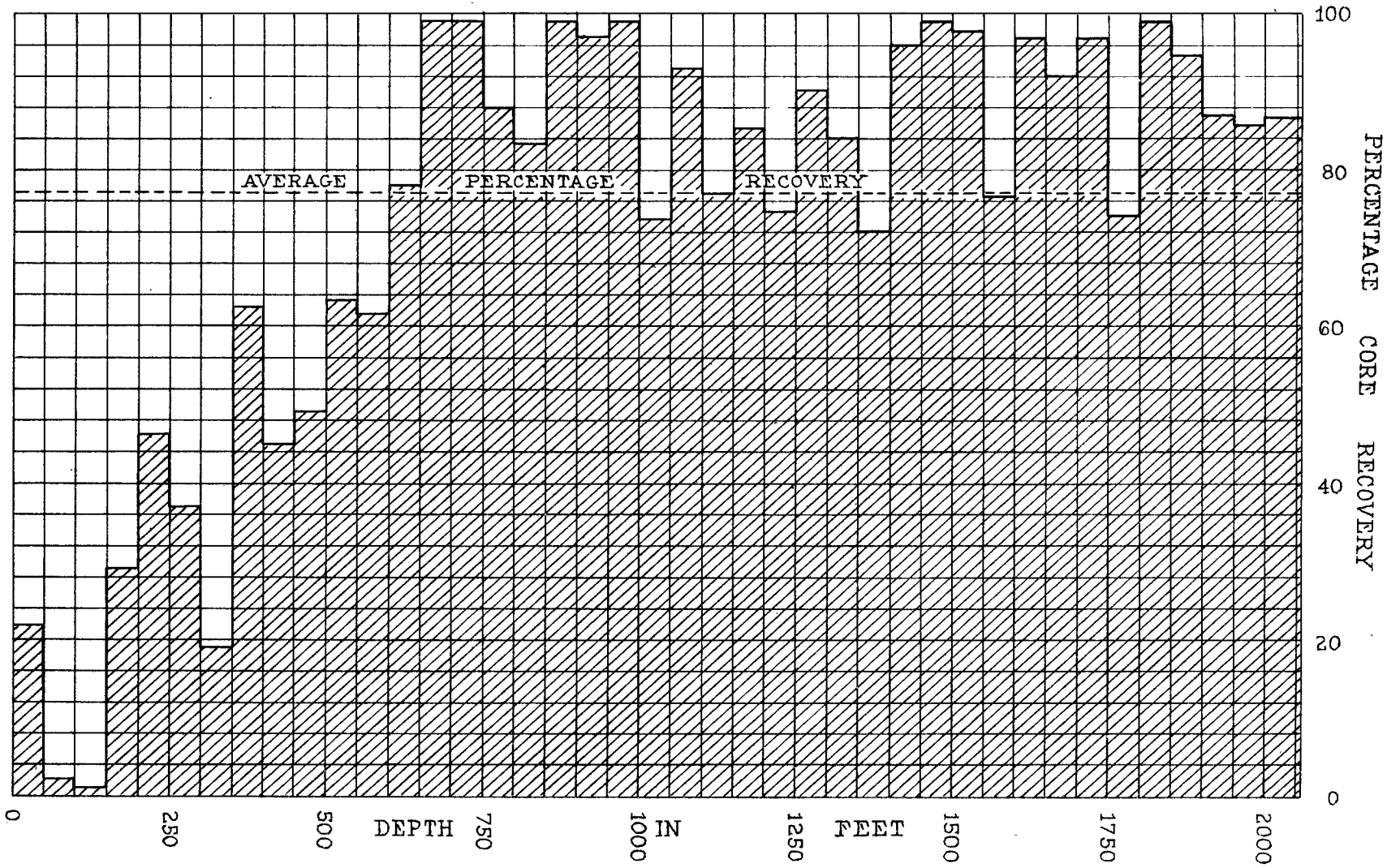


Fig. 4

DIAMOND DRILL HOLE Nº 5 - SITE D

PERCENTAGE CORE RECOVERY



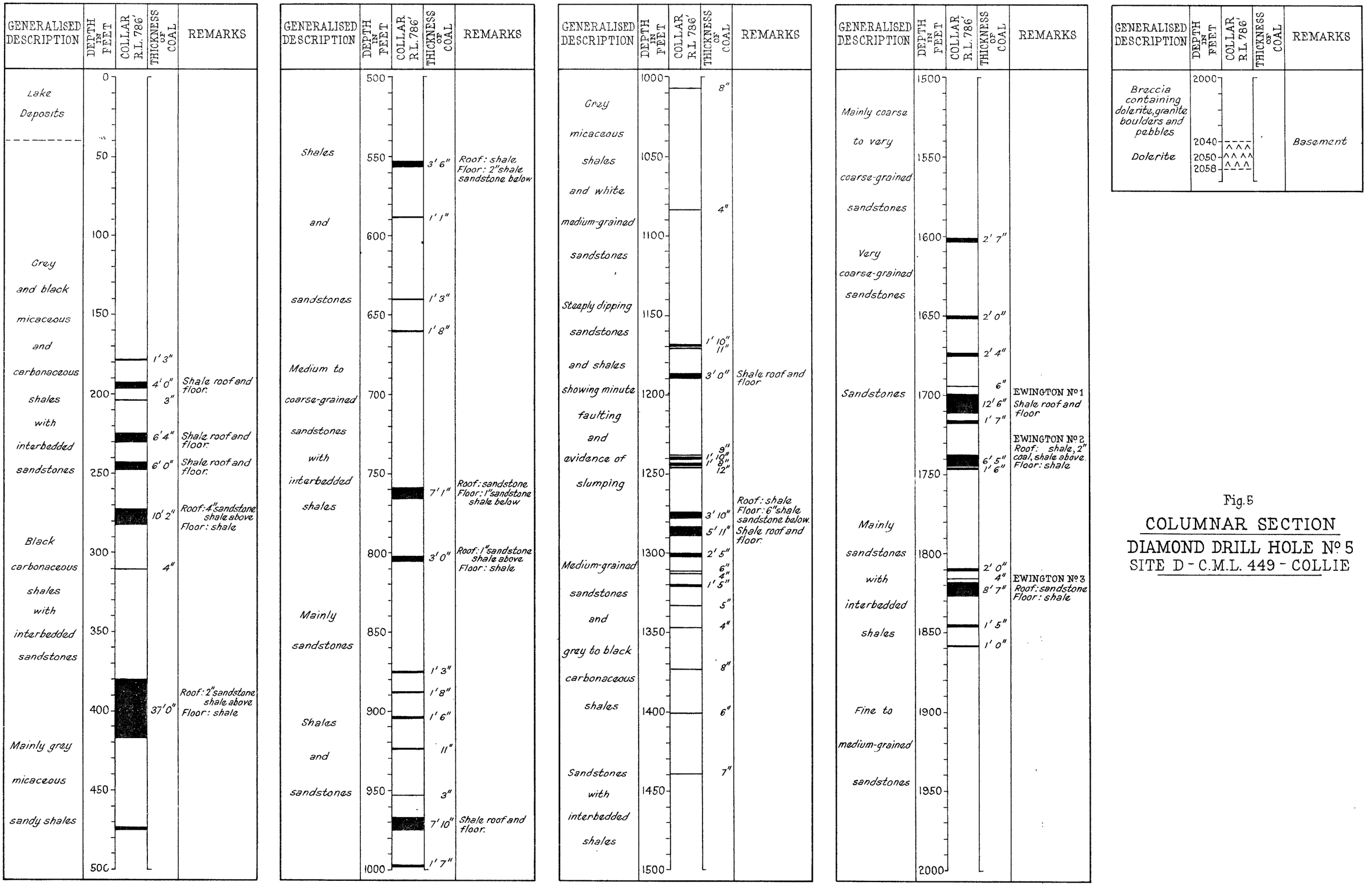


Fig. 5

COLUMNAR SECTION
DIAMOND DRILL HOLE No 5
SITE D - C.M.L. 449 - COLLIE

As well as the acute dip, many of the beds showed minute faulting and some slumping. However, no brecciated or other zone which could be actually identified as a fault plane was encountered.

Below 1528 feet dips were again normal, until the basement was encountered at 2040 feet. In this last section three important seams were met with. Because of their proximity to the basement, and their disposition and thickness, they are regarded as being the 1, 2 and 3 seams of the Ewington Horizon. These seams are:—

No. 1 (top) seam—12' 6" of coal at 1699 feet.

No. 2 (middle) seam—6' 5" of coal at 1738 feet.

No. 3 (bottom) seam—8' 7" of coal at 1818 feet.

The coal seams of the Premier Horizon, intersected during the prospecting of the southern part of P.A. 53, dip to the south, and it was expected that they would be intersected by the Diamond Drill. However, they are absent in their typical form and no correlation with the Premier Seams was possible. Whether this is due to faulting or to lensing, cannot be known until the area is more extensively drilled.

Since the beds intersected at Site D show some dip, the inference is that at least as far as the coal measures are concerned, this is not the deepest part of the basin. From general considerations it seems likely that the greatest depth will be some distance to the south of Site D.

The acute dips which exist at Site D between the depths of 948 feet and 1528 feet suggest that a relative displacement of the strata has occurred. This could conceivably be the result of either faulting or monoclinal folding. If it were the former, then it is surprising that no actual fault plane or zone was observed in the core. If it were monoclinal folding however, the appreciable thickness of the disturbed zone could be adequately explained.

In either case the result would be the same, with a difference of elevation of the same bed on opposite sides of the disturbance.

It should be remembered that the coal seams shown as occurring in the zone of steep dips will be dipping at the same angle as the beds which contain them, therefore the thickness of coal measured in the core, and shown in the columnar section, will not be the true vertical thickness of the seams.

Quality of the coal.

The results of proximate analyses carried out by the Government Chemical Laboratories on coal samples from the hole at Site D are shown in Table 1.

Table I.

PROXIMATE ANALYSES OF THE THICKER SEAMS INTERSECTED IN BORE AT SITE D.

Chem. Lab. No.	Depth.	Thickness of Sample.	As Received.					Dry and Ash Free.		Ash on Dry Basis.	Colour of Ash.
			Moisture.	Ash.	Vol. Matter.	Fixed Carbon.	Calorific Value.	Vol. Matter.	Calorific Value.		
	Feet.	ft. in.	%	%	%	%	B.Th.U.	%	B.Th.U.	%	
2611/53	193¼	4 0	20	4·4	29·0	46·6	9,670	38·3	12,790	5·8	Off white.
2612/53	224½	3 10	20	4·2	29·1	46·7	9,650	38·4	12,730	5·5	White.
2613/53	228¼	2 6	20	8·7	28·8	42·5	9,150	40·4	12,840	12·2	White
2614/53	242	6 0	20	3·2	26·2	50·6	9,710	34·1	12,640	4·2	Off white
2615/53	272¼	3 6	20	4·7	26·3	49·0	9,450	34·9	12,550	6·2	Mauve-white
2616/53	275¾	3 6	20	2·2	29·5	48·3	9,920	37·9	12,750	2·8	White
2617/53	279	3 2	20	11·8	26·0	42·2	8,505	38·1	12,470	17·3	White
2619/53	380¼	4 9	20	4·1	26·8	49·1	9,775	35·3	12,890	5·1	Salmon
2620/53	385	4 0	20	3·8	28·1	48·1	9,910	36·8	13,010	4·7	Salmon
2621/53	389	3 0	20	6·8	25·4	47·8	9,450	34·7	12,920	8·5	Salmon
2622/53	392	4 0	20	4·0	28·1	47·9	9,950	37·0	13,090	5·0	Salmon
2623/53	396	5 0	20	3·7	27·0	49·3	9,950	35·4	13,040	4·6	Salmon
2624/53	401	5 0	20	2·1	30·4	47·5	10,080	39·0	12,950	2·5	Salmon
2625/53	406	6 0	20	2·6	31·4	46·0	10,120	40·5	13,090	3·2	Salmon
2626/53	412	5 3	20	2·9	29·6	47·5	9,950	38·4	12,920	3·6	Salmon
3087/53	553½	3 6	20	5·1	29·3	45·6	9,610	39·1	12,840	6·4	Light buff
3088/53	758½	7 1	20	12·2	27·2	40·6	8,660	40·1	12,770	15·2	Light buff
3746/53	802½	3 10	20	8·3	30·5	41·2	9,290	42·5	12,940	10·4	Chocolate
3747/53	966½	3 10	20	3·2	29·2	47·6	10,090	38·0	13,140	4·0	Red-brown
3748/53	970½	4 0	20	6·3	29·0	44·7	9,660	39·2	13,100	7·9	Red-brown
5071/53	1,274¼	3 10	20	5·1	27·2	47·7	9,990	36·3	13,320	6·4	Red-brown
5072/53	1,283	5 11	20	7·3	26·0	46·7	9,620	35·8	13,230	9·1	Red-brown
5975/53	1,699	4 0	20	10·2	23·8	46·0	9,030	34·1	12,930	12·8	Dark salmon
5976/53	1,703	2 9	20	10·0	23·0	47·0	8,940	32·9	12,770	12·5	Dark salmon
5977/53	1,706¾	4 11	20	7·5	24·4	48·1	9,680	33·6	13,340	9·4	Dark salmon
5978/53	1,737¾	3 3	20	9·9	22·6	47·5	9,160	32·2	13,070	12·4	Light salmon
5979/53	1,741	3 2	20	6·0	25·7	48·3	9,950	34·7	13,430	7·5	Light salmon
6562/53	1,818½	4 0	20	6·7	24·5	48·8	9,730	33·4	13,280	8·4	Fawn
6563/53	1,822½	4 7	20	4·2	26·5	49·3	10,270	26·5	13,540	5·2	Fawn

Conclusion.

The hole at Site D, the fifth in the Collie deep drilling programme, encountered dolerite of the basement after penetrating 2040 feet of sedimentary strata. Fifteen coal seams of three feet or greater thickness were encountered.

A new and previously unknown series of beds was found to occur from the top of the coal measures to a depth of at least 420 feet. On this section five seams of three feet or greater thickness were met with, giving an aggregate of 63 feet of coal. The lowest of these seams is 37 feet thick.

The Ewington Horizon was identified, but the seams of the Premier Horizon are either absent or have been sufficiently altered in form and deposition as to be rendered unrecognisable in this section.

APPENDIX 1.

Government Deep Drilling.

Site D. Centaur Area. (Lease 449.)

Drilled by: McCallum Bros. & Grill. Commenced December 18, 1952.

Logged by: G. H. Low. Completed April 10, 1953.

Depth (feet) From		To	Summarised Log
0	-	40	Lake Deposits
40	-	178	Sediments
178	-	179¼	COAL (1ft. 3in.)
179¼	-	193¼	Sediments
193¼	-	197¼	COAL (4ft. 0in.)
197¼	-	204	Sediments
204	-	204¼	COAL (3in.), poor quality
204¼	-	224⅓	Sediments
224⅓	-	230⅜	COAL (6ft. 4in.)
230⅜	-	242	Sediments
242	-	248	COAL (6ft. 0in.)
248	-	272¼	Sediments
272¼	-	282½	COAL (10ft. 2in.)
282½	-	310	Sediments
310	-	310⅓	COAL (4in.)
310⅓	-	380¼	Sediments
380¼	-	417¼	COAL (37ft. 0in.)
417¼	-	473	Sediments
473	-	475⅓	COAL (2ft. 4in.), poor quality
475⅓	-	553½	Sediments
553½	-	557	COAL (3ft. 6in.)
557	-	588	Sediments
588	-	589	COAL (1ft. 1in.)
589	-	640	Sediments
640	-	641¼	COAL (1ft. 3in.)
641¼	-	659⅓	Sediments
659⅓	-	661	COAL (1ft. 8in.)
661	-	758⅓	Sediments
758⅓	-	765⅓	COAL (7ft. 1in.)
765⅓	-	802½	Sediments
802½	-	805½	COAL (3ft. 0in.)
805½	-	875½	Sediments
875½	-	876¾	COAL (1ft. 3in.)
876¾	-	887⅓	Sediments
887⅓	-	889	COAL (1ft 8in.), poor quality
889	-	903½	Sediments
903⅓	-	904¾	COAL (1ft. 6in.)
904¾	-	923⅜	Sediments
923⅜	-	924⅜	COAL (11in.)
924⅜	-	953⅜	Sediments
953⅜	-	954	COAL (3in.)
954	-	966½	Sediments
966½	-	974⅓	COAL (7ft. 10in.)
974⅓	-	996½	Sediments
996½	-	998	COAL (1ft. 7in.)
998	-	1007¾	Sediments
1007¾	-	1008½	COAL (8in.)
1008½	-	1073	Sediments
1073	-	1073⅓	COAL (0ft. 4in.)
1073⅓	-	1168	Sediments
1168	-	1169¾	COAL (1ft. 10in.)
1169¾	-	1171	Sediments
1171	-	1172	COAL (11in.)
1172	-	1186¾	Sediments
1186¾	-	1189¾	COAL (3ft. 0in.)
1189¾	-	1237¾	Sediments
1237¾	-	1238½	COAL (9in.)
1238½	-	1239	Sediments
1239	-	1240¾	COAL (1ft. 10in.)
1240¾	-	1243	Sediments
1243	-	1244⅜	COAL (1ft. 8in.)
1244⅜	-	1245	Sediments
1245	-	1246	COAL (12in.)
1246	-	1274	Sediments
1274	-	1278	COAL (3ft. 10in.)
1278	-	1283	Sediments
1283	-	1289	COAL (5ft. 11in.)
1289	-	1300	Sediments
1300	-	1302⅓	COAL (2ft. 5in.)
1302⅓	-	1311	Sediments
1311	-	1311½	COAL (6in.)
1311½	-	1313½	Sediments
1313½	-	1313¾	COAL (4in.)
1313¾	-	1320	Sediments
1320	-	1321½	COAL (1ft. 5in.)
1321½	-	1333¼	Sediments
1333¼	-	1333¾	COAL (5in.)
1333¾	-	1347⅜	Sediments
1347⅜	-	1348	COAL (4in.)
1348	-	1373	Sediments
1373	-	1373⅜	COAL (8in.)
1373⅜	-	1401½	Sediments
1401½	-	1402	COAL (6in.)
1402	-	1439¼	Sediments
1439¼	-	1439¾	COAL (7in.)
1439¾	-	1601½	Sediments
1601½	-	1604	COAL (2ft. 7in.)
1604	-	1650	Sediments
1650	-	1652	COAL (2ft. 0in.)
1652	-	1673¼	Sediments
1673¼	-	1675½	COAL (2ft. 4in.)
1675½	-	1694¾	Sediments
1694¾	-	1695¼	COAL (6in.)
1695¼	-	1699	Sediments
1699	-	1711½	COAL (12ft. 6in.)
1711½	-	1716¼	Sediments
1716¼	-	1717¾	COAL (1ft. 7in.)
1717¾	-	1737¾	Sediments
1737¾	-	1744¼	COAL (6ft. 5in.)
1744¼	-	1745½	Sediments
1745½	-	1747	COAL (1ft. 6in.)
1747	-	1809	Sediments
1809	-	1811	COAL (2ft. 0in.)
1811	-	1815⅔	Sediments
1815⅔	-	1816	COAL (4in.)
1816	-	1818½	Sediments
1818½	-	1827	COAL (8ft. 7in.)
1827	-	1845¼	Sediments
1845¼	-	1846⅔	COAL (1ft. 5in.)
1846⅔	-	1858⅔	Sediments
1858⅔	-	1859⅔	COAL (1ft. 0in.)
1859⅔	-	2040¼	Sediments
2040¼	-	2058	Quartz-dolerite

PROGRESS REPORT ON DIAMOND DRILLING COLLIE MINERAL FIELD, W.A. (5).

Bore No. 6—Site H—Mineral Lease 48.

40 Chains south-west of Collie Burn Townsite.

By G. H. Low, B.Sc.

CONTENTS.

Introduction.

This hole is the sixth in a deep drilling programme at Collie, designed to prove extensions at depth of coal seams, and to prospect the confines of the coal basin.

The previous five holes were outstandingly successful in this regard, and the information gained from them has been of considerable value in working towards the ultimate object of complete correlation and definition of all coal seams at Collie.

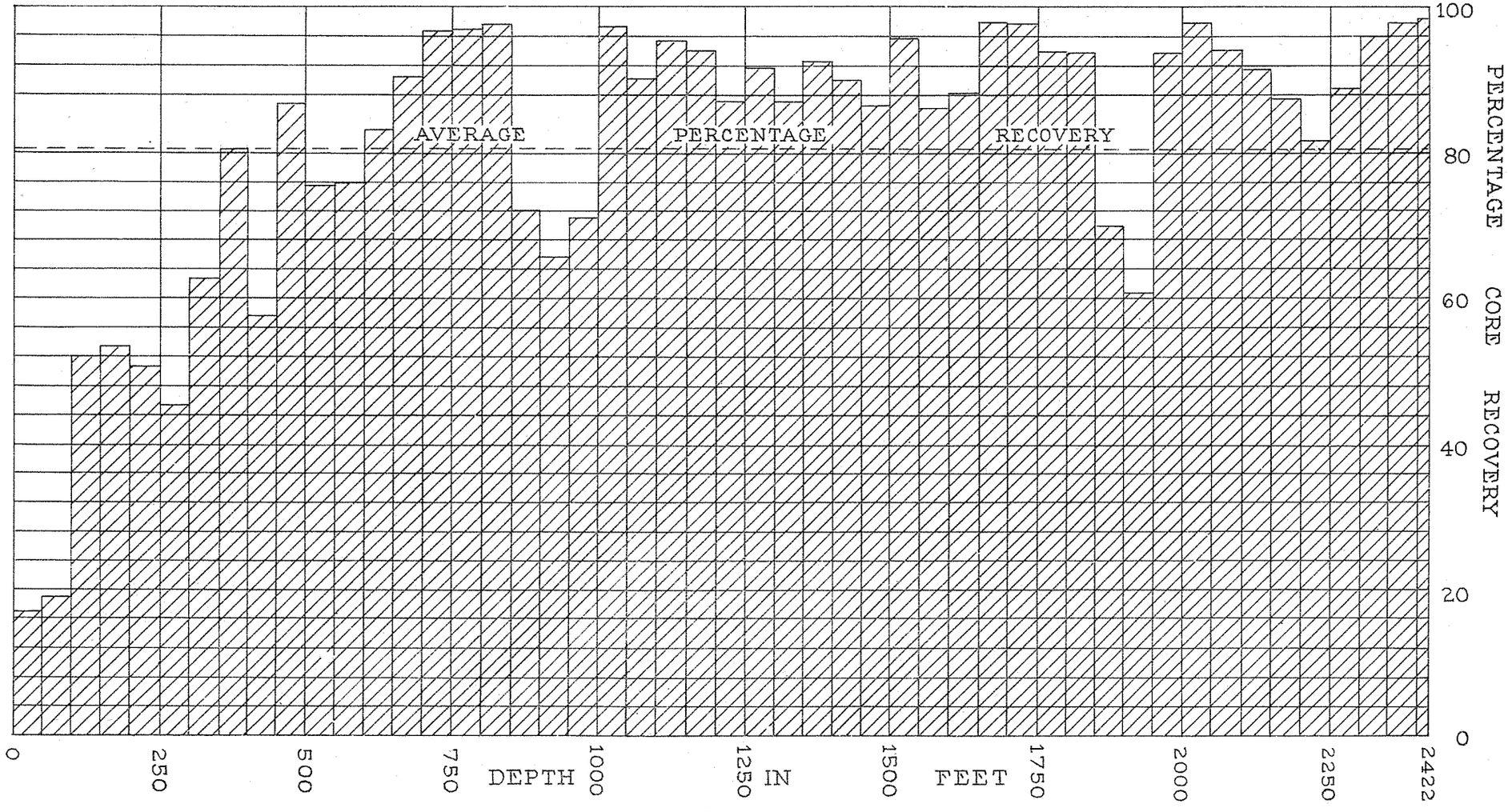
The Boyles Bros. B.B.S.-4 drilling machine used on earlier holes was used again at Site H. This machine, the rig, and general drilling method is adequately described in earlier reports. Any reader wishing to check these details is especially referred to the report on the hole at Site C in the 1951 report of the Geological Survey.

Core Recovery and Log.

The overall total core recovery for this hole was 80.8%. The core recovery graph (Fig. 6) shows a fairly steady rise from the surface to a depth of about 600 feet. From 600 feet to the bottom of the hole the core recovery figure is

Fig. 6

DIAMOND DRILL HOLE Nº 6 - SITE H
PERCENTAGE CORE RECOVERY



fairly constant except for a falling off over the two sections 850 feet to 950 feet, and 1850 feet to 1950 feet.

The strata at both of these places consists essentially of relatively unconsolidated sandstones of medium and coarse grade with a fairly high clay content. While providing a rather insecure bonding in itself, the clay has prevented the strengthening of the sandstone by siliceous or other cements.

Table 1 shows the percentage core recovery over each 50 feet of depth, and the total overall percentage for the hole.

TABLE I.

Diamond Drill Hole No. 6.

M.L. 48. R.L. 688 ft.

Site H—Collie Burn.

Drilled by : McCallum Bros & Grill. Commenced : 4th May, 1953.

Logged by : G. H. Low. Completed : 10th July, 1953.

Depth (feet).		Core Recovered.	Percentage.
From.	To		
		(feet)	
0	50	8·3	16·6
50	100	9·5	19·0
100	150	26·0	52·0
150	200	26·6	53·2
200	250	25·3	50·6
250	300	22·6	45·2
300	350	31·1	62·2
350	400	40·2	80·4
400	450	28·9	57·8
450	500	43·2	86·4
500	550	37·8	75·6
550	600	37·9	75·8
600	650	41·5	83·0
650	700	45·2	90·4
700	750	48·2	96·4
750	800	48·5	97·0
800	850	48·7	97·4
850	900	36·0	72·0
900	950	32·9	65·8
950	1,000	35·8	71·6
1,000	1,050	48·9	97·6
1,050	1,100	45·3	90·6
1,100	1,150	47·9	95·8
1,150	1,200	47·0	94·0
1,200	1,250	43·7	87·4
1,250	1,300	45·9	91·8
1,300	1,350	43·5	87·0
1,350	1,400	46·1	92·2
1,400	1,450	45·0	90·0
1,450	1,500	41·5	83·0
1,500	1,550	47·9	95·8
1,550	1,600	43·2	86·4
1,600	1,650	44·3	88·6
1,650	1,700	49·7	99·4
1,700	1,750	49·8	99·6
1,750	1,800	47·0	94·0
1,800	1,850	46·9	93·8
1,850	1,900	35·0	70·0
1,900	1,950	30·3	60·6
1,950	2,000	46·8	93·6
2,000	2,050	48·9	97·8
2,050	2,100	46·9	93·8
2,100	2,150	45·7	91·4
2,150	2,200	43·8	87·6
2,200	2,250	40·8	81·6
2,250	2,300	44·2	88·4
2,300	2,350	48·0	96·0
2,350	2,400	49·0	98·0
2,400	2,422	21·6	98·1
0	2,422	1,958·3	80·8
For contract purposes— 100	2,411⅓	1,929·9	83·5

Appendix 1 is a summarised log of the hole, which shows all coal seams of three inches or more in thickness, and the thickness of sediments between them.

A detailed log has been prepared and is available at the Perth office of the Geological Survey.

Geology.

Site H is located on Lease 48, in the Main Basin of the Collie Coal Field, about 40 chains southwest of Collie Burn Townsite, and about 12 chains distant from the most westerly workings of the old Collie Burn Colliery. (See Locality Map, Fig. 7.) The hole was drilled to test the Collie Burn and Collie Horizons of coal seams, and to sound the depth of the basin in this area.

Figure 8 is a columnar section which graphically shows all coal seams of a thickness of three inches or more, and the accompanying sediments, intersected in this hole

The coal measures are, as usual, overlain by Recent lake deposits, and in this case the deposits were found to be 80 feet thick.

The top coal seam was entered at 116 feet, and six feet one inch of coal was recovered in the core. This seam has not been worked in the Collie Burn area, and had previously been struck in only two bores. These were hand bores located about 20 chains south of the southernmost part of the Collie Burn workings.

However, a six feet eleven inch seam was found by the Government Wyvern Hole No. 2[1], occurring about 300 feet above the No. 1 Seam of the Collie Burn Horizon. The thickness of the intervening sediment has decreased to 119 feet in the Collie Burn area, but the seam has a shale roof and floor in both places.

The No. 1 Collie Burn seam was intersected at 234 feet. It was seven feet eight inches thick with a six inch shale band one foot from the floor. The roof contained almost five feet of hard black carbonaceous shale, while the floor consisted of 11 inches of grey shale, on sandstone.

Both the No. 2 and the No. 3, or Phoenix, Seams showed a decrease in thickness when compared with the Wyvern area, the No. 2 being represented by two feet nine inches at 327 feet, and the No. 3 by one feet eleven inches at 643 feet.

The No. 4 (Griffin) Seam at 847 feet, was six feet seven inches thick. It contained a three inch sandstone band one foot seven inches from the floor. The roof is fine grained sandstone, and the floor shale.

Compared with the Wyvern area the thickness of the Collie Burn Horizon has increased by about 100 feet, while the coal seams themselves, particularly the Nos. 2 and 3 seams, have become thinner.

Below the Collie Burn Horizon, 1,100 feet of sediments were drilled before the top seam of the Collie Horizon was encountered. These sediments consist essentially of interbedded shales and sandstones, typical of the Coal Basin. Several minor coal seams of no economic importance were found between the two horizons.

The No. 1 or Moira, Seam of the Collie Horizon, three feet ten inches thick, was struck at 1.961 feet. This emphasises the lenticular nature of this seam which, as indicated in the few bore results available, varies considerably in thickness from west to east across the basin. It has a hard sandstone roof, and a black shale floor.

[1] Lord, J. H.: Report on Diamond Drilling Ahead of Existing Collieries, Collie Mineral Field, W.A. II Wyvern Colliery. *G.S.W.A. Ann. Rept., 1952.*

The No. 2, or Dirty, Seam, at 1,974 feet was found to be eleven feet seven inches thick. It contains light grey shale, and sandstone bands which give it a high ash content. It has a nine inch shale roof, and a shale floor.

The No. 3, or Wallsend, Seam, sixteen feet six inches thick, was intersected at 2,031 feet. It has a hard medium grained sandstone roof, and a grey shale floor.

Several smaller seams were intersected below the Wallsend Seam, the thickest being three feet one inch at 2,073 feet.

Interbedded grey shales and standstones continued to 2,300 feet, below which a formation of fine grained sandstones, siltstones, and mudstones, with breccia and some small boulders extended downwards to the granite at 2,412 feet.

This is regarded as being the westward extension, much reduced in thickness, of a formation described by Lord in his report on the hole at Site J, Stockton area[2], and for which he suggested the name Stockton Formation.

The granite was a normal biotite type and showed no weathering when examined under a hand lens. The upper surface of the granite in the core was quite flat, and had an apparent dip of about 30 degrees. This is rather suggestive of an ice planed surface but cannot be regarded as conclusive proof of such.

Quality of Coal.

The results of proximate analyses carried out by the Government Chemical Laboratories on major seams from this hole are shown in Table 2.

Table II.

PROXIMATE ANALYSES OF THE THICKER SEAMS INTERSECTED AT SITE H.

Chem. Lab. No.	Depth.	Thickness of Sample.	As Received.					Dry and Ash Free.		Ash on Dry Basis.	Colour of Ash.
			Moisture.	Ash.	Vol. Matter.	Fixed Carbon.	Calorific Value.	Vol. Matter.	Calorific Value.		
	Feet.	ft. in.	%	%	%	%	B.Th.U.	%	B.Th.U.	%	
7556/53	115⅜	3 1	20	3·15	29·7	47·15	9,830	38·65	12,780	3·9	White
7757/53	118¾	3 0	20	5·0	27·7	47·3	9,510	36·95	12,680	6·3	White
7758/53	234	3 3	20	2·25	32·3	45·45	10,040	41·55	12,910	2·8	White
7759/53	237¼	3 0	20	10·20	28·40	41·40	9,130	40·70	13,090	12·75	White
7760/53	240¼	1 5	20	28·85	23·2	27·95	n.d.	45·30	n.d.	36·05	White
7761/53	327	2 9	20	4·5	31·40	44·10	9,930	41·55	13,150	5·65	Light brown
8075/53	847	5 0	20	2·7	31·4	45·9	10,220	40·6	13,220	3·4	Red-brown
8076/53	852½	1 4	20	5·7	29·8	44·5	9,820	40·1	13,210	7·1	Red-brown
9205/53	1,961½	3 10	20	8·95	22·0	49·05	9,470	30·95	13,330	11·2	Orange-brown
9206/53	1,983¾	1 9	20	44·6	12·4	23·0	4,100	35·0	11,600	55·75	Light brown
9207/53	1,985½	3 3	20	16·95	19·2	43·85	8,130	30·45	12,880	21·15	Orange-brown
9208/53	1,988¾	3 3	20	16·35	21·1	42·55	8,180	33·15	12,850	20·4	Dark brown
9209/53	1,992	3 4	20	11·7	19·95	48·35	9,030	29·15	13,230	29·15	Orange-brown
9210/53	2,031	4 3	20	11·2	20·65	48·15	9,200	30·0	13,380	14·0	Orange-brown
9211/53	2,035¼	4 3	20	10·35	20·45	49·2	9,350	29·35	13,420	12·95	Brown
9212/53	2,039¼	4 0	20	8·45	20·9	50·65	9,650	29·2	13,490	10·55	Brown
9213/53	2,043¼	4 0	20	6·55	22·1	51·35	9,970	30·1	13,590	8·2	Brown

Excepting for the bottom one-half of No. 1 Seam, the seams of the Collie Burn Horizon analysed typically with a low ash content.

The top 21 inches of the No. 2 Seam of the Collie Horizon contained light grey shale bands, which accounts for the high ash content (44.6%) in this sample. There was also a four inch black shale band four feet from the top of this seam. Excluding the top 21 inches, its average calorific and ash values on a 20 per cent. moisture basis were 8,787 B.Th.U's and 15 per cent. respectively.

The Wallsend Seam averaged 9.14 per cent. ash and 9,542 B.Th.U's on the same basis.

Conclusion.

The Deep Drill Hole at Site H, south-west of Collie Burn, encountered the granite basement of the Collie Main Basin at 2,412 feet.

The seams of the Collie Burn and Collie Horizons were intersected. The seams of the former, especially Nos. 2 and 3, showed a general diminution in thickness.

[2] 1952 Lord, J. H.: Report on Diamond Drilling ahead of existing Collieries, Collie Mineral Field, W.A. III Stocton Colliery. *G.S.W.A. Ann. Rept. 1952.*

APPENDIX I.

Government Deep Drilling.

Hole No 6; C.M.L. 48.

Deep Drill Site H.

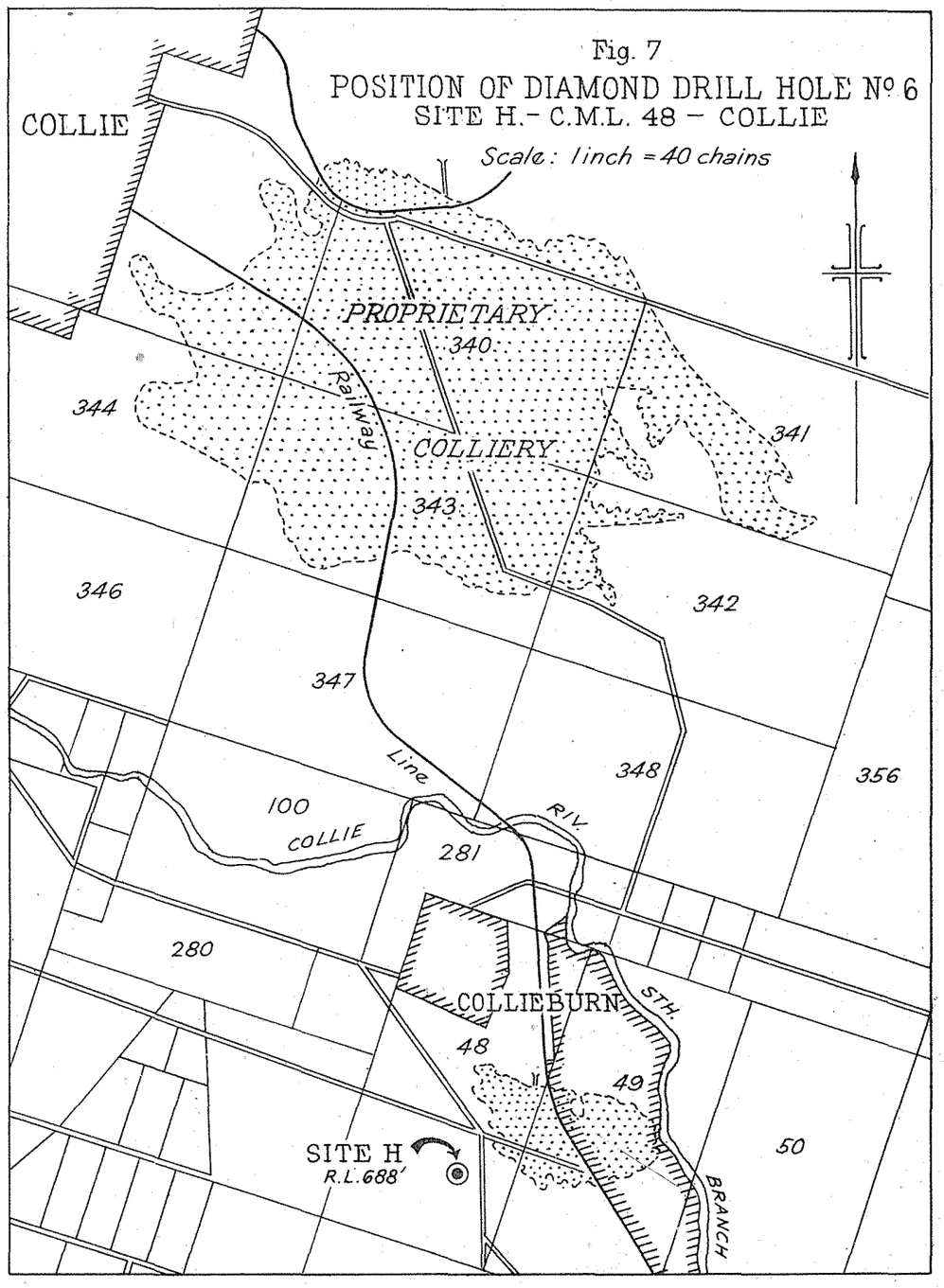
Drilled by: McCallum Bros. & Grill. Commenced: 4th May, 1953.

Logged by: G. H. Low. Completed: 10th July, 1953.

Depth (feet) From		To	Summarised Log
0	-	115⅔	Sediments
115⅔	-	121¾	COAL (6ft. 1in.)
121¾	-	145¼	Sediments
145¼	-	146	COAL (9in.)
146	-	169½	Sediments
169½	-	169¾	COAL (4in.)
169¾	-	203⅔	Sediments
203⅔	-	204	COAL (4 in.)
204	-	204⅓	Sediments
204⅓	-	205	COAL (7in.)
205	-	206	Sediments
206	-	207	COAL (11in.)
207	-	217	Sediments
217	-	217¼	COAL (3in.)
217¼	-	234	Sediments
234	-	241⅔	COAL (7ft. 8in.)
241⅔	-	287⅔	Sediments

Fig. 7

POSITION OF DIAMOND DRILL HOLE Nº 6
SITE H.- C.M.L. 48 – COLLIE



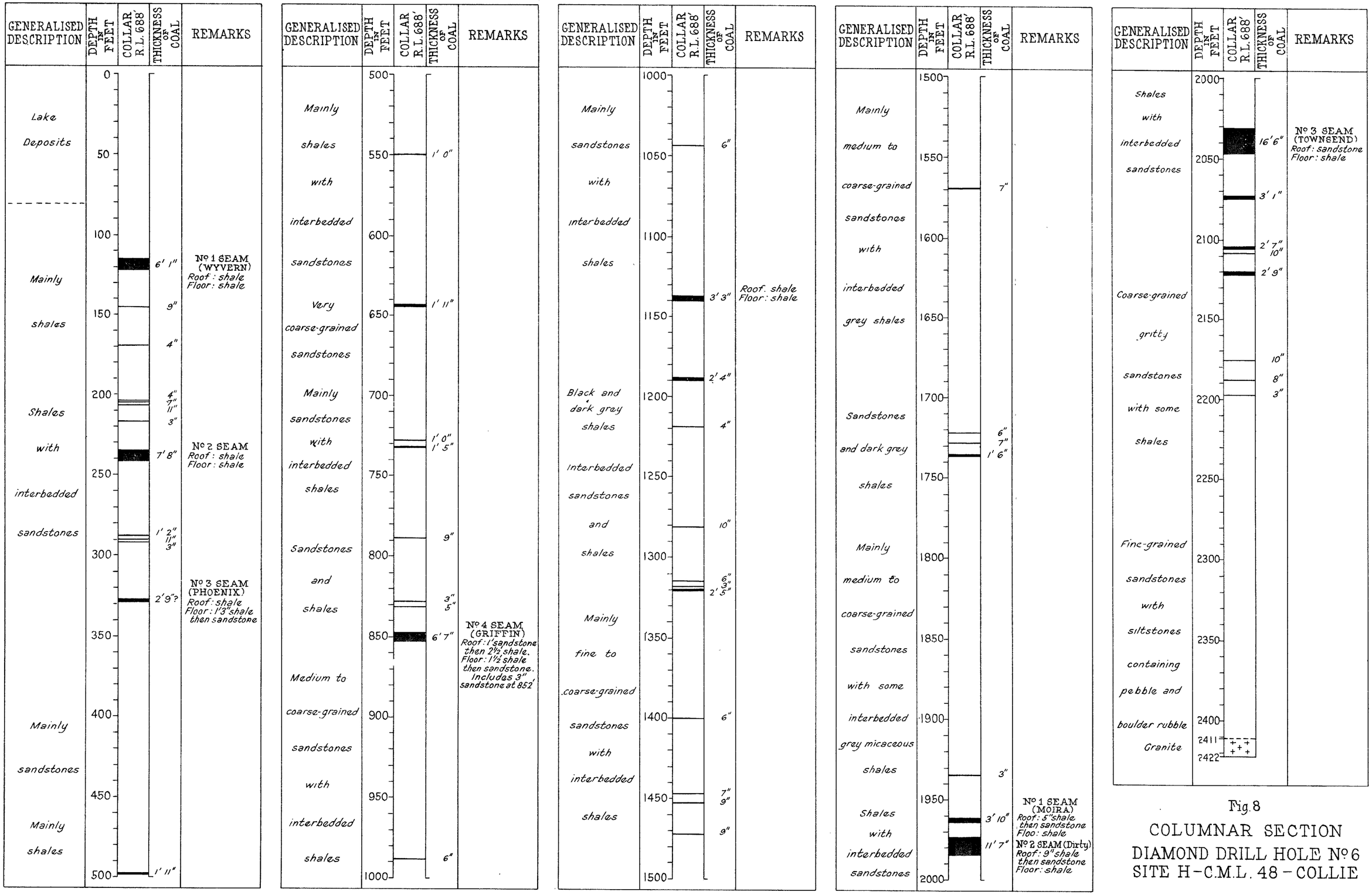


Fig. 8

COLUMNAR SECTION
DIAMOND DRILL HOLE Nº 6
SITE H-C.M.L. 48 - COLLIE

Depth (feet) From		To	Summarised Log
287⅝	-	288¾	COAL (1ft. 2in.)
288¾	-	289¼	Sediments
289¼	-	290¼	COAL (11in.)
290¼	-	291	Sediments
291	-	291¼	COAL (3in.)
291¼	-	327	Sediments
327	-	329¾	COAL (2ft. 9in.-broken core)
329¾	-	497¾	Sediments
497¾	-	498¾	COAL (1ft. 1in.)
498¾	-	549	Sediments
549	-	550	COAL (1ft. 0 in.)
550	-	643	Sediments
643	-	645	COAL (1ft. 11in.)
645	-	728⅓	Sediments
728⅓	-	729⅓	COAL (1ft. 0in.)
729⅓	-	732¾	Sediments
732¾	-	734¼	COAL (1ft. 5in.)
734¼	-	788¼	Sediments
788¼	-	789	COAL (9in.)
789	-	828¾	Sediments
828¾	-	829	COAL (3in.)
829	-	831½	Sediments
831½	-	832	COAL (5in.)
832	-	847	Sediments
847	-	853½	COAL (6ft. 7in.-broken core)
853½	-	988½	Sediments
988½	-	989	COAL (6in.)
989	-	1043⅜	Sediments
1043⅜	-	1044¼	COAL (6in.)
1044¼	-	1137½	Sediments
1137½	-	1140⅜	COAL (3ft. 3in.)
1140⅜	-	1188¼	Sediments
1188¼	-	1190½	COAL (2ft. 4in.)
1190½	-	1219	Sediments
1219	-	1219⅓	COAL (4in.)
1219⅓	-	1281	Sediments
1281	-	1281¾	COAL (10in.)
1281¾	-	1314½	Sediments
1314½	-	1315	COAL (6in.)
1315	-	1318½	Sediments
1318½	-	1318¾	COAL (3in.)
1318¾	-	1319¼	Sediments
1319¼	-	1321¾	COAL (2ft. 5in.)
1321¾	-	1400⅓	Sediments
1400⅓	-	1400¾	COAL (6in.)
1400¾	-	1447	Sediments
1447	-	1447½	COAL (7in.)
1447½	-	1453¾	Sediments
1453¾	-	1454½	COAL (9in.)
1454½	-	1472	Sediments
1472	-	1472¾	COAL (9in.)
1472¾	-	1569¾	Sediments
1569¾	-	1570¼	COAL (7in.)
1570¼	-	1722	Sediments
1722	-	1722½	COAL (6in.)
1722½	-	1728¼	Sediments
1728¼	-	1728¾	COAL (7in.)
1728¾	-	1735½	Sediments
1735½	-	1737	COAL (1ft. 6in.)
1737	-	1934¾	Sediments
1934¾	-	1935	COAL (3in.)
1935	-	1961½	Sediments
1961½	-	1954¼	COAL (3ft. 10in.)
1954¼	-	1973¾	Sediments
1973¾	-	1985¼	COAL (11ft. 7in.—contains 4in. shale at 1977½ft.)
1985¼	-	2031	Sediments
2031	-	2047½	COAL (16ft. 6in.)
2047½	-	2073	Sediments
2073	-	2076	COAL (3ft. 1in.)
2076	-	2104	Sediments
2104	-	2106½	COAL (2ft. 7in.)
2106½	-	2108¼	Sediments
2108¼	-	2109	COAL (10in.)
2109	-	2119¾	Sediments
2119¾	-	2126½	COAL (2ft. 9in.)
2126½	-	2174½	Sediments
2174½	-	2175	COAL (6in.)
2175	-	2176	Sediments
2176	-	2176¾	COAL (10in.)
2176¾	-	2188½	Sediments
2188½	-	2189⅓	COAL (8in.)
2189⅓	-	2197¾	Sediments
2197¾	-	2198	COAL (3in.)
2198	-	2411⅓	Sediments
2411⅓	-	2422	Granite

End of the Hole.

PRELIMINARY REPORT ON GOVERNMENT "FAILING" DRILLING, CENTAUR AREA. Collie Mineral Field, W.A.

By G. H. LOW, B.Sc.

CONTENTS.

Introduction.

A drilling programme to prospect and define the general geological attitude, and the extent of coal seams in the southern part of the North-Eastern Basin is being carried out by a Government Failing A1500 Drill under the supervision of the Geological Survey.

This report concerns the first three holes drilled in this programme. The positions of these three holes are shown on the Locality Plan (Fig. 9).

The Failing Drill, which is trailer mounted, uses either Failing or NM diamond bits. Drag bits and Reed Hard Formation bits have also been used but give a most unsatisfactory core recovery, particularly in coal. They are now used only where core recovery is not essential.

The holes drilled are designated holes A, B, and C. Hole A was sited to be on the extended line of the Centaur Mine Main Tunnel. The other two holes complete a triangle designed to give the maximum possible information regarding the number of coal seams, and their strike and dip.

Core Recovery and Log.

The average core recoveries for holes A, C, and B, drilled in that order, were 56.3 per cent., 41.6 per cent., and 72 per cent respectively. Because of very poor recovery over the initial 700 feet of hole C, using drag, and hard rock bits, it was decided to recore a section on either side of the 14 ft. Centaur Seam. The recovery over this redrilled section was 49.0 per cent., using a diamond bit.

A summarised log of each of the three holes appears as Appendix 1. of this report. These logs show all coal seams of three or more inches in thickness, and the intervening sediments. Columnar sections are shown in Fig. 2. Appendix 2. is the percentage core recovery over each 50 feet of the holes.

Geology.

These three holes are sited near the southern end of the north-eastern basin of the Collie Coal Field, and ahead of the workings of the Centaur Colliery. Sites A and B are in Lease 459. Site C is 23 chains directly south of B, in Lease 465. The coal basin gets shallower to the west, south and east of these holes.

The Centaur Colliery, about 40 chains south-east of C, is working a coal seam 14 feet thick. The blind outcrop of this seam, and another which lies about 100 feet above it, and averages eight feet six inches in thickness, has been traced for some distance north and south of the colliery by a series of holes percussion drilled by the Griffin Coal Mining Company.

It has been suggested that these seams belonged to the Ewington Horizon which has been encountered in Government Drilling near Shotts in the northern part of this basin. However, evidence from these three Failing holes indicates that this is not the case, and that in this area the Ewington seams are some 600 feet below the seam worked in the Centaur Mine.

The following table shows a correlation of important seams intersected in these three holes. They are arbitrarily numbered 1, 2, 3 etc.

Table 1.

CORRELATION OF COAL SEAMS ENCOUNTERED IN GOVERNMENT FAILING HOLES, CENTAUR AREA.

Site "A" (R.L. 802'.)		Site "B" (R.L. 766'.)		Site "C" (R.L. 728'.)	
Thickness of Seam.	Depth.	Thickness of Seam.	Depth.	Thickness of Seam.	Depth.
ft. in.	ft.	ft. in	ft.	ft. in	ft.
4 0	142	(a)	(a)	(a)	(a)
5 6	186	(a)	(a)	(a)	(a)
5 3	290	(d)	(d)	(a)	(a)
6 5	474	5 4	226	(c)	(c)
4 1	558	2 10	288	(c)	(c)
8 9	580	8 5	317	(c)	(c)
2 4	620	3 7	361	2 7	285
14 0	696	13 6	420	13 6	340
(b)	(b)	7 11	579	(c)	(c)
(b)	(b)	3 6	605	(c)	(c)
(b)	(b)	(b)	(b)	6 8	938
(b)	(b)	(b)	(b)	4 4	965
(b)	(b)	(b)	(b)	6 7	1027

(a) Bore sited beyond outcrop of this seam.
(b) Bore stopped above this seam.
(c) Core lost.
(d) Hole non-coring at this depth.

The hole at Site A was taken down to 724 feet, and intersected seven seams of three feet or greater thickness, which gives a total of 48 feet of coal. The two seams which were known to exist from the Griffin Company drilling were encountered at 580 and 690 feet, and measured eight feet nine inches and 14 feet respectively.

Other important intersections in this hole were:— four feet at 142 feet, five feet six inches at 186 feet, five feet three inches at 290 feet, six feet five inches at 474 feet, and four feet one inch at 558 feet.

The hole at Site C was drilled to the bottom of the sedimentary formations. Granite of the basement was encountered at 1183 feet. Unfortunately the use of hard formation bits over the initial 700 feet of this hole resulted in very poor coring, and made definite correlation of the seams impossible.

For this reason, when the granite had been reached, it was decided to re-core the strata on either side of the 14 feet Centaur Seam. Accordingly the drill was moved about 20 feet and the section from 270 to 376 feet re-drilled. This resulted in a recovery of 13 feet 6 inches from the Centaur Seam.

Other important intersections in this hole were six feet eight inches at 938 feet, four feet four inches at 965 feet, and six feet seven inches at 1,027 feet.

Because of their proximity to the bottom of the coal measures, and their general similarity to the bottom seams encountered in the Government Deep Drill hole at Site C, north-east of Shotts[1], these are considered to represent the Ewington Horizon in this area.

The following table gives a comparison of these seams and minor seams between them.

Table 2.

COMPARISON OF BOTTOM SEAMS AT CENTAUR AREA AND SHOTTS.

Seam.	Site "C" Centaur Area.		Site "C." N.E. of Shots.	
	Thickness.	Sediments between.	Thickness.	Sediments between.
	ft. in.	ft. in	ft. in.	ft. in.
	2 9	....	3 4	....
	....	14 0	....	19 0
No. 1 (Top) Seam	6 8	....	12 9	....
	....	5 0	....	54 0
	2 5	....	2 2	....
	....	14 0	....	2 0
No. 2 (Middle) Seam	4 4	....	4 7	....
	....	58 0	....	27 0
No. 3 (Bottom) Seam	6 7	....	8 9	....

The hole at Site B was taken to a depth of 834 feet. Because of information obtained from the first two holes it was unnecessary to core the first 200 feet of this hole.

The seams intersected at Site B, excepting those below the 14 feet Centaur Seam and above the Ewington Horizon, can be correlated with those in the other holes.

Between 550 and 620 feet are two seams greater than 3 feet. These are seven feet eleven inches at 579 feet and 3ft. 6in. at 605 feet. The hole at Site A was not deep enough to intersect these seams, and the poor core recovery at C precludes their certain correlation in that hole.

The logs of these three holes give a complete picture of the coal seams occurring in this part of the basin. There appears to be three horizons of coal deposition. The upper two are separated by about 120 feet of sediments, while the middle and lower horizons are separated by some 600 feet of sediments. In both cases these sediments consist mainly of coarse grained sandstones, containing grit and pebbles in places, with some interbedded shales.

A feature of a considerable proportion of these sandstones is their very porous nature and uniform composition. They consist essentially of sub angular to moderately rounded quartz particles, rather insecurely bonded by either clay or siliceous cement.

Below the Ewington Horizon in Hole C, the sandstones and grits were, by comparison, quite fresh, and are probably better called arkoses. Under a hand lens they may be seen to contain angular quartz and felspar and an appreciable quantity of biotite. They appear to have been formed directly from the breakdown of a granite.

In the area bounded by these three holes, the seams are dipping at 10° (1 in 6) in the direction of N. 80° W.

Further prospecting by drilling will be necessary to prove the exact behaviour of the coal seams discovered by the Failing drill. The Failing programme should be supplemented by percussion drill holes sited nearer the blind outcrops. It is anticipated however, that the three seams of the Ewington Horizon will remain rather deep in the basin in this area, and rather than blind outcropping in the usual manner beneath a superficial cover of Recent lake deposits, will lens out against the granite confines of the basin.

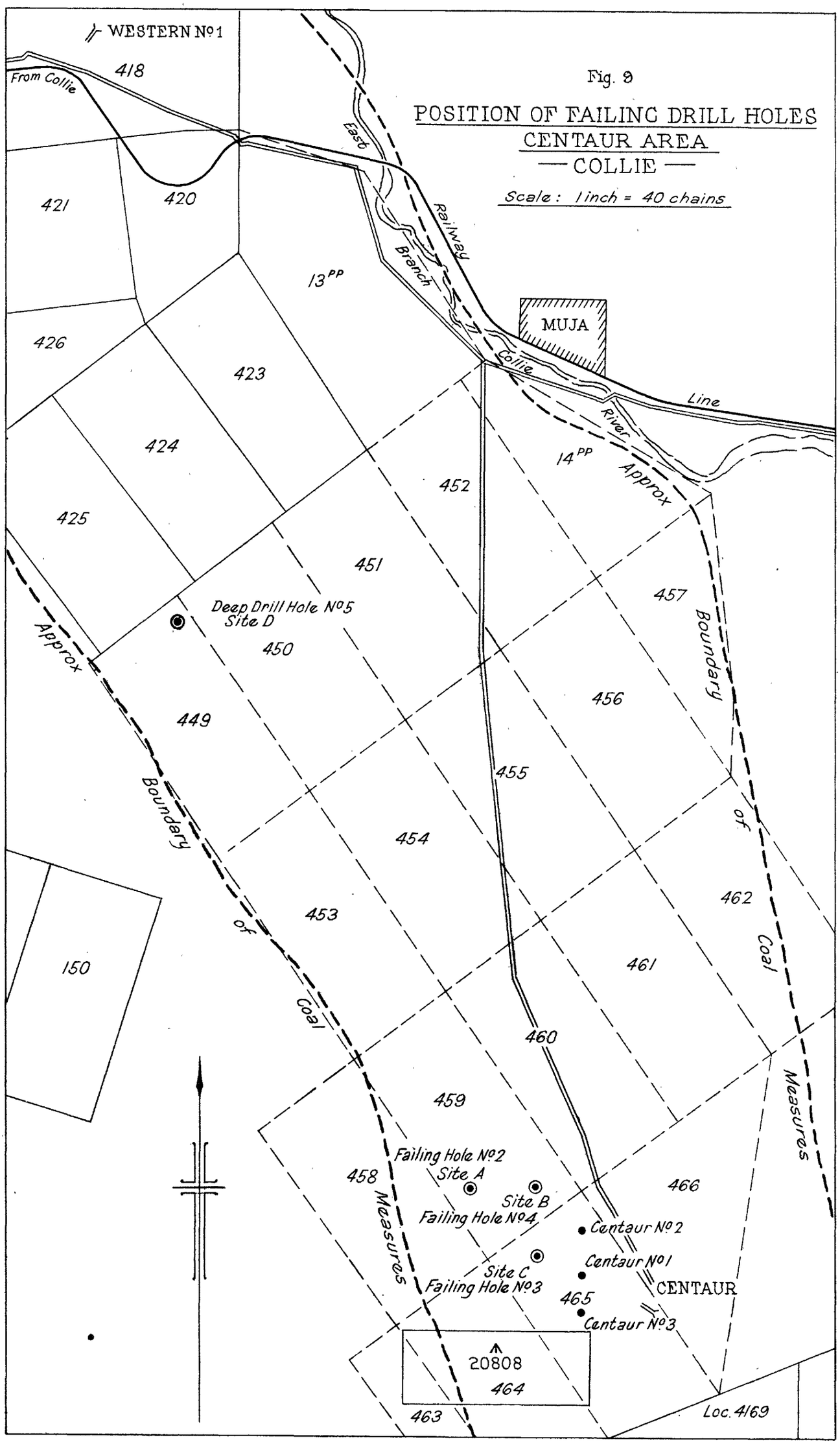
Excepting for reference to the 8 feet and 14 feet Centaur Seams and the Ewington Horizon, no attempt has been made here to suggest a classifica-

[1] Lord, J. H. Prog. Rept. on Diamond Drilling, Collie Mineral Field, W.A. No. 1 Site C, M.L.415, North-East of Shotts. *G.S.W.A. Ann. Rept. 1951.*

Fig. 9

POSITION OF FAILING DRILL HOLES
CENTAUR AREA
— COLLIE —

Scale: 1 inch = 40 chains



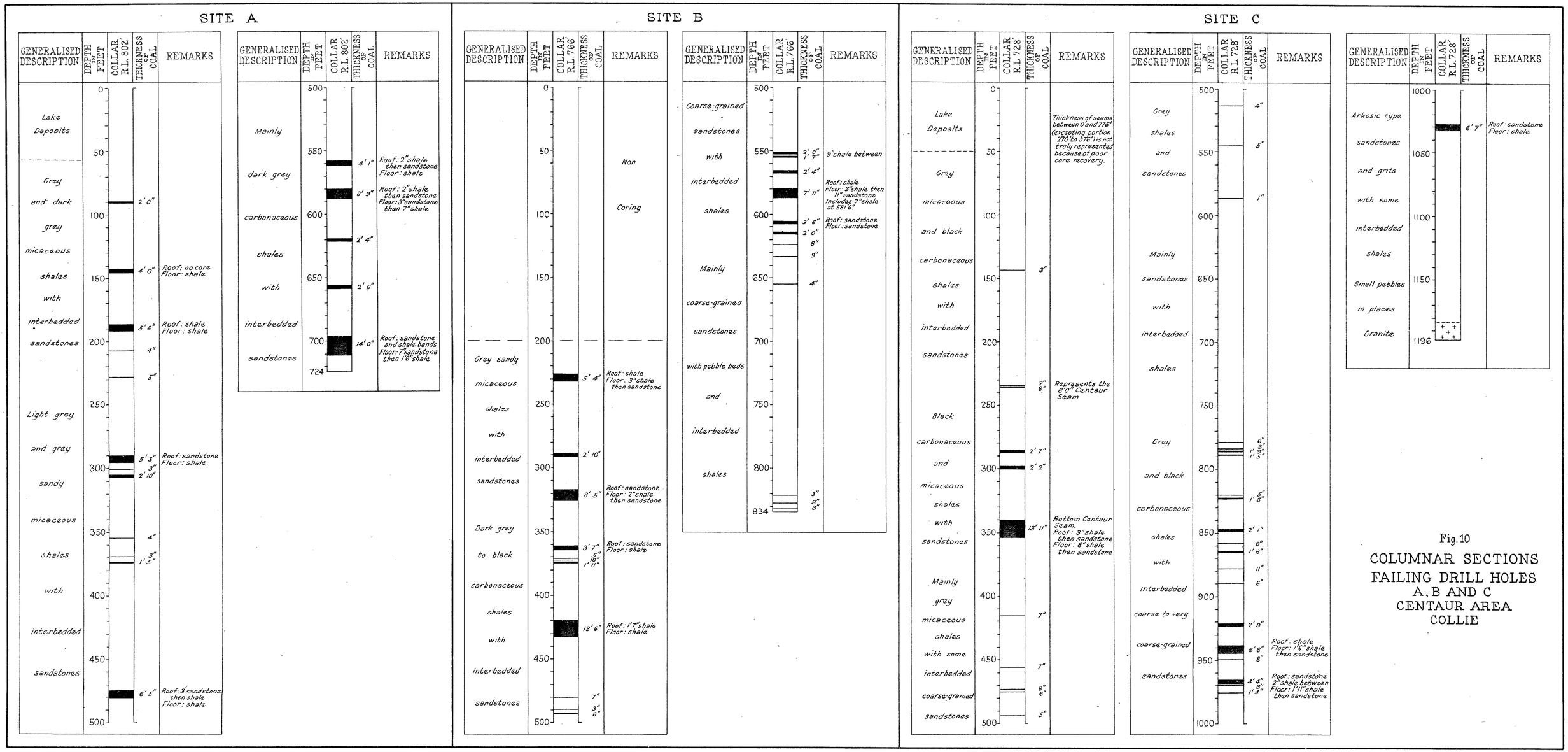


Fig. 10

COLUMNAR SECTIONS
FAILING DRILL HOLES
A, B AND C
CENTAUR AREA
COLLIE

tion of the various seams encountered during the drilling. It is felt that it is advisable to await further results from the drilling now in progress before so doing.

Quality of Coal.

The results of proximate analyses carried out by the Government Chemical Laboratories on coal samples from seams encountered during the drilling of these three Failing holes are shown in Table 3.

Table III.

PROXIMATE ANALYSES OF SEAMS AT SITE A—CENTAUR AREA.

Chem. Lab. No.	Depth.	Thickness of Sample.	As Received.					Dry and Ash Free.		Ash on Dry Basis.	Colour of Ash.
			Moisture.	Ash.	Vol. Matter.	Fixed Carbon.	Calorific Value.	Vol. Matter.	Calorific Value.		
	Feet.	ft. in.	%	%	%	%	B.Th.U.	%	B.Th.U.	%	
2610/53	142	4 0	20	5·3	31·3	43·4	9,410	41·9	12,600	6·6	Off white
2608/53	186⅔	3 0	20	2·2	31·1	46·7	10,100	40·0	12,980	2·7	Mauve-white
2609/53	189⅔	2 6	20	7·2	28·8	44·0	9,140	39·6	12,550	9·0	White
3089/53	290	5 3	20	7·4	27·5	45·1	9,330	37·9	12,840	9·2	Off white
3090/53	475	5 9	20	3·7	29·5	46·8	9,865	38·7	12,930	4·6	Pink
3091/53	480¾	1 0	20	27·2	22·6	30·2	6,360	42·8	12,050	34·0	Off white
3092/53	558	4 1	20	6·4	27·0	46·6	9,505	36·7	12,920	8·0	Off white
3093/53	580	4 7	20	5·2	27·6	47·2	9,565	36·9	12,790	6·5	Light brown
3094/53	584½	4 2	20	5·0	29·4	45·6	9,630	39·2	12,850	6·2	Light brown
3743/53	696⅓	4 8	20	3·2	28·5	48·3	9,870	37·1	12,860	4·0	White
3744/53	701	4 6	20	1·6	29·1	49·3	10,120	37·1	12,910	2·0	White
			PROXIMATE ANALYSES OF SEAMS AT SITE B—CENTAUR AREA.								
7402/53	226	2 8	20	3·65	31·7	44·65	9,815	41·55	12,860	4·55	Fawn
7403/53	228⅔	2 8	20	3·85	30·9	45·25	9,800	40·6	12,860	4·80	Buff
7404/53	317½	4 5	20	3·80	29·8	46·4	9,820	39·15	12,890	4·75	Fawn
7405/53	322	4 0	20	3·6	31·35	45·05	9,800	41·0	12,820	4·5	Fawn
7406/53	419⅔	4 6	20	3·8	29·75	46·45	9,750	39·05	12,800	4·75	White
7407/53	424¼	4 6	20	2·05	29·2	48·75	10,080	37·4	12,920	2·55	White
7408/53	428⅔	4 6	20	4·95	30·5	44·55	9,720	40·7	12,950	6·2	White
7752/53	579½	2 8	20	9·0	26·20	44·80	9,080	36·85	12,800	11·2	White
7753/53	582¼	5 3	20	4·6	28·25	47·15	9,680	37·40	12,830	5·75	White
			PROXIMATE ANALYSES OF SEAMS AT SITE C—CENTAUR AREA.								
6556/53	938	3 8	20	6·1	26·3	47·6	9,670	35·6	13,100	7·6	Red-brown
6557/53	941⅔	3 0	20	11·7	24·3	44·0	8,690	35·6	12,730	14·6	Red-brown
6558/53	964¾	2 2	20	7·6	23·6	48·8	9,240	32·6	12,760	9·5	Red-brown
6559/53	967	2 2	20	7·0	24·9	48·1	9,270	34·1	12,700	8·8	Red-brown
6560/53	1,027	3 2	20	4·5	27·4	48·1	9,740	36·3	12,900	5·6	Red-brown
6561/53	1,030¼	3 5	20	4·3	27·6	48·1	9,890	36·5	13,070	5·4	Red-brown
			CENTAUR SEAM—RE-CORED SECTION.								
7197/53	340¼	4 8	20	3·9	26·75	49·35	9,670	35·1	12,700	4·9	White
7198/53	345	4 6	20	1·85	29·0	49·15	10,070	37·1	12,880	2·3	White
7199/53	349½	4 10	20	5·8	29·45	44·75	9,460	39·7	12,740	7·25	Light purple

Conclusion.

The first three Failing holes in a programme designed to outline the geological structure of the southern part of the North Eastern Coal Basin, Collie, have proved the continuance of the 8 and 14 feet Centaur Seams in an undisturbed form for at least 50 chains ahead of the present Colliery workings.

Ten other seams of three feet or greater thickness were encountered, the three bottom-most of which are regarded as representing the Ewington Horizon in this area.

APPENDIX 1.

Failing Drill Hole No. 2.

M.L. 459. R.L. 802 ft.

Centaur Site A.

Drilled by: Day Labour. Commenced Jan. 19, 1953.

Logged by: G. H. Low. Completed Feb. 11, 1953.

Depth (feet) From		To	Summarised Log
0	-	60(?)	Lake Deposits
60	-	89	Sediments
89	-	91	COAL (2ft. 0in.)
91	-	142	Sediments
142	-	146	COAL (4ft. 0in.)
146	-	186⅔	Sediments
186⅔	-	192⅓	COAL (5ft. 6in.)
192⅓	-	207½	Sediments
207½	-	207¾	COAL (4in.)
207¾	-	228	Sediments
228	-	228½	COAL (5in.)
228½	-	290¼	Sediments
290¼	-	295½	COAL (5ft. 3in.)
295½	-	301	Sediments
301	-	301¼	COAL (3in.)
301¼	-	305	Sediments
305	-	307¾	COAL (2ft. 10in.)
307¾	-	335½	Sediments
335½	-	335¾	COAL (4in.)
335¾	-	369	Sediments
369	-	369¼	COAL (3in.)
369¼	-	373¼	Sediments
373¼	-	374¾	COAL (1ft. 5in.), poor quality
373¾	-	474½	Sediments
474½	-	481	COAL (6ft. 5in.)
481	-	558	Sediments
558	-	562	COAL (4ft. 1in.)
562	-	580	Sediments
580	-	588¾	COAL (8ft. 9in.)
588¾	-	619¼	Sediments
619¼	-	621½	COAL (2ft. 4in.)
621½	-	656	Sediments
656	-	658½	COAL (2ft. 6in.), poor quality
658½	-	696⅓	Sediments
696⅓	-	710⅓	COAL (14ft. 0in.)
710⅓	-	724	Sediments

End of Hole.

Failing Drill Hole No. 3.

M.L. 465. R.L. 728.

Centaur Area Site C.

Drilled by: Day Labour. Commenced: 17th February, 1953.

Logged by: G. H. Low. Completed: 10th April 1953.

Depth (feet) From		To	Summarised Log
0	-	42	No core
42	-	142⅜	Sediments
142⅜	-	143	COAL (3in.), evidence of severe grinding
143	-	234	Sediments
234	-	234¼	COAL (2in.), evidence of grinding
234¼	-	235	Sediments
235	-	235¾	COAL (8in.), evidence of grinding
235¾	-	297½	Sediments
297½	-	297¾	COAL (2in.)
297¾	-	317	Sediments
317	-	334	No core
334	-	335½	Sediments
335½	-	335¾	COAL (3in), evidence of grinding
335¾	-	415	Sediments
415	-	415½	COAL (7in.), evidence of grinding
415½	-	456	Sediments
456	-	456½	COAL (7in.), evidence of grinding
456½	-	473¼	Sediments
473¼	-	474	COAL (8in.), evidence of grinding
474	-	475	Sediments
475	-	475½	COAL (6in.), evidence of grinding
475½	-	493⅜	Sediments
493⅜	-	494	COAL (5in.), evidence of grinding
494	-	513⅜	Sediments
513⅜	-	514	COAL (4in.), evidence of grinding
514	-	544	Sediments
544	-	544½	COAL (5in.), evidence of grinding
544½	-	574	Sediments
574	-	586	No core
586¼	-	586⅓	COAL (1in.), evidence of severe grinding
586⅓	-	630	Sediments
630	-	644	No core
644	-	674	Sediments
674	-	694	No core
694	-	779	Sediments
779	-	799½	COAL (6in.)
779½	-	784¼	Sediments
784¼	-	784½	COAL (3 in.)
784½	-	785½	Sediments
785½	-	787¼	COAL (1ft. 9in.)
787¼	-	788¾	Sediments
788¾	-	790¼	COAL (1ft. 5in.)
790¼	-	819¾	Sediments
819¾	-	820¼	COAL (5in.)
820¼	-	821⅜	Sediments
821⅜	-	823¼	COAL (1ft. 6in.)
823¼	-	847	Sediments
847	-	849	COAL (2ft. 1in.)
849	-	858	Sediments
858	-	858½	COAL (6in.)
858½	-	864	Sediments
864	-	865⅜	COAL (1ft. 8in.)
865⅜	-	878¾	Sediments
878¾	-	879¾	COAL (11in.)
879¾	-	895	Sediments
895	-	895½	COAL (6in.)
895½	-	921¼	Sediments
921¼	-	924	COAL (2ft. 9in.)
924	-	938	Sediments
938	-	944⅜	COAL (6ft. 8in.)
944⅜	-	949⅓	Sediments
949⅓	-	950	COAL (8in.)
950	-	965	Sediments
965	-	969⅓	COAL (4ft. 4in.)
969⅓	-	969½	Sediments
969½	-	969¾	COAL (3in.)
969¾	-	974⅜	Sediments
974⅜	-	976	COAL (1ft. 4in.)
976	-	1,027	Sediments
1,027	-	1,033½	COAL (6ft. 7in.)
1,033½	-	1,183	Sediments
1,183	-	—	Granite

Failing Drill Hole No. 3A.

Centaur Area—Site C.

M.L. 465. R.L. 728 ft.

Drilled by: Day Labour. Commenced: 13th April, 1953.

Logged by: G. H. Low. Completed: 20th April, 1953.

Depth (feet) From		To	Summarised Log
0	-	270	Non coring
270	-	285½	Sediments
285½	-	288	COAL (2ft. 7in.)
288	-	298½	Sediments
298½	-	300¾	COAL (2ft. 2in.)
300¾	-	340¼	Sediments
340¼	-	354¼	COAL (13 ft. 11in)
354¼	-	—	Sediments

Hole stopped at 376ft.

Failing Drill Hole No. 4.

M.L. 459. Site B. R.L. 766 ft.

Drilled by: Day Labour. Commenced 22nd April, 1953.

Logged by: G. H. Low. Completed 18th May, 1953.

Depth (feet) From		To	Summarised Log
0	-	200	Open hole
200	-	209	No core
209	-	217	No core
217	-	226	Sediments
226	-	231⅓	COAL (5ft. 4in)—broken core)
231⅓	-	288½	Sediments
288½	-	291⅓	COAL (2ft. 10in.)
291⅓	-	317½	Sediments
317½	-	326	COAL (8ft. 5in.), Centaur No. 1 Seam
326	-	361	Sediments
361	-	364½	COAL (3ft. 7in.)
364½	-	371¼	Sediments
371¼	-	371⅜	COAL (5in.)
371⅜	-	372	Sediments
372	-	372¾	COAL (10in.)
373	-	373¼	Sediments
373¼	-	375¼	COAL (1ft. 11in.)
375¼	-	420	Sediments
420	-	433½	COAL (13ft. 6in.), Centaur No. 2 Seam
433½	-	480	Sediments
480	-	480½	COAL (7in.)
480½	-	489¾	Sediments
489¾	-	490	COAL (3in.)
490	-	492¾	Sediments
492¾	-	493¼	COAL (6in.)
493¼	-	551	Sediments
551	-	553	COAL (2 ft.)
553	-	553¾	Sediments
553¾	-	555¼	COAL (1ft. 7in.)
555¼	-	565⅜	Sediments
565⅜	-	568	COAL (2ft. 4in.)
568	-	579½	Sediments
579½	-	581½	COAL (2ft. 1in.) }
581½	-	582¼	Sediments } 7ft. 11in.
582¼	-	587½	COAL (5ft. 3in.) }
587½	-	605	Sediments
605	-	608½	COAL (3ft. 6in.)
608½	-	614¼	Sediments
614¼	-	616¼	COAL (2ft. 0in.)
616¼	-	623¼	Sediments
623¼	-	624	COAL (8in.)
624	-	633¼	Sediments
633¼	-	634	COAL (9in.)

Depth (feet) From	To	Summarised Log
634 -	654⅔	Sediments
654⅔ -	655	COAL (4in.)
655 -	821	Sediments
821 -	821¼	COAL (3in.)
821¼ -	828½	Sediments
828½ -	828½	COAL (3in.)
828½ -	832¼	Sediments
832¼ -	832½	COAL (3in.)
832½ -	834	Sediments

End of Hole.

APPENDIX 2.

Failing Drill Hole No. 2.

M.L. 459. R.L. 802 ft.
Site A. Centaur Area.
Drilled by: Day Labour. Commenced Jan. 19, 1953.
Logged by: G. H. Low. Completed Feb. 11, 1953.

Depth (Feet). From.	To.	Core Recovered. (Feet.)	Percentage.
0	50	1⅓	3
50	100	7⅔	15
100	150	11	22
150	200	34⅙	68
200	250	44	88
250	300	38½	77
300	350	35	70
350	400	24	48
400	450	20	40
450	500	27¾	55
500	550	46½	93
550	600	43½	87
600	650	15½	31
650	700	42½	85
700	724	23	92
0	724	414½	57·2

Failing Drill Hole No. 3.

M.L. 465. Centaur Area: Site C. R.L. 728 ft.
Drilled by: Day Labour. Commenced Feb. 17, 1953.
Logged by: G. H. Low. Completed April 10, 1953.

Depth (Feet). From.	To.	Core Recovered. (Feet.)	Percentage.
0	50	1·1	2·2
50	100	7·3	14·6
100	150	9·6	19·2
150	200	7·0	14·0
200	250	21·7	43·4
250	300	11·7	23·4
300	350	4·9	9·8
350	400	9·6	19·2
400	450	19·9	39·8
450	500	8·4	16·8
500	550	8·6	17·2
550	600	3·8	7·6
600	650	6·1	12·2
650	700	2·0	4·0
700	750	16·6	33·2
750	800	30·7	61·4
800	850	39·1	78·2
850	900	43·8	87·6
900	950	43·4	86·8
950	1000	45·3	90·6
1000	1050	46·6	93·2
1050	1100	38·7	77·4
1100	1150	37·0	74·0
1150	1183	29·5	89·4
0	1183	492·4	41·6

(6)—88619.

Failing Drill Hole No. 3A.

M.L. 465. Centaur Area: Site C. R.L. 728 ft.
Drilled by: Day Labour. Commenced April 13, 1953.
Logged by: G. H. Low. Completed April 20, 1953.

Depth (Feet.) From.	To.	Core Recovered. (Feet.)	Percentage.
0	270	Non Coring	
270	300	17·3	57·6
300	350	27·7	55·4
350	376	7·0	26·9
270	376	52·0	49·0

Failing Drill Hole No. 4.

M.L. 459. Centaur Area: Site B. R.L. 766 ft.
Drilled by: Day Labour. Commenced April 22, 1953.
Logged by: G. H. Low. Completed May 18 ,1953.

Depth (Feet.) From.	To.	Core Recovered. (Feet.)	Percentage.
0	200	Non Coring	
200	250	19·1	38·2
250	300	43·5	87·0
300	350	33·2	66·4
350	400	26·1	52·2
400	450	28·5	57·0
450	500	28·4	56·8
500	550	17·8	35·6
550	600	40·7	81·4
600	650	45·8	91·6
650	700	43·5	87·0
700	750	48·2	96·4
750	800	48·9	97·8
800	834	33·2	97·8
200	834	456·9	72·0

PROGRESS REPORT ON DIAMOND DRILLING. COLLIE MINERAL FIELD, W.A. (6).

Bore No. 7—Site A—Mineral Lease 384, 80 chains South-West of Collie Railway Station.

By G. H. LOW, B.Sc.

CONTENTS.

Introduction.

The Government Diamond Drill Hole at Site A, Lease 384, Collie, is the seventh drilled in the Collie Deep Drilling programme. These holes have been sited to furnish the maximum possible information about the extension at depth of the various coal horizons, and the extent and basement configuration of the field.

The Boyles Bros. B.B.S.-4 drilling machine was used again at Site A. Considerable information on the rig assembly and the mud drilling technique is given in earlier reports, and for these details readers are referred to the 1951 Report of the Geological Survey.

Core Recovery and Log.

Granite was struck in this hole at 2181 feet. The overall core recovery from the surface to this depth was 75.4 per cent. The core recovery graph (fig. 12) shows that the greatest loss occurred between the surface and 400 feet. Over this vertical section the sediments consist of soft grey shales with interbedded clays.

From 600 feet to the granite, the graph shows only minor fluctuations excepting for the section 1150 to 1300 feet where there is some falling off in medium to coarse grained sandstone beds. It will be seen that from 800 to 1150 feet, the section which contains the three seams of the Collie Horizon, the core recovery was mostly quite good.

Table 1 shows the percentage core recovery over each 50 feet depth, and the total core recovery for the hole.

Table I.

GOVERNMENT DEEP DRILL: SITE A.

Core-Recovery Table.

Depth (Feet).		Core Recovered. (Feet.)	Percentage.
From.	To.		
0	50	11·1	22·2
50	100	16·4	32·8
100	150	12·0	24·0
150	200	14·0	28·0
200	250	9·4	18·8
250	300	2·3	4·6
300	350	2·5	5·0
350	400	4·2	8·4
400	450	27·0	54·0
450	500	40·0	80·0
500	550	39·7	79·4
550	600	40·0	80·0
600	650	48·0	96·0
650	700	44·5	89·0
700	750	49·4	98·8
750	800	38·1	76·2
800	850	44·3	88·6
850	900	42·2	84·4
900	950	46·8	93·6
950	1,000	48·3	96·6
1,000	1,050	48·0	96·0
1,050	1,100	41·4	82·8
1,100	1,150	46·8	93·6
1,150	1,200	36·2	72·4
1,200	1,250	31·0	62·0
1,250	1,300	38·9	77·8
1,300	1,350	47·0	94·0
1,350	1,400	48·8	97·6
1,400	1,450	49·6	99·2
1,450	1,500	49·5	99·0
1,500	1,550	50·0	100·0
1,550	1,600	50·0	100·0
1,600	1,650	48·9	97·8
1,650	1,700	48·2	96·4
1,700	1,750	49·1	98·2
1,750	1,800	48·5	97·0
1,800	1,850	35·8	71·6
1,850	1,900	41·2	82·4
1,900	1,950	45·2	90·4
1,950	2,000	46·7	93·4
2,000	2,050	44·8	89·6
2,050	2,100	46·2	92·4
2,100	2,150	43·3	86·6
2,150	2,181	26·8	86·4
0	2,181	1,642·1	75·3
For Contract purposes—			
100	2,181	1,614·6	77·6

A summarised log of the hole showing all coal seams three inches or greater thickness, and the thickness of sediment between them, is shown as Appendix 1.

A detailed log of the hole is retained at the Perth office of the Geological Survey.

Geology.

Site A is located in Lease 384, near the north-western end of the Main Basin of the Collie Coal Field, approximately 20 chains south of the most southerly workings of the Co-operative Colliery (See Locality Map, fig. 11.). The basin gets shallower and narrower to the north-west of site A and broader and deeper to the south-east. The hole was drilled to test the Collie Horizon of coal seams, and the depth of the basin in this area.

A columnar section of the hole is shown as fig. 13. All coal seams of three inches or greater thickness, and the nature of the intervening sediments, are diagrammatically illustrated.

The coal measures are, as usual, overlain by the relatively unconsolidated Recent lake deposits. These consist of light coloured soft sandy clays. They are not very compact and did not core well. The contact between these beds and the underlying coal measures was not shown clearly in the core but is considered to be at about 48 feet.

Five seams of coal more than four feet in thickness were intersected in this hole. These all lie between the depths of 868 and 1081 feet, and belong to the Collie Horizon.

The No. 1 (Moira) Seam at 869 feet is seven feet four inches thick. It has a soft sandstone roof, and a two feet four inches shale floor which grades from black at the top to light grey at the bottom. This is underlain by firm, medium to coarse grained sandstone.

A four feet three inches seam at 896 feet three inches has not been named, but has an equivalent in a two feet one inch seam encountered in a similar stratigraphic position in a Government Failing hole sited about 48 chains north-east of Site A. (See fig. 14).

Between 909 feet nine inches and 925 feet are four small seams, aggregating eight feet eight inches. They are separated by black, carbonacous shales. This is considered to be the equivalent of the No. 2 (Dirty) Seam, showing a considerable decrease in quality due to the development of shale bands at the expense of the coal. This series of seams has a sandstone roof and floor.

The No. 3 (Wallsend) Seam is 15 feet nine inches thick and was intersected at 966 feet 10 inches. Its roof consists of seven inches of coal containing sandy lenses, overlain by 14 inches of black and light grey banded sandy shale. The floor is six feet of hard black shale.

The other two significant seams are four feet nine inches at 1050 feet five inches, with a shale roof and floor; and four feet eight inches at 1076 feet four inches. The latter seam has a soft coarse grained sandstone roof and a shale floor.

Fig. 4 is a geological section through Site A and the Government Failing Hole No. 1, Site B, Co-operative Colliery. It shows the major seams of the Collie Horizon intersected in both holes, and the projected position of the No. 3 seam from the Co-operative Colliery workings. It shows that the Failing Hole is sited in a trough faulted area which has a downthrow of approximately 250 feet.

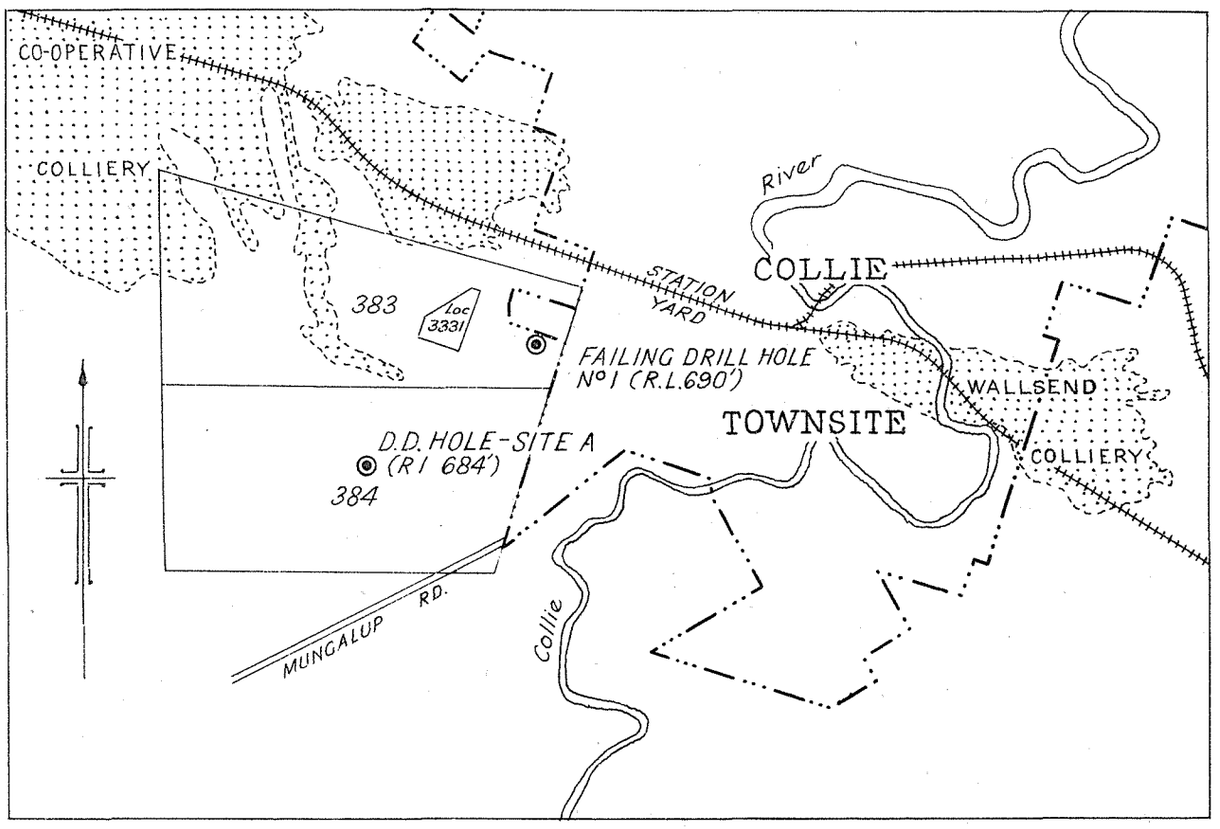
On the line of section, the country between the Co-operative workings and Site A appears to be undisturbed. If it is faulted, then the faults are either small (less than 30 feet), or their various displacements counteract.

Beneath the seams of the Collie Horizon the drill encountered well bedded sandstones, the grains of which gradually reduced in size until at 1320 feet siltstone was encountered. Below 1370 feet down to 2000 feet the drill passed through compact dark green mudstones, broken by minor developments of siltstones and sandstones at 1700 and 1900 feet.

Fig. 11

POSITION OF DIAMOND DRILL HOLE Nº 7
SITE A - C.M.L. 384 - COLLIE

Scale 40 chains to an inch



Below 1500 feet the mudstones contain many small sandstone dykes and irregular siltstone inclusions, and show slump structures. Small limestone inclusions are scattered irregularly throughout.

Mudstones occur below 2000 feet but contain beds of sandstones and siltstones which gradually increase in frequency of occurrence until, at about 2060 feet, varving is evident. In places the mudstones show wave ripple formations, covered by fine grained sandstone or siltstone.

From 2100 feet to the granite at 2181 feet lies an unsorted aggregate of material ranging from silt to boulder size which seems to have most of the characteristics of a frontal moraine.

A similar type of deposit has been found in all the holes which have reached the granite in the coal basin. In the Stockton Deep Drill Hole, Site J, the mudstone-siltstone formation was drilled for 768 feet, but was not penetrated. In the Collie Burn Deep Drill Hole the formation was similar but was greatly reduced in thickness.

At Site A the contact of the sediments with the granite is sharp and distinct. The granite is almost completely unaltered by weathering and its surface, as shown in the core, dips flatly at about 20 degrees to the horizontal. A set of faint striations can be seen and felt running transversely to the dip of the surface.

The freshness of the granite shows that it has not been subject to atmospheric weathering but, after being planed and striated, was quickly covered by the unsorted and unstratified deposit mentioned above.

The whole deposit, from the mudstones down to the granite, appears to belong to a glacial environment. Lack of fossil remains is further suggestive of this, since the generally low temparature existing in glacial waters are unfavourable to animal life.

The unsorted material immediately above the granite may be regarded as a frontal moraine, and the silts and mudstones as products of melt water deposition.

Quality of the Coal.

The results of proximate analyses carried out by the Government Chemical Laboratories on coal samples from the seams encountered during the drilling of Site A are shown in Table 2.

Table II.

PROXIMATE ANALYSES OF SEAMS AT SITE A.

Chemical Lab. No.	Depth.	Thickness of Seam.	Name of Seam.	As Received.					Dry and Ash Free		Ash on Dry Basis.	Colour of Ash.
				Moisture.	Ash.	Volatile Matter	Fixed Carbon.	Calorific Value.	Volatile Matter	Calorific Value.		
	ft. ins.	ft. ins.		%	%	%	%	B.Th.U.	%	B.Th.U.	%	
13200/53	868 11	7 4	No. 1 (Moira)	20·0	10·6	20·4	49·0	9,180	29·4	13,220	13·2	Orange-brown
13201/53	896 3	4 3	....	20·0	12·7	20·0	47·3	8,930	29·8	13,270	15·9	Orange-brown
13202/53	909 9	2 3	No. 2 (Dirty)	20·0	10·4	21·8	47·8	9,190	31·3	13,200	13·0	Yellow-brown
13203/53	917 4	2 5	No. 2 (Dirty)	20·0	15·5	21·0	43·5	8,520	32·6	13,220	19·4	Yellow-brown
13204/53	921 5	3 6	No. 2 (Dirty)	20·0	16·5	19·4	44·1	8,300	30·6	13,060	20·7	Yellow-brown
13774/53	966 10	4 0	No. 3 (Wallsend)	20·0	10·2	....	....	....	....	....	12·8	Fawn
13775/53	970 10	4 0	No. 3 (Wallsend)	20·0	8·2	....	....	....	....	....	10·3	Fawn
13776/53	974 10	4 0	No. 3 (Wallsend)	20·0	13·1	....	....	....	....	....	16·3	Fawn
13777/53	978 10	3 9	No. 3 (Wallsend)	20·0	8·0	....	....	....	....	....	10·0	Fawn
13800/53	1,050 5	4 9	....	20·0	6·6	....	....	....	....	....	8·2	Red-brown
13801/53	1,076 4	4 8	....	20·0	8·8	....	....	....	....	....	10·8	Red-brown
Composite of No. 3 Seam (Chem. Lab. Nos. 13774–77).												
....	966 10	15 9	No. 3 (Wallsend)	20·0	10·1	20·7	49·2	9,410	29·6	13,470	12·7	Fawn

It should be noted that the three samples representing the No. 2 (Dirty) Seam are separated by black carbonaceous shales and, under present conditions of coal extraction, do not represent a workable seam.

Conclusion.

The seventh hole (Site A) of the Deep Drilling programme encountered granite at 2181 feet. A satisfactory percentage of core was recovered, and all objects aimed at were achieved.

The three seams of the Collie Horizon were present as expected, but the No. 2 Seam shows a considerable decrease in the quantity of coal present, due to a development of black shale bands.

APPENDIX I.

Government Deep Drilling.

C.M.L. 384; Site A.

Drilled by: McCallum Bros. & Grill. Commenced: 28th July, 1953.

Logged by: G. H. Low. Completed: 26th November, 1953.

Depth (feet) From		To	Summarised Log
0	-	165	Sediments
165	-	168	COAL (2ft. 11in.)
168	-	425½	Sediments
425½	-	427	COAL (1ft. 6in.)

Depth (feet) From		To	Summarised Log
427	-	616½	Sediments
616½	-	617¼	COAL (8in.)
617¼	-	617⅝	Sediments
617⅝	-	618	COAL (4in.)
618	-	628⅓	Sediments
628⅓	-	629¼	COAL (10in.)
629¼	-	635	Sediments
635	-	636½	COAL (1ft. 6in.)
636½	-	669¼	Sediments
669¼	-	670½	COAL (1ft. 3in.)
670½	-	742⅜	Sediments
742⅜	-	745	COAL (2ft. 4in.)
745	-	761½	Sediments
761½	-	761⅝	COAL (3in.)
761⅝	-	820½	Sediments
820½	-	822⅓	COAL (2ft. 10in.)
822⅓	-	853	Sediments
853	-	855½	COAL (2ft. 5in.)
855½	-	869	Sediments
869	-	876¼	COAL (7ft. 4in.)
876¼	-	896¼	Sediments
896¼	-	900½	COAL (4ft. 3in.)
900½	-	904½	Sediments
904½	-	905	COAL (6in.)
905	-	909¾	Sediments
909¾	-	912	COAL (2ft. 3in.)
912	-	916⅓	Sediments
916⅓	-	918¾	COAL (2ft. 5in.)
918¾	-	919¾	Sediments
919¾	-	920¼	COAL (6in.)
920¼	-	921½	Sediments
921½	-	925	COAL (3ft. 6in.)
925	-	964	Sediments
964	-	965	COAL (10in.)
965	-	966¾	Sediments
966¾	-	982½	COAL (15ft. 9in.)
982½	-	1043⅓	Sediments
1043⅓	-	1044	COAL (8in.)
1044	-	1050½	Sediments
1050½	-	1055¼	COAL (4ft. 9in.)
1055¼	-	1076⅓	Sediments
1076⅓	-	1081	COAL (4ft. 8in.)
1081	-	1103⅜	Sediments
1103⅜	-	1105⅜	COAL (2ft. 1in.)
1105⅜	-	2181	Sediments
2181	-	2199	Granite

End of Hole.

REPORT ON THE MT. McMAHON MINING GROUP, RAVENSTHORPE, PHILLIPS RIVER G.F., W.A.

Approx Lat. 33° 56′
Approx. Long. 120° 04′

By J. A. NOLDART, B.Sc.

CONTENTS.

GENERAL.

Introduction.

Detailed mapping and investigation of the area containing the Mt. McMahon Minning Group has now been completed. This report is to be regarded as a summary of pertinent facts and data observed in the field. Full details, including a geological map of the area will, at a later date, be reproduced in bulletin form, together with maps and reports of other mining groups in the district.

General.

Situated approximately 330 miles south-east by road from Perth, the township of Ravensthorpe is the main centre and supply base for the Phillips River Goldfield. A smaller settlement, and holiday resort for rural districts to the north, is situated 30 miles south by road, at Hopetoun, on Mary Ann Haven, South Coast of W.A. A rail line linked the two townships from 1909 to 1935, but has since been abandoned. The wharf and shipping facilities at Hopetoun were used for light shipping only, and are now in a state of decay. The nearest railheads are at Esperance (120 miles east), Ongerup (100 miles west) and Newdegate (80 miles north-west). A road transport service is in operation between Hopetoun-Ravensthorpe and Newdegate.

The district is supplied by a school, post office, hotel, baker and two stores contained in the township of Ravensthorpe. Garage facilities are available, and a Government bus service is in operation to Perth, via Newdegate, twice a week.

Chief source of income for the district is from wheat, sheep and associated farm produce. Two or three small prospecting ventures are under way at present, but mining activity is otherwise non-existent. Present population of the area is approximately 200.

Area Investigated.

The Mt. McMahon Mining Group lies approximately three and a half miles east-north-east of Ravensthorpe, with an areal coverage of approximately four and a half square miles. The majority of the mining leases fall within the boundaries of Location 384, with the remainder extending into Locations 123, 129, 130, 268 and the foothills of the Ravensthorpe Range to the east and north.

Reference Maps.

Mines Department Lithograph L 105.
Lands and Surveys, Perth, L.O. 420/80, 405/80.

Water Supplies.

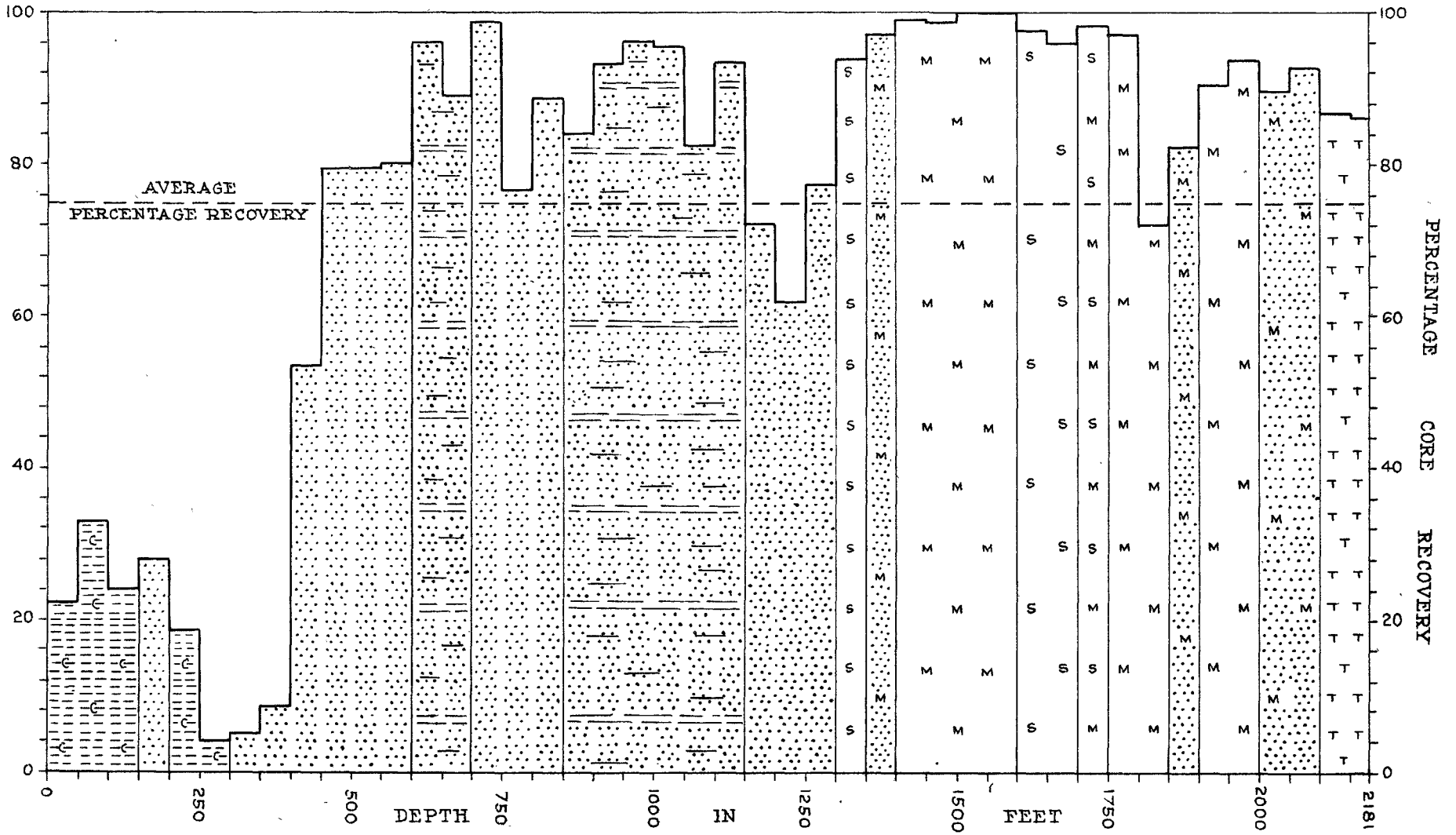
The district has an average rainfall of 15-16 inches per year, and excepting for exceptionally dry periods the farms and properties are amply supplied with stock water from a series of small dams on the properties. Town and miscellaneous requirements are supplied by two main dams—"Cordingup" (capacity 20 million gallons) and "Town" dam (5 million gallons).

Irrigation is not practised in the district, and grain crops etc., are dependent on rainfall. Domestic and household requirements are supplied by roof catchment.

The water table is encountered at depths ranging from 40 feet down, and abundant supplies of salt water are available below this level.

Fig. 12

DIAMOND DRILL HOLE N° 7 - SITE A
PERCENTAGE CORE RECOVERY



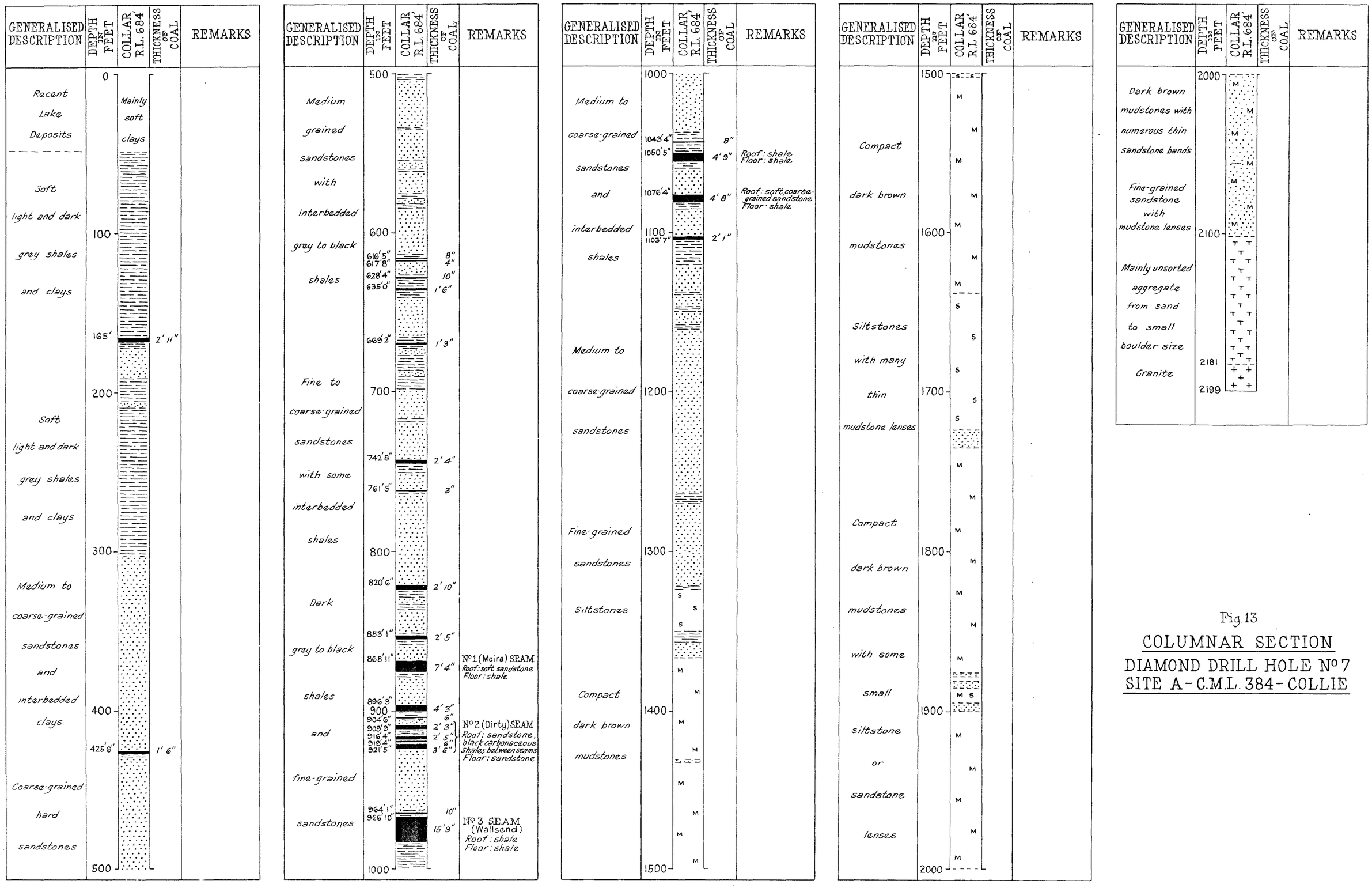
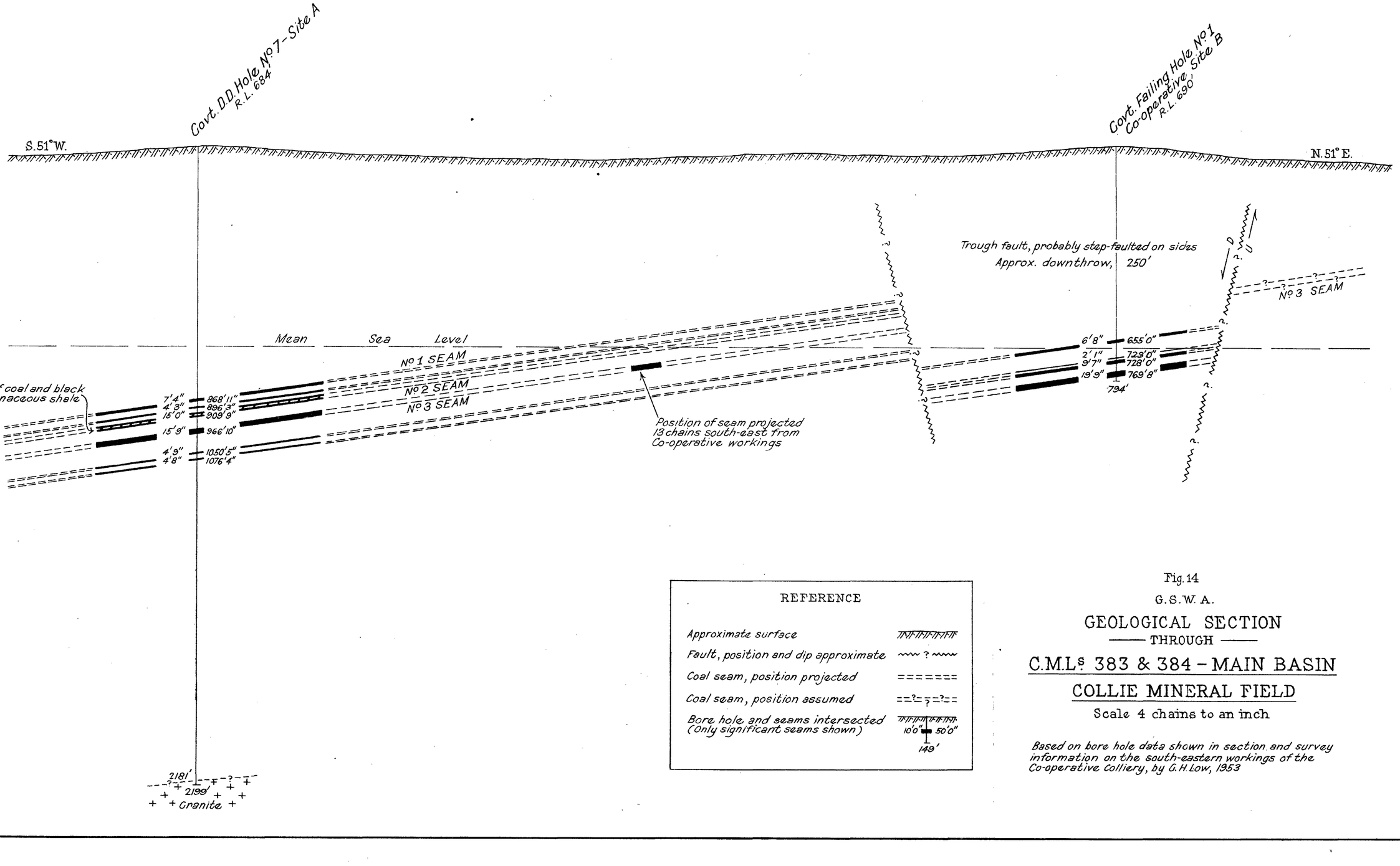


Fig.13

COLUMNAR SECTION
DIAMOND DRILL HOLE No 7
SITE A-C.M.L. 384-COLLIE



REFERENCE

Approximate surface	
Fault, position and dip approximate	~~~ ? ~~~
Coal seam, position projected	=======
Coal seam, position assumed	==?= ? =?==
Bore hole and seams intersected (Only significant seams shown)	10'0" 50'0" 149'

Fig. 14

G.S.W.A.

GEOLOGICAL SECTION
THROUGH
C.M.L.s 383 & 384 - MAIN BASIN
COLLIE MINERAL FIELD

Scale 4 chains to an inch

Based on bore hole data shown in section and survey information on the south-eastern workings of the Co-operative Colliery, by G.H. Low, 1953

Timber and Firewood.

Ample supplies of timber for fuel, mining, and agricultural needs are obtainable throughout the district.

Previous Work on Area.

A brief description of the geology and some of the mines in the Group is given in the Geological Survey of W.A. Bulletins No. 5 (T. Blatchford, 1900) and No. 35 (H. P. Woodward, 1909), plus W.A. Department of Mines reports by A. Montgomery in 1903, 1910, 1914. Mention of the area is also made by Dr. M. Maclaren in his "Geological Report on the Mines of the Phillips River Gold and Copper Mining Co. Ltd.," incorporated in the 1914 report by A. Montgomery.

No detailed map of the area was available prior to this survey.

Field Work.

A plane table survey using telescopic alidade and staff was carried out during February-March, 1953. Maps were compiled using a scale of 5 chain = 1 inch.

GEOLOGY.

Rock Types of the Area.

Geological mapping indicates at least several different series of rocks. A brief description of each group is given, but further subdivision is not attempted here.

(i) Greenstones.

Are predominantly agglomeritic in nature, moderately metamorphosed and interbedded with amygdaloidal, porphyritic, tuffaceous, fine and medium grained lavas.

Bedding is thought to be indicated by a continuous band of chloritic amygdaloidal lava striking north-west at the south end, and arcing to a west-north-west trend at the north end of the outcrop.

Subsequent igneous intrusion is suggested by the occurrence of small outcrops of porphyritic andesites.

(ii) Highly Weathered Lavas.

These outcrop to the north-east of the greenstone series, and are yellow-brown in colour. Shearing appears to be less pronounced than in the greenstones, and weathering takes the form of heavy zonal weathering spreading from joint planes with subsidiary spheroidal weathering. It is probable that these rocks are a weathered basic lava related to the fresher greenstones.

(iii) Granites.

The area mapped contains the north-western flank of a large dome shaped granitic mass. The granite composition varies considerably, but it is predominantly of a sodic nature. The occurrence of a "Hornblende Granite" in some places suggests a possible second phase of intrusion. Should this be so, then it is probable that the economic mineralisation of the area is associated with the later phase.

(iv) Dyke Intrusives.

Though included under the one group, several dyke systems are present. As the systems differ in age and composition, individual mention should be made of each. Five separate systems were noted.

(a) Quartz Diorites.—A fine to medium grained rock occurring as a sub parallel dyke swarm trending north-west. Averaging some 70ft. in width, the dykes vary from 20ft.-150ft. wide, and are transgressive through both granites and greenstones. Where seen in the granite they outcrop in the form of low ridges and knolls, and are easily traceable over considerable distances.

Due to strong similarity in appearance and weathering rate, this prominence is lost on entering the greenstone bands, but the same trend is retained and the dykes appear to be equally abundant as in the granite.

No surface evidence or underground information is available in this area, but underground obserations in other mining groups indicate a vertical to steep south-westerly dip.

N.B. Close petrological examination would probably indicate that some of the smaller bars (mapped as Quartz Diorite) within the granite are in actuality undigested greenstone remnants, and not dykes. This is suggested by the fact that only smaller and narrower lenses appear to be schisted and mineralised, while the larger, more obvious dyke types, being relatively blocky in nature, are apparently unmineralised.

(b) Hornblendites.—Mapping in this area strongly suggests that the hornblendites and quartz diorite dyke rocks are differentiates of the same magma, with the formation of composite dykes by the later injection of the hornblendites into the pre-existing quartz diorite dyke swarm.

(c) Pegmatites.—These are tabular flat lying bodies, occurring in granite, greenstones, and weathered lavas, but restricted in distribution to within a quarter mile of the main granite front. They show a marked sub parallelism to the granite front, trending approximately north-west and dipping flatly south-west. They are of considerable longitudinal extent but no economic mineralisation was noted.

(d) Quartz Gabbro.—A sub parallel dyke swarm trending north-east and cutting granite, greenstone, quartz diorites, pegmatites and weathered lavas. Outcrops are in the nature of rounded boulders and are easily followed in unbroken bands up to one mile in length, with an average width of approximately 50 ft. varying from 30-100 ft. in places.

The most prominent dyke contains both fine and coarse grained versions of this rock in a pseudo multiple dyke form. The finer grained version could more appropriately be termed a dolerite, and it may be that there have actually been two phases of intrusion.

(e) Diabase.—One small dyke (?) only, noted, trending north-east and transgressing granite and greenstones. No evidence of age relative to the other dyke systems was noted, but it is thought to be of later age than the quartz diorites.

(v) Jaspilitic Unit.

This forms the capping of the Ravensthorpe Range in the north, north-east and east regions of the area mapped. It consists of a series of banded ironstones and basic schists trending generally north-west to the south of Mt. McMahon, and west-north-west to the north, and lipping vertical to steep north-east.

A mapped discontinuity north of Mt. McMahon is evident, but doubt exists as to the origin of this dislocation. No evidence of faulting is to be observed in the other large rock formations of the area.

An adit driven a short distance into the side of Mt. McMahon shows the series to be alternating bands of banded quartzite and basic schists. The schists contain several manganiferous horizons striking parallel to the schistosity. These schists may be better classed as meta-sediments of a phyllitic type.

The age of this series is as yet vague. Traces of mineralisation have been noted, but as yet no evidence has been found of transgressive, post mineralisation dykes.

(vi) Laterite.

This occurs as a secondary nodular ironstone capping over large areas of the banded quartzites of the Ravensthorpe Range, and as heavy soil cover on the slopes of the Range. The nodular ironstone in parts show strong lineation, corresponding to the lineation of the underlying quartzites, and is believed to be a weathering product of the latter series.

Age Relationships.

A suggested chronological order for the above rocks types is given as:—

Laterite (Youngest)
Quartz Gabbro
Diabase (?)
Pegmatite
Hornblendite
Quartz Diorite
Granite
Jaspilite Unit
Agglomerate Series
Weathered Lava Series (Oldest)

Structure.

From correlation with the rock types of other mapped mining groups in the district, the greenstones in this area form portion of the east flank of what appears to be an anticlinal or synclinal formation with the granite mass occupying the core of the structure. On present results it is suggested that this structure is a southerly plunging syncline.

It would appear in this area that considerable control of the granite front has been exercised by the Jaspilite Unit to the North and East. Though not intruded by the granite, economic mineralisation in the Jaspilite series indicates a pre-granite age for it.

Trends of the quartz diorite dykes, foliation of the greenstones, and bedding strike of the Jaspilite series closely approximate the trend of the probable axial plane of the main structure. This is approximately north-west to north-north-west.

No evidence is forthcoming in this area but observations from other mining groups suggest the structure to be overturned slightly to the east with a steep westerly dip for the axial plane of the structure.

Bedding of the Agglomeratic series, as suggested by a comparatively extensive amygdaloidal lava band, appears transgressive to the north-west foliation of the greenstones.

Pegmatite intrusions are thought to be transgressive to bedding, but evidence is not available. Pegmatite dykes are sub parallel to greenstone schistosity.

Metamorphism.

Takes the form of amphibolitisation and chloritisation throughout the area. Generally, the metamorphism has been low grade and of dynamic origin, giving rise to the north-west schistosity prevailing in the area. Localised metamorphism of higher grades is indicated by the occurrence of strong garnet development in shear zones. Thermal metamorphism is restricted to a comparatively narrow contact aureole adjoining the granite.

Faulting.

Recourse must again be made to other mining groups in the area for direct underground observations. Dr. M. Maclaren has shown that the relative movement of faulting of the quartz diorite dykes in the Mt. Cattlin mine has been west side displaced southwards in a lateral movement. There is no reason to believe that this movement does not apply equally well to the Mt. McMahon mining group, although no local evidence is available.

The apparent dislocation noted in the Jaspilitic series to the north of Mt. McMahon may possibly result not from faulting but from repetitive folding, as this series is highly folded. Should faulting prove to be the cause of dislocation, it is suggested that faulting occurred prior to the intrusion of the granite mass. This would explain the E.-W. trending shear zones of the Mt. Benson and Mary leases, and adjacent shafts in the greenstone series and granitised areas, but lack of shearing in the intrusive granite nearby on the line of shear.

Mineralisation.

Host Rocks.

The rock type most conducive to mineralisation appears to be the finer grained basic lava bands within the Agglomeratic series, and basic remnants in the main granite body.

That mineralisation has followed natural weaknesses in the rocks, is suggested by the stronger mineral concentration in areas where shear zones have transgressed favourable lava bands. This results in a series of rich pockets along the line of shear separated by areas of lower grade.

Mineralised Garnetiferous Zones.

It has been noted in this and other mining groups in the district that mineralisation on an economic scale is most prevalent in shear zones with garnets developed, these shear zones having acted as mineralising channels for both gold and copper bearing fluids.

Mr. J. Sofoulis in his "Report on the Cattlin Mining Group" has made the following observations which apply equally to the Mt. McMahon Mining Group.

"With regard to such garnetiferous shear zones, the following facts are known:—

(i) They consist of small garnet crystal development along shear zones within the lavas only. Lavas often schistose close to the shear zones, schistosity and shear lines being parallel.

(ii) Garnetiferous shear zones do not consist of a single shear, but rather a series of echelon shears, concentrated along zones at varying distances from the granite.

(iii) The direction of such shear zones is parallel to that of the shape of the granite front, being disposed along north-east lines in the Maori Queen vicinity and east-west in the Cattlin area.

(iv) Past workings are aligned along such garnet shear zone trends, and garnetiferous lavas were noted in the dumps of most workings.

(v) Past workings lie within a mile of the granite front boundary.

(vi) Lack of workings in the garnetiferous shear zones found beyond this mile limit suggests that the mineralising emanations from the magmatic granite have had limited penetrative powers."

These facts are borne out by observations in the Mt. McMahon area, with the exception that mineralisation is restricted to within a quarter mile of the granite front, and it is suggested that unmineralised garnet zones beyond this radius are contained in rock types less prone to mineralisation.

Reference paragraph (iii) the garnet zones in this area also parallel the main granite front trending north-north-west, except in the region of the Mt. Benson workings, where they run east-west along a major shear zone already mentioned.

Pegmatites.

That there have been at least two phases of mineralisation is indicated by the occurrence of post quartz diorite pegmatites. This later phase was apparently of no economic importance, as no copper or gold mineralisation has been associated with it in this area. The pegmatites here are medium to fine grained, and consist predominantly of quartz and muscovite mica.

Lodes.

Underground workings are inaccessible, but as far as is ascertainable from surface examination and old reports, the lodes of this group are mainly cupriferous with a ferruginous quartz network in a sheared greenstone matrix.

Previous literature is sketchy and contradictory, and an underground examination of the mines would be necessary before the true nature of the lodes could be determined.

The following facts, however, are known:—

(i) Lodes in the area are predominantly cupriferous.

(ii) Gold values in the Mt. Benson workings averaged 6 dwts. per ton, but were of minor importance elsewhere.

(iii) Lodes at the surface are of ferruginous quartz vein type, becoming cupriferous at levels approximately 20 feet and deeper.

(iv) Highest gold values obtained in the upper levels of oxidised zone. Progressive decrease in value with depth.

(v) Copper mineralisation mainly basic carbonates with subsidiary oxides above water table, with chalcopyritic type minerals below water table. Some sulphides have been found above water table.

(vi) No appreciable zone of secondary enrichment.

(vii) Lode matrix is mainly sheared greenstone honeycombed with quartz veins. Lodes become more massive and less quartzose with depth. Walls usually well defined.

(viii) Richest concentration of copper mineralisation encountered in close proximity to granitic tongues. Granite often forms one wall of the lodes.

(ix) Strong concentration of mineralisation where shear zones transgress favourable basic lava bands.

(x) Mineralisation follows shear pattern.

THE MINES.

Mining activity in this group was discontinued prior to 1915, and all major shafts and workings are now inaccessible due to collapse and/or flooding. Some shallow workings and open cuts were inspected.

Principal mines in the area are the Mt. Benson and Last Chance mines and the Mary mine. A summary of information from previous reports and observations made during this survey is given below.

Mt. Benson.

The last available description of this mine is that of A. Montgomery, State Mining Engineer's Report on the Phillips River Goldfield in 1903. This report states the depth at some 30 feet, with the best ore in the nature of a dense brown iron oxide, carrying oxides and carbonates of copper and yellow copper pyrites, with the quartz being much stained with green carbonates. Lode matter is described as quartzose, high in gold values, and was then regarded mainly as a gold prospect. Plan and section of the workings as at March 1908 are available, but no further information on the lode is available.

The plans show the mine to have been developed to the 157 ft. level in two sections. The main shaft was situated in the western group of the shafts, and sunk to a depth of 167 ft. Further sinking was then carried out to the 183 ft. level from the west drive. Drives to the west (190 ft.) and the east (120 ft.) and crosscutting to the north (130 ft.) and south (70 ft.) were put through. The trend of the drives—indicating probable lode trend—was N.75°W. and S.75°E. in this area. As the surface trend of the lode in this group is N.80°E., this indicates a decided northerly swing to the lode as it progresses westwards. No further driving was carried out from the crosscuts, suggesting that no further lodes were encountered. Some little stoping was carried out above the main west drive at the 157 ft. level.

A second shaft was sunk to the 157 ft. level in the eastern group of workings some 400 ft. east-north-east of the main shaft. This shaft was connected to the old south drive by a crosscut, and drives to the south-east (80 ft.) and north of east (170 ft.) were put through. A crosscut to the north (140 ft.) shows short north and south drives, at 50 ft., suggesting small parallel lodes encountered. Trend of the main east drive is N.80°E. Intermediate levels were driven from this shaft at 50 ft., 70 ft. and 90 ft., and the bulk of the stoping activity in this mine appears to have been carried out between these levels to the east of the shaft. Trend of the 90 ft. level is roughly parallel to the 157 ft. level, and the plan suggests a steep northerly underlay for this section of the mine. An arcuate formation is suggested by shear trends at the surface, and this would appear to continue at depth.

Some work was done on this mine subsequent to these plans being made, and it is probable that the higher levels will now be out of date. Flooding of the lower levels in 1909 would preclude any further work being carried out below the water table, and this section of the plans would probably be correct.

A deep shaft is stated to have been sunk at the eastern boundary of the lease to intercept the lode of the neighbouring Mary lease, but no information is available on this work.

Very little can be determined from a surface examination, but the workings are in a tongue of greenstones running southerly into the granite mass, with granite to the east and west. Considerable quantities of granite on the dump make it evident that granite was encountered in the workings, probably in the drives at the 157 ft. level.

The lode appears to have been in the nature of a series of shears en echelon, consisting of quartzose material in a cupriferous sheared greenstone matrix, becoming less quartzose with depth. Width of the lode on the surface has varied from 2 ft. - 6 ft., and appears to have averaged three ft. in deeper levels. That the sulphide zone is not restricted to water table is evidenced by the occurrence of sulphides in the vicinity of the 35 ft. level. Some smaller gold bearing sugary pyritic quartz veins were seen in small workings on the lease, but these were not of any great extent. Mine sections show the ore "shoots" to be short and inconsistent, with an apparent westerly plunge. Assay plans show the bottom level to be generally barren. Minerals identified in dumps and in the shallow workings were blue and green carbonates of copper, traces of oxides of copper and considerable amounts of pyrite in patches. Some chalcopyrite is present below 30 ft.

Production figures show this mine to have the largest ore tonnage of the group, and by far the largest gold output, but to be comparatively poor in copper content.

Production figures supplied by the Mines Dept. Statistician for the Mt. Benson mine are given as:—

Year.	Ore Tonnage.	Copper.		Gold.	Silver.	Remarks.
		Metal	Value.			
		Tons.	£	fine ozs.	fine ozs.	
1900–1903	11·00	3·15	256	4·71	5	As Kingston and M.L.10 M.L. 143
1903–1906	605·19	73·64	3,702	287·88	....	As Mt. Benson M.L. 175
1906–1913	1,142·40	80·21	5,692	458·77	199·83	As Mt. Benson : Phillips River G. & C. Co., Ltd., M.L. 175
1913–1916	16·95	....	....	28·95	....	As Mt. Benson M.L. 175
1916–1919	376·33	20·44	....	115·76	....	As Mt. Benson M.L. 363
Total =	2,151·87	177·44	....	896·07	204·83	

Mary.

No plans or sections of this mine are available, and it is now inaccessible due to flooding and collapse. The last known inspection of this mine was in 1903 by A. Montgomery, and as only 33 tons of ore had been shipped as against a final produc-

tion figure of 885 tons, the data given by Montgomery on development progress would be very incomplete.

At the time of the 1903 inspection the main shaft being worked was on the eastern boundary of the lease, and was at approximate water table in depth (79 ft.). The lode being worked was four ft. - five ft. wide at the surface, narrowing in to two ft. at the 25 ft. level, but opening out again to four ft.-five ft. at the then bottom of the shaft. The lode was heavily cupriferous in a sheared greenstone matrix, the oxidised zone only extending to a depth of 25 ft. Above this level the ore consisted of blue and green carbonates of copper, ferruginous quartz and earthy copper oxides. At the 25 ft. level a sudden change to sulphides occurred, the ore then consisting of copper pyrites coated with indigo copper (covellite). This lode strikes N.85°E. and had a steep underlay to the north. The oxidised ore was reported to be of good smelting quality.

A second lode trending N.85°W. and underlaying to the south at 80° was being opened, and it would appear that this lode later developed into the major producer. The lode was about four and a half ft. wide and some 400 ft. long, and has since been opened by four shafts. The ore was reported as oxide of iron with oxides of copper and carbonates of copper carrying considerable quartzose material. The sulphide zone had not been penetrated at the time of inspection.

A series of smaller parallel lodes were reported at other parts of the lease, mainly in the south-west corner and toward the northern boundary, containing similar lode matter to the above, and with the sulphide zone ranging to within 12 ft. of the surface.

The present survey shows that most of these lodes lie in sheared garnet zones in greenstone country rock. The shears are slightly transgressive to the strike of the main granite front. Numerous small granitic tongues are present in the vicinity, and granitic material was noted on several dumps.

This mine, though only the third largest ore producer, was second only to the Last Chance mine for actual copper production, carrying a considerably higher percentage of copper than the Mt. Benson mine.

Production figures for the Mary mine as supplied by the Mines Dept. Statistician are given as:—

Year.	Ore Tonnage.	Copper.		Gold.	Silver.	Remarks.
		Metal.	Value.			
1901–1913	844·62	Tons. 120·53	£ 6,245	fine ozs. 20·15	fine ozs. 42·35	As Mary M.L. 7.

Last Chance.

This mine is now inaccessible and flooded throughout the lower levels, and no underground inspection was possible. No plans or sections of the mine are available. Mining information given here is from the G.S.W.A. Bulletin 35 and reports by A. Montgomery, State Mining Engineer in 1903, 1910 and 1914, and is now considerably out of date.

The lode had a general strike of N.70°W. with a steep underlay to the south. A shaft was sunk to 120 ft. and further winzing from the 100 ft. level down to 130 ft. was carried out on a small shoot. Short drives only were put out at the 100 ft. level. Some 400 ft. of driving was carried out on the 60 ft. level and most of the production of the mine was from stoping between this level and the surface. Work on the 100 ft. level was restricted owing to the disseminated nature of the ore in a hard host rock. Last known activity in the mine was the extraction of an 18 inch seam at the 130 ft. level in the bottom winze. The full lode width was not then being taken.

The lode was in schistose country with well defined walls, and was originally believed to be a fissure vein. Wall rock noted in a crosscut was seen to be a garnetiferous mica schist. Width of the lode averaged three to four feet throughout.

Water level in the mine was at approx. 65 ft., and the oxidised zone apparently extended down to this depth, as the ore in the face of a drive at the 60 ft. level was described as "oxides and carbonates of copper in a gangue of brown iron ore." Below this level the oxides gave way to sulphides, and good chalcopyritic ore was reported from an 18 inch seam at the 130 ft. level. Traces of nickel and cobalt were reported in 1903.

H. P. Woodward in G.S.W.A. Bulletin 35 notes the lode formation as being disseminated sulphides throughout very hard ground, suggesting that the lode matrix becomes more massive and possibly less sheared with depth.

The present survey shows the workings to be situated in sheared greenstone country within five chains of the nose of a north trending granite tongue, and some granitic material was noted on the dump. The workings were in a N.80°W.-N.70°W. trending shear zone consisting of a series of parallel E.-W. shears.

This mine, though second to the Mt. Benson mine in ore tonnage, was the largest copper producing mine in this group. Gold values were found to be very low.

Production figures for the Last Chance mine as supplied by the Mines Dept. Statistician are given as:—

Year.	Ore Tonnage.	Copper.		Gold.	Silver.	Remarks.
		Metal.	Value.			
1901–1913	1,134·48	Tons. 181·72	£ 11,030	fine ozs. 25·82	fine ozs. 46·57	As Last Chance M.L. 116
1916–1918	77·29	8·80	....	4·49	....	As Last Chance M.L. 361
Total =	1,211·77	190·52	11,030	30·31	46·57	

Ballarat (Emily Hale).

This mine was originally opened up as the Emily Hale (M.L.124) and later worked as part of the larger Ballarat (M.L. 205) lease.

Workings are reported to have extended down to the depth of 110 feet and drives to the north (90 ft.) and south (70 ft.) put out, but all the stoping activity was confined to the 65 ft. level, where the lode was driven on for a distance of 90 ft. south and 100 ft. north. A short crosscut west from the 110 ft. south drive encountered a second small vein of ore with well defined walls and a southerly dip trending north-west. In the main lode, the width is said to have averaged three ft. with poorly defined walls.

The lode had a general north-south strike with a 45° dip to the westward. This dip steepened to vertical at 40 ft. but resumed its original dip at 60 ft. The lode is said to have consisted of sulphide ore in the lower levels with a matrix of hard greenstone rock. The upper lode consisted of ferruginous quartzose material carrying oxides and carbonates of copper. Water level in the mine was at 65 ft. but the zone of oxidation only extended to approximately 60 ft., with the carbonates then giving way to chalcopyrite in a quartzose lode. Pumping in the Mt. Benson mine over half a mile to the north-west had a marked influence on the rise and fall of the water in this mine, the mine being practically dry to the lowest levels whilst pumping continued in the Mt. Benson mine.

The workings are within five chains of the main granite front to the west and lie in a belt of partly granitised lavas and greenstones. A garnetiferous zone runs through the workings on a N.10°W. trend.

Production figures as supplied by the Mines Dept. Statistician for this mine are given as:—

Year.	Ore Tonnage.	Copper.		Gold.	Silver.	arks.
		Metal	Value.			
		Tons.	£	fine ozs.	fine ozs.	
1903–1906	132·27	21·43	1,192	....	....	As Emily Hale M.L. 124
1906–1909	199·70	21·70	1,876	2·84	....	As Ballarat M.L. 205
Total =	331·97	43·33	3,068	2·84	....	

Last Chance Proprietary.

Only one shaft has been sunk on this lease which lies to the west of the Last Chance lease and east of the Emily Hale-Ballarat lease. It is reported to be the deepest mine in the group with the main shaft sunk to a depth of 125 ft., and a winze sunk from this level to the 215 ft. level on a south plunging ore body.

The lode strikes north-south at the surface but swings to a trend west of north with depth. The lode averaged three ft. in width and consisted of oxides and carbonates of copper down to the 65 ft. level, with well defined walls. Most of the production has been from above this level.

At deeper levels the lode consisted of quartz, chalcopyrite and marcasite, with a little covellite coating. Water level was approximately 65 ft.

The workings are situated to the west of a northerly trending tongue of granite, and are the most southerly of a set running north-south over a length of a quarter of a mile. That granite is in the near vicinity of the workings underground is evidenced by the occurrence of granitised lavas on the mine dump.

Production figures as supplied by the Department of Mines Statistician for this mine are given as:—

Year.	Ore Tonnage.	Copper.		Gold.	Silver.	Remarks.
		Metal.	Value.			
		Tons.	£	fine ozs.	fine ozs.	
1901–1940	34·87	4·53	252	....	....	As Last Chance Prop. M.L. 120
1904–1907	238·07	27·47	2,257	....	....	As Last Chance Prop. M.L. 200
Total =	272·94	32·00	2,509	....	....	

Other Mines.

Kilmore-New Moon.

This mine was originally known as the Kilmore (M.L. 119) and later as the New Moon (M.L. 204). Workings were reported to have been approximately 40 ft. deep in a greenstone remnant in granite country. The granite in this vicinity is of the hornblende variety. The lode occurred at the contact of the granite and greenstone, and was 13 ft. wide, consisting of small, rich ferruginous veins of oxides and carbonates of copper in a sheared greenstone matrix. From the lower part of the main shaft, sulphides were reported in veins up to 15 inches wide in hard greenstone country. Trend of the lode in the main workings was N.25°E. with a steep dip to the north-west.

This mine produced approximately 135 tons of ore for 19 tons of copper valued at £1,150. Some 70 fine ounces of gold was recovered.

Mt. Benson Extended.

Situated just west of the Mt. Benson mine, and had two shafts in greenstone country and one in a greenstone remnant in granite country. The lodes here appear to be of a ferruginous quartzose type with sugary quartz carrying pyrite in the deeper levels. Some chalcopyrite is evident on the dump, but main mineralisation is in the form of copper carbonates. Granite is to be seen on all dumps. Strike of the main lode was N.50°W. with a steep dip to the south-west.

This mine produced 66 tons of ore for 12 tons of copper valued at £693.

Birthday.

Consists of two groups of shafts, one situated at the northern boundary of the lease with a trend N.75°W. and the second situated toward the south boundary and having a north-south trend.

The north group consisted of three shafts on parallel shear zones striking N.80°W. with a steep dip to the south. The lodes were sheared greenstone carrying cupriferous quartz veins. A strong garnet zone is developed about the workings.

The south group consists of a series of shafts trending north-south and lying in a series of parallel shears striking N.15°W., the lodes having steep dips to the west. Lodes here appear to have been ferruginous quartz veins in a sheared greenstone matrix with only light traces of copper.

Commonwealth.

These workings were originally worked as the Federal mine (M.L. 131) then as the Contest (M.L.'s 191, 196) and finally as the Commonwealth (M.L. 295).

The workings consisted of a string of leases trending north-west. The lode was reported to trend north-west and consist of ferruginous quartz veins in sheared greenstone with strong copper staining in the oxidised zone. The lode was three ft. wide and contained considerable pyrite at depth. The lodes are in sheared greenstone country in the near vicinity of the main granite front, and granitic material is present on several of the dumps.

Only a small tonnage was ever shipped from these workings, the copper extracted being valued at £285.

Other leases and workings in this group have had a very limited output, and are of no significance either geologically or economically, and further discussion of this group is not necessary.

Mt. McMahon Pyrite Lode.

The alleged occurrence of a pyritic ore body in a diamond drill hole beneath the Mt. McMahon ironstone outcrops, with a width of some 160 ft. along the line of drilling, was first reported by A. Montgomery in 1910 in his Report on the Phillips River Gold & Copper Mines. A further report in 1914 by the same author gave such information on the drill hole as was then known.

In 1915 the Mines Department commenced drilling to prove this lode, but the depth reached was insufficient for the purpose.

In October 1949 an investigation of this area was carried out by Messrs. N. M. Gray and J. S. Gleeson of this Department, and a report on their findings together with a summary of previous reports and literature is given in their "Report on Pyrite—Mt. McMahon." This report is incorporated in the Report of the Geological Survey for the year 1949.

A detailed investigation of the surface and accessible workings, together with the compilation of a detailed map of the surface and adit, was then carried out by the author as part of the present survey in November-December, 1952.

The following details were then ascertained.

The lode at the surface was found to be a gossanous type outcrop of haematite and limonite with a strike N. 35° W. and apparent vertical dip. Length of the lode is approximately 250 ft. with an average width of 55 ft. The lode tongues out at either end into thin bands of ironstone interfoliated with quartzite bands, and eventually gives way to ferruginous banded quartzite country.

A second smaller body lies 30ft. to the west striking N. 25° W. with an approximate length of 170 ft. It is in the shape of a thin wedge with a thickness of 20 ft. at the north or widest end.

An investigation of the adit there showed the lode to be only 50 ft. in width, and to consist of a series of thin bands of haematite and limonite in highly weathered schists. The band of country separating the two gossan outcrops is here only 18 ft. wide, and consists of slightly manganiferous schists. The lode appears to terminate just beyond the winze 15 ft. in from the adit portal. The winze is now inaccessible.

As the adit level is only 30 ft. below the surface in the vicinity of the winze, it would appear that the surface gossans do not extend to any great depth. Although possible, it is not considered likely that the gossan is directly connected with any underlying pyrite body. Similar outcrops occur further to the south along the Ravensthorpe Range, and these have in some cases proved to be of only shallow depth when quarried.

No further comment is necessary to the report of Messrs. Gray and Gleeson, but emphasis should be placed upon the unreliable nature of information concerning the original drill hole, as no written records are known to exist. Further development of this deposit is not considered to be warranted at this stage.

Conclusions.

The main shear zones of this mining group are (i) Mt. Benson, trending N. 80° W. (ii) Mary, trending No. 80° E. (iii) Last Chance, trending N. 70° W. and (iv) Ballarat—Emily Hale trending north-south. The first two mentioned are believed to be the east and west expressions of an arcuate shear zone concave to the north.

The Ballarat shear zone, together with minor shear zones such as the north-south zone through the Birthday lease, and the north-west trending zone through the Commonwealth, all run parallel to the main granite front, or to large granitic tongues extending into the greenstones. The three zones first mentioned are all transgressive at approximately 60 degrees to the trend of the main granite front. The trend of this front and the regional schistosity of the greenstones show a marked parallelism.

The main shear zones are thought to predate the granite, and that these were emphasised and other smaller shears developed by stresses set up by the intrusive forces.

Mineralisation in this group has been largely controlled by the relationship between amygdaloidal lava bands in the agglomeratic horizon, and shear zones transgressive to this horizon, in conjunction with the proximity of granitic bodies. Most mineralisation has occurred in the immediate vicinity of known granite masses, and was strongest where sheared lava amygdaloids were the host rock.

Satisfactory explanation of the higher gold values obtained from the Mt. Benson mine as against other mines cannot be given, due to inaccessibility of workings and poor outcrop conditions. Multiple granitic phases as previously mentioned may have had considerable influence on mineralisation.

Each shear zone is believed to consist of a series of parallel shears en enchelon, each shear being of comparatively short lateral extent. All mineralised shear zones in this area dip vertical to steeply south to south-west, i.e., the dip is in all cases towards the granite front, and where known to be of lenticular nature plunge steeply to the west.

Recommendations.

From the results of this survey it would seem that the majority of the larger ore bodies have been extracted, but that the occurrence of other smaller bodies similar in nature is to be expected.

Occurrences of such bodies would be proven in many cases by investigation of the following possibilities:—

(i) Garnetiferous outcrops in the greenstone series adjoining the granitic front.

(ii) Shear zones transgressive to the regional schistosity of the greenstones. These zones are most strongly recommended where they intersect bands of lava amygdaloids in the vicinity of any granite mass.

(iii) Sheared areas of granitised material on the outskirts of the granite.

(iv) Investigation of possibility of shear zones occurring parallel and adjacent to old workings. These would best be indicated by underground crosscutting, or lateral drilling.

(v) Schistose greenstone remnants in the main granite mass within half a mile of the main granite front.

It is probable that, owing to the complexity of the ore and difficulty entailed in treatment, any prospect in this group would be primarily a copper prospect, with gold values subsidiary.

On past production and results, any prospect in this group would of necessity be limited in extent, but the present high price obtainable for copper makes this field a fairly good prospect for small scale mining activity.

REPORT ON ALLEGED MOLYBDENITE DEPOSIT ON LOCATION 41, GREENBUSHES, W.A.

By A. J. NOLDART, B.Sc.

On 17th October, 1953, a report appeared in "The West Australian", Perth's morning newspaper, that a Mr. E. Aurisch had discovered a rich molybdenite deposit on Location 41, Greenbushes area, near the junction of the Blackwood River and Norlup Brook.

No samples or specimenes were submitted to the Government Chemical Laboratories from this locality, but Mr. Aurisch stated that private assays revealed a "rich content of Molybdenite" in the samples assayed. The lode had not been located, but high grade samples were still being located at that time.

The area was examined by the writer on 29th October, 1953.

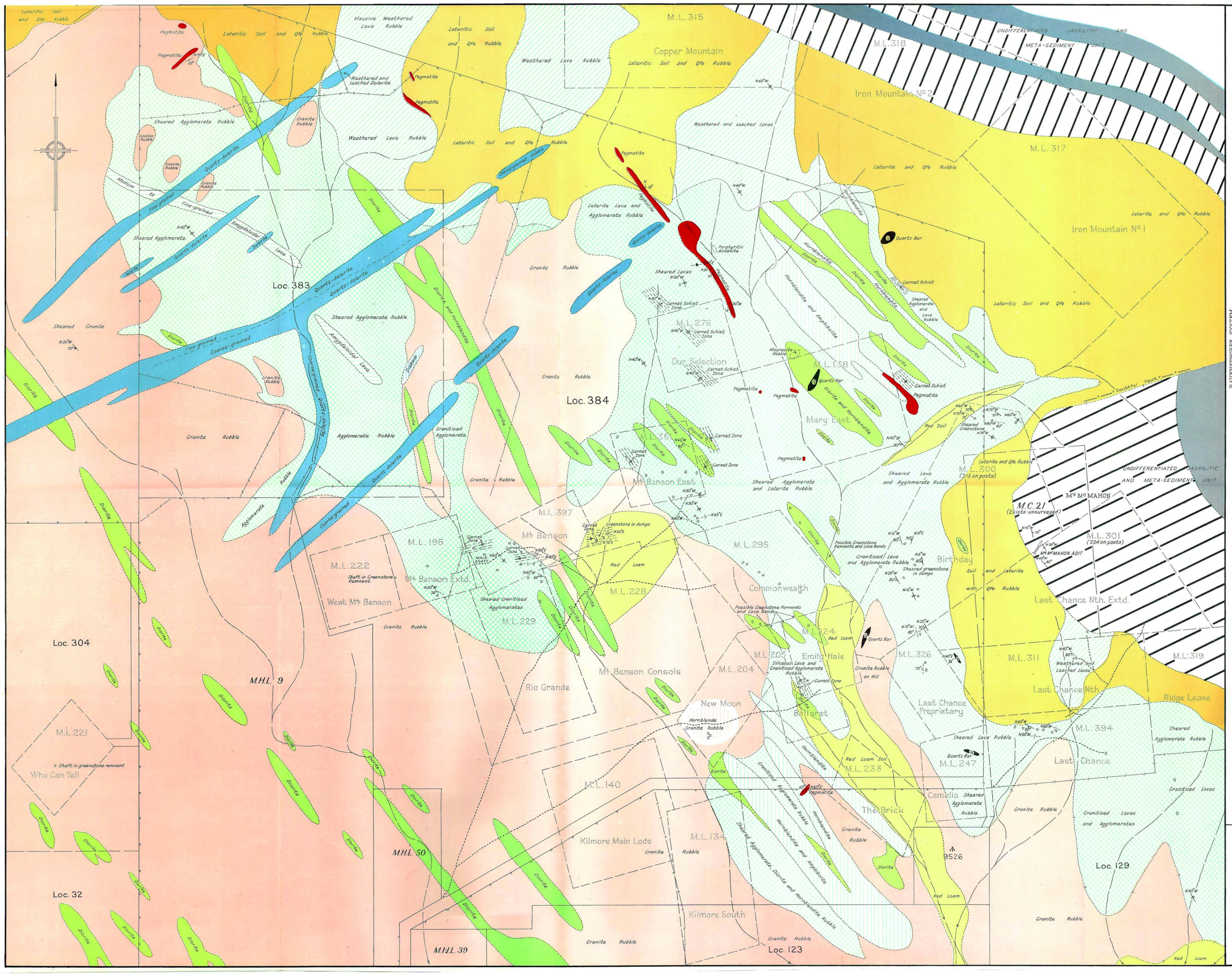
Locality.

Location 41 is situated five and a half miles south-west of Greenbushes Townsite, at the junction of the Blackwood River and the Norlup Brook. The distance by car is 6.8 miles. Location 41 is outside the western boundary of the Greenbushes Mineral Field.

Geology.

The discovery adjoins the Blackwood River in hilly country, with alluvial flats extending for a few chain on either side of the Blackwood River. Basement, where determinable under heavy soil cover, consists of a much weathered biotite gneiss with a general schistosity strike of N.40°W. No dips are available. A ridge rises from the river flats south-east of the junction, and rises consistently to the south. A heavy diorite type greenstone outcrop occurs on the southern portion of this ridge. Origin of this diorite is not readily determinable, but it is probably a north-west trending dyke. The samples of ore shown the writer by Mr. Aurisch were reported to have come from this ridge midway between the diorite and its northern end. The soil cover in the area extends to a depth of three ft. - four ft. in general, and investigations were further hampered by a half grown hay crop. Some small potholes had been sunk to bedrock on the

PLATE XIV



— LEGEND —

TERTIARY - RECENT

- Alluvium
- Ferruginous Laterite and Lateritic Soil

PRE-CAMBRIAN

- Pegmatite
- Quartz-dolerite
- Diabase
- Hornblendite
- Quartz-diorite
- Hornblende Granite
- Acid Granite, Aplite etc.

RAVENSTHORPE SYSTEM

- WHITESTONES — Undifferentiated jaspilites and associated meta-sedimentary schists etc.
- GREENSTONES — Predominately agglomerates with interbedded tuffs, porphyritic, amygdaloidal, basic lavas etc.
- Amygdaloidal Lavas
- Porphyritic Andesite
- Weathered Lava
- Quartz
- Garnetiferous Zones

REFERENCE TO SIGNS

- Geological boundaries approximate
- Geological boundaries assumed
- Strike and dip of bedding
- Strike of vertical bedding
- Strike and dip of lode
- Strike of vertical lode
- Strike and dip of schistosity
- Strike of vertical schistosity
- Strike of vertical jointing
- Strike and dip of foliation
- Doubtful fault
- Shaft inaccessible
- Portal of tunnel or adit
- Fence on surveyed boundary
- Fence not on surveyed boundary
- Drainage channels
- Tracks
- Mining holding existing (MC 21)
- Mining holding void (ML 195)

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

Mt McMAHON GROUP
RAVENSTHORPE
PHILLIPS RIVER GOLDFIELD

Scale: 5 chains to an inch

5 0 5 10 15

Geology, plane table and telescopic alidade survey by J. Noldart, 1953

ridge, but the lode was not encountered. Soil cover on the flats extends to more than 12 ft., and no outcrops occur in the stream beds.

Examination.

The ridge was examined over its length as far as the diorite outcrop at the southern end, but no rocks were found in situ. The trend of the rubble encountered was at a slight angle to the crest of the ridge and trended west of north. The rubble contained three distinct rock types—medium grained quartz microcline biotite pegmatite on the western side of the ridge, a fine grained siliceous gneiss on the eastern side, and between these two, a quartz, felspar gneissic rock with some biotite, and containing traces of molybdenite in places. This latter rock is similar to that in the hand specimens produced by Mr. Aurisch. These samples contained molybdenite in "books", up to half an inch in size, scattered throughout the rock, but nothing approaching this mineral content was sighted by the writer in his examination of the ridge. A similar rock formation was stated by Mr. Aurisch to occur three quarters of a mile to the north-north-west of this ridge, on a general line with the trend of the rubble on the ridge, but this was not examined. The ground between the two outcrops is covered by the alluvial flats of the Blackwood River.

Conclusions.

No definite outcrop of molybdenite bearing rocks has yet been discovered in this area. Such samples as contained a high percent of molybdenite were produced by Mr. Aurisch, and were stated to have come from the one patch of ground on the ridge to the south-east of the junction of the Blackwood River and Norlup Brook. No rich specimens were sighted by the writer in the field, though minute traces were noted from the same area. The molybdenite appears to be associated with a quartz microcline felspar pegmatite, but is not contained in this pegmatite.

It is probable the lode, if uncovered, would be of an irregular nature and generally low of grade, with some small rich lenses. Until bedrock has been uncovered sufficiently to define any lode present, no estimate of lode size or quantity could be given. Any trenching operations carried out should extend down into the weathered surface of the gneiss basement.

A set of trenches transverse to the ridge containing the mineralisation was recommended to outline any lode present.

No other mineralisation was sighted in the vicinity of the pegmatite.

REPORT ON A SHALE DEPOSIT EAST OF ALBANY HIGHWAY, MUNDIJONG AREA.

By A. J. NOLDART, B.Sc.

Introduction.

During the early part of December 1953, a request was received from the State Brick Works to investigate a shale deposit outcropping in the north-west corner of Location 653. The assistance of this department was further required to set out a drilling programme to test the extent and depth of these shales.

The area was examined on December 8th and 9th, 1953, and a number of bore sites pegged by the writer, together with a programme of shallow pits and costeens, to test the more inaccessible regions of the outcrop.

Location.

Location 653 is situated 20 chains approx, to the east of the Bunbury Highway, 28 miles south of Perth. It is bounded on the north, and west, by the Millars' Mundijong-Jarrahdale Private Railway.

The outcrop examined lies 20-25 chains east of the highway, immediately adjoining the boundary of location 653 outcropping in the railway cutting to the north, and extending south-south-west for approx. 20 chains.

Geology.

The shales examined are part of the Lower Cardup Shale series, and outcrop on the crest and eastern flank of a northerly trending ridge. The shales are bounded on the east by the granite/gneiss complex, the boundary being sharp and virtually forming the crest of the ridge. The country slopes away to the east over the granite/gneiss complex at a moderate angle, but drops sharply to the west over the shale beds, into a tributary valley of the Medulla Brook drainage system. Shale outcrops on the west flank of the ridge, over its full length from the railway line southwards, until lost under alluvial soil cover on the flats adjoining Medulla Brook. Regional cleavage trend of this outcrop is N.25°W. with a steep westerly dip.

At the northern end of the ridge a second ridge runs away to the west, this ridge being capped with 10 ft. to 15 ft. of pisolitic laterite. The shale disappears under this cover but outcrops again in the floor of a gravel quarry in the laterite, three chains east of the highway. South of this second ridge, the shales are lost under a heavy cover of soil and residual clays, but shales outcrop again at the junction of the highway and the Mundijong Road, where the shales have been quarried.

A heavy outcrop of epidiorite type greenstone intrusive rock occurs on the lower slopes of the western flank of the main ridge, about midway along the ridge. This greenstone has an actual outcrop over an area of approx. five chains square, but epidiorite type rubble occurs for a considerable distance, noth and east, up the side of the ridge. The greenstone also disappears under the soil cover to the west, but isolated boulders may be seen in the soil.

Further west, some five chains east of the highway, the soil cover is further overlain by a superficial aeolian cover of siliceous sand. This sand extends from the pisolitic laterite in the north, to the shale quarries in the south, and westwards across the highway for a considerable distance. The southern limit is marked by a low scarp into which the quarry faces have been cut on both sides of the highway. Cleavage of the shales in these quarries is N.20°E. with a steep dip to the east.

Alluvial soil cover obscures the geology of the lower lying river flats.

Access.

Access is available to either end of the shale ridge across cleared ground. Direct access to the north end of the ridge can be made by way of the gravel quarry in the pisolitic laterite capping on the east-west ridge, but this route would not be very suitable for quarrying operations. The better approach would be along the south flank of this laterite ridge.

Conclusions and Recommendations.

The areal coverage of the shale outcropping on the main ridge is approx. 24 acres, and that outcropping at the road junction, approx. one acre. The shale probably extends under the soil cover and laterite cover in the north, to the outcrop in the laterite quarry immediately to the east of the highway. If this is so, then there would be a considerable area of shale available for open cut mining, that is not outcropping at the surface. Investigation of the clays between the quarries and the shale ridge may show these clays to be also suitable for use in the brick industry.

The main outcrop has a difference in elevation of approx. 200 ft. from the crest of the ridge to the lowest shale outcrop on the west flank. This elevation change takes effect over a lateral distance of approx. 450 ft. A shaft has been sunk in the shale at the top of the ridge, and shows shale to a depth of at least 40 ft. The shale here would most likely

extend to a considerably greater depth than this, and the terrain would lend itself admirably to open cut quarrying operations.

The southern end of the shale ridge would also be well suited for open cutting purposes.

A set of seven bore holes has been laid out and pegged. Two of these are to test for shale below the pisolitic laterite on the east-west ridge, and five are to test the extent and quality of the shale on the lower slopes of the shale ridge south of the greenstone outcrop. The vegetation and terrain of the shale ridge precludes the possibility of any boring being carried out there, and a set of semi-arbitrarily sited costeens and pits is recommended to test the shales along the ridge top, and on the western flanks in the steeper regions. These pits and costeens should further outline the greenstone intrusive boundaries if it extends for any appreciable distance up the hillside.

The bore hole positions, together with the approximate locations recommended for costeans and pits, are shown on the map of the area accompanying this report. This map is on a scale of 5 chains to 1 inch and shows the basic distribution of rock and soil types. Accurate detailed mapping was not attempted in the time available.

REPORT ON BARITE DEPOSITS ON M.C. 487H, CRANBROOK.

South-West Division.

By A. J. NOLDART, B.Sc.

Introduction.

The barite veins at Cranbrook were discovered about 1897 by Mr. J. H. Cox, a Cranbrook farmer. No attempt was made to work the deposit owing to the lack of a satisfactory market for the mineral at that time. In May, 1920, a mineral lease (277H) was pegged by J. H. Cox, and, later in the same month, a prospecting area (P.A.341H) was pegged adjoining the original lease and to the north-east. This P.A. was later extended to the north-east, and pegged as a mineral lease of 48 acres in July, 1920, for Mr. L. M. Healy.

Three barite veins were discovered, the two larger being located on M.L. 277H, and the smallest of the three on P.A.341H.

An examination of the veins, and the surrounding country, was carried out by Mr. F. R. Feldtmann of this department between the 8th and 14th July, 1920, and his report was incorporated in the Annual Report of the Geological Survey for the year 1920.

Very little work was done on the above leases, and the leases eventually lapsed. The veins then received only sporadic attention until a series of prospecting areas were taken up over recent years, and finally pegged as a prospecting area by Mr. A. Ferrari in February, 1953. This P.A. was converted to M.C.487H on 17th July, 1953, by Mr. Ferrari.

Instructions to examine the deposits were received on the 11th December, 1953, and the area was examined between the 15th and 18th December, 1953. The existing workings were mapped on a scale of 20 ft. to 1 inch.

Location.

Cranbrook is situated on the Great Southern Railway, 274 miles from Perth. Road distance from Perth is 200 miles, the township lying three miles to the east of the Albany Highway.

The barite deposits lie approx. three and three-quarter miles east of the township, and approx. one and a half miles east-north-east of Sukey Hill. Access to the veins is by road leaving Cranbrook 15 chains south of the Railway Station and bearing south-east for two miles and thence east for 1.8 miles. At this point a track leads north to the workings through undulating country for 1.5 miles, giving a total distance from the township of 5.3 miles. A second track leads into the workings from the north-west through some farming properties, but this track is rarely used now.

Geology.

The workings lie in a fine grained silicified sandstone, reddish in colour, and closely approaching a quartzite in texture and hardness. On the lower levels away from the mine the rocks become harder and more creamy in colour. The quartzites contain numerous veinlets of quartz ranging from 1 inch wide to mere threads, and are quite typical of the Stirling Range quartzites. No bedding is determinable in these rocks due to poor outcrop conditions and the massive nature of the rock.

Overlying these rocks on the tops of the hills and knolls is a dark, reddish-brown ferruginous sandstone, with minute quartz veinlets throughout. This alteration may be due to weathering and lateritic action. At a point approx. six chains west-north-west of the main shaft of the workings an apparent bedding strike of N.30°W. with a dip of 10° to the north-east was obtained. This bedding strike is rather vague and cannot be taken as a true indication of bedding in the area.

F. R. Feldtmann reported the occurrence of two aplite veins approximately midway between the barite veins and the township, striking approx. east-north-east, but these were not sighted by the writer.

The flats to the north, south, and west of the deposits are covered by superficial deposits, and salt lakes, which completely obscure the underlying rock types.

The Mine.

Of the three barite veins so far discovered only the largest one and the smallest have been worked. The largest vein is the only one being worked at present, no work having been done elsewhere since the 1920 report by F. R. Feldtmann. This report stated the smallest vein to have been worked to a depth of 40 ft., but nothing further is known of this vein.

The largest vein was originally prospected by a series of shallow costeans and a 10 ft. shaft. This shaft was later sunk to a depth of approx. 45 ft. in the early days of the activity on this vein.

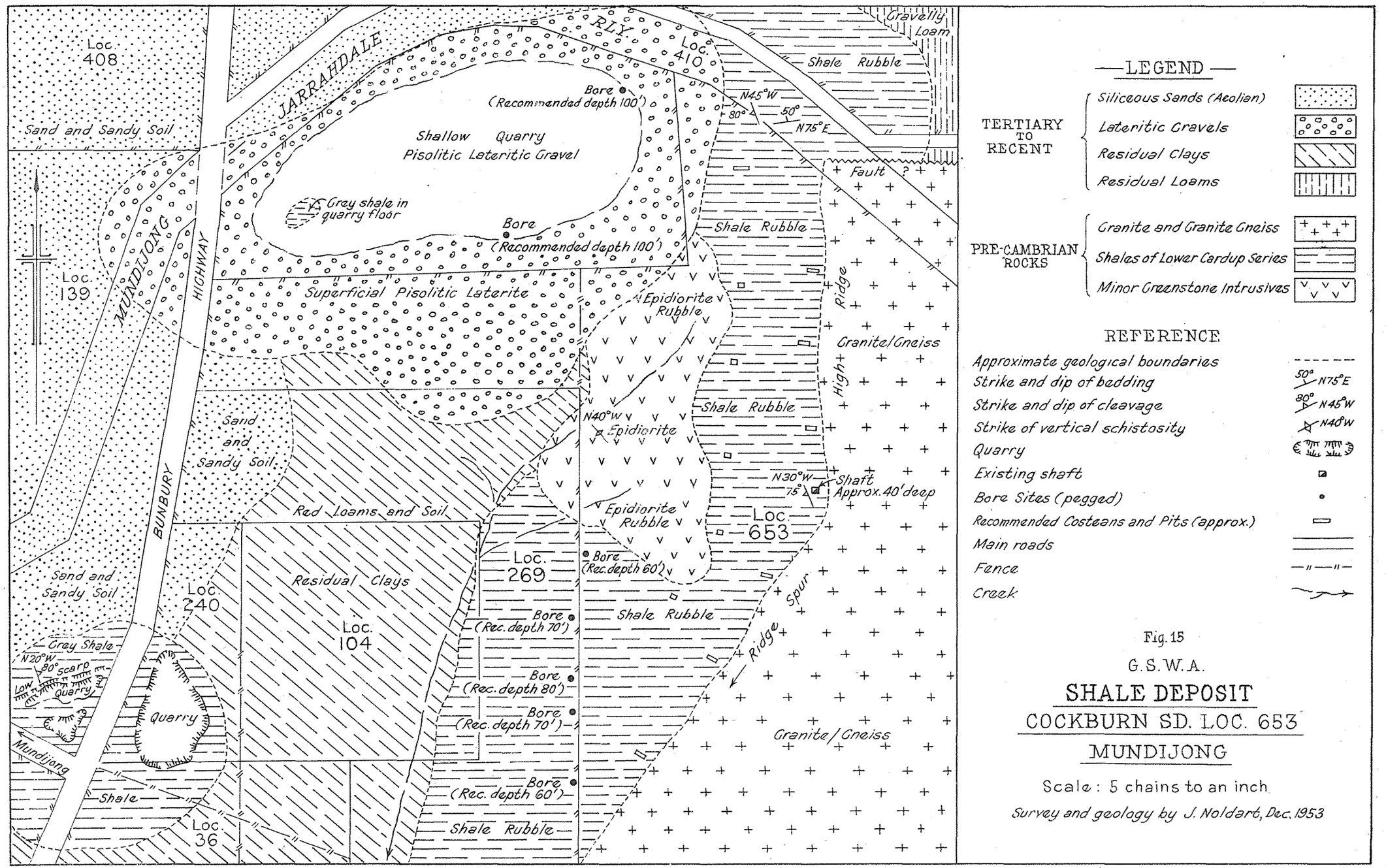
The mine has now been developed to a depth of 41 ft. by a new main shaft 56 ft. east of the old shaft. From this new shaft drives have been put out to the east at the 26 ft. level (37 ft. drive), and 41 ft. level (26 ft. drive), and to the west on the 34 ft. level for 32 ft. On the 26 ft. level a 20° rise was put out west of the shaft for 32 ft., and 20 ft. of driving carried out to the west on this intermediate level. This level is at 15 ft. vertical depth, and terminates to the west in the old shaft. Present stope development varies between four ft. and ten ft. width on all levels.

Mr. Ferrari reports the new main shaft to have continued to a depth of approx. 60 ft., and that he blocked it off below the 41 ft. level pending further development.

The Veins—No. 1 Vein.

This, the largest of the three veins, is also the most southerly.

The vein has been traced over a distance of approx. 400 ft. at the surface, and has an arcuate shaped outcrop. The western section strikes N.85°E., swinging to east-west over the eastern section. In the workings the vein trends almost west on the western side of the shaft, but swings to the north on the eastern side. This swing becomes more pronounced with depth, the vein trending N.85°E. on the 26 ft. level, and N.80°E. on the 41 ft. level. On the 26 ft. level the vein has



LEGEND

TERTIARY TO RECENT	Siliceous Sands (Aeolian)	
	Lateritic Gravels	
	Residual Clays	
	Residual Loams	
PRE-CAMBRIAN ROCKS	Granite and Granite Gneiss	
	Shales of Lower Cardup Series	
	Minor Greenstone Intrusives	

REFERENCE

Approximate geological boundaries	
Strike and dip of bedding	50° N75°E
Strike and dip of cleavage	80° N45°W
Strike of vertical schistosity	N40°W
Quarry	
Existing shaft	
Bore Sites (pegged)	
Recommended Costeans and Pits (approx.)	
Main roads	
Fence	
Creek	

Fig. 15

G.S.W.A.

SHALE DEPOSIT

COCKBURN SD. LOC. 653

MUNDIJONG

Scale: 5 chains to an inch

Survey and geology by J. Noldart, Dec. 1953

been mined a short distance past the surface limits east of the shaft, and still shows a two ft. width in the drive face.

The main shaft has been sunk 35 ft. from the eastern end of the outcrop on a vein width of three and a half ft. The surface width decreases east and west of this point to about a six inch width at each end of the vein. The vein narrows slightly with depth to an average width of two and a half ft. at the 41ft. level. The maximum vein width so far encountered is on the west drive of the 34 ft. level where it reaches a width of eight ft., approximately 22 ft. west of the main shaft. At this point the vein splits, and a large lens of country rock considerably veined with barite, is making an appearance. The next greatest vein width is on the 15ft. intermediate level, where the vein is up to seven ft. wide on the floor of the drive, although narrowing considerably to the back of the drive where it is considerably shattered and broken. The vein also forks on this level, immediately east of the old shaft, in a similar manner to that on the 34 ft. level.

A fault was encountered in the 34ft. level drive, three ft. above the floor, with a strike of N. 40° W. and a shallow (5°) dip to the south-west. The fault was determined as an overthrust fault with a movement of three ft. Bedding was noted in the lens of country rock on this level as striking N.40°W. with a 10° dip to the north-east.

Elsewhere throughout the mine the vein has little appreciable width variation, showing only a gradual decrease away from the shaft.

The ore at the surface, and for the first ten feet in depth, is considerably iron-stained, giving a creamy colouration when powdered. Below this level the ore throughout the workings is very pure and clean consisting of a fine grained, opaque white variety, interbanded with a coarsely crystalline, translucent to transparent, "crested" and "lamellar" form of barite.

The vein is almost vertical, with occasional "rolls" of the order of six inches to two feet, but with a general very steep underlay to the north. The walls are for the most part smooth and clean, particularly the hanging wall, and show polishing and slickensiding throughout.

The country rock on both walls is a fine grained pinkish quartzitic type of rock, fairly soft in the upper levels, but becoming progressively harder and more siliceous with depth. No bedding strikes or dips were obtainable due to the slickensiding and polishing on the walls.

No. 2 Vein.

This vein is the second largest of the trio and occurs 600 ft. N.W. of the main vein. It has been traced over a distance of about 180 ft., with a strike of N. 80° E. and an apparent vertical dip. The maximum width of this vein is 4 ft., narrowing to approximately 1 ft. towards the extremities of the lode. The widest section of the vein is again the eastern section, as in the larger vein. Prospecting on this vein was in the nature of a shallow (4½ ft.) pit and several costeans, the pit being in the widest portion of the vein.

The ore at the surface is similar in all respects to that in the larger vein, and, although nothing is known of the vein at depth, it is probable that it will have similar characteristics to the larger vein in both grade and occurrence.

No. 3 Vein.

This vein is by far the smallest of the three with a surface outcrop length of only 50 ft., and a maximum width of 1½ ft. The vein strikes N. 70° W. with a dip of 80° to the north. The vein was reported to have been explored by a shaft to a depth of 40 ft., with the vein gradually narrowing until it pinched out at the bottom of the shaft. Collapse of the shaft precludes the possibility of any inspection, but F. R. Feldtmann described this vein as follows:—

> This vein differs from the others in that it consists practically entirely of dense fine grained barite, either very slightly translucent and of a creamy colour, or opaque and white, the opaque white mineral occurring on the walls or in cracks in the vein. Analysis of the opaque white material might show it to be of a different composition to the rest of the vein, but the vein appears on the whole to consist of purer material than the others.

From this description it would seem that the ore in this vein was characteristically similar to that in the one now being mined.

General.

The surface indications of all three veins are identical, and a notable feature is the scarcity of barite "floaters" even in the immediate vicinity of the veins. A surface examination of the two larger veins showed that large quantities of quartz rubble appeared at the extremities of the barite veins, and continued to outcrop upwards of a mile west of the larger veins, and on the same strike as the barite veins, but only for a short distance to the east. These quartz rubble bands appear to be distinct in strike and continuity from any other quartz bars in the area, and are probably the continuation of the main fracture zones.

Grade and Tonnage.

The grade in the main workings, below the 10 feet level, is high on all levels, and, except for the two different varieties of barite, no appreciable variation in grade was noticed. In his 1920 report R. F. Feldtmann judged the purity of the two larger veins on the surface indications only, as these were more iron-stained than the smallest vein. With the evidence now to hand of the purity of the largest vein, there is no reason to suppose that there would be any noticeable difference in the grade of any of the three veins below the zone of iron staining.

Approximately 150 tons of barite ore has so for been extracted from the largest vein, and present development has prepared a further 300 tons for immediate extraction if required. A lateral extent of only 100 ft. has so far been developed, and this only on the upper levels, so a payable width of ore could be expected to be encountered for some distance further west than at present mined. Assuming this vein to be similar in character to the smallest vein, then it should live to a depth of at least 80-90 feet. With due consideration for the above assumptions, a reasonable figure for the reserve ore tonnage in this vein would be about 1,500 tons.

On similar reasoning a minimum tonnage of about 1,000 tons should be available from the No. 2 vein.

It should be remembered that these tonnages are purely estimates, but the writer considers them to be fairly conservative. Considerable development is yet required to prove the existence of payable vein widths at the limits assumed.

Water and Timber.

Limited quantities of water for mining purposes are available from small dams on the neighbouring farms, but water for domestic use is an urgent problem. All supplies used to date have been transported from Perth.

The timber in the area is chiefly white gum and yate, with some small jam thickets, and ample supplies for mining purposes are available within a five mile radius from the mine.

Conclusions and Recommendations.

Three barite veins have been located in the area, the largest with a length of 400 ft., the next 180 ft. long, and the smallest with a length of only 50 ft. The two larger veins have a maximum width of four feet at the surface, but the smallest vein has only a width of 18 inches. Maximum width so far encountered in the largest vein is at a depth of 34 feet, where the vein has widened to a width of eight feet, over a distance of about 10 feet.

The barite is pure and of high grade with two types predominating. The major portion of the veins consists of a coarse grained, translucent, "crested" or "lamellar" variety of barite. The remainder is a very dense, fine grained, opaque white barite. The relative purity of the two varieties is as yet unknown.

The veins occur in fracture zones in a quartzitic country rock, believed to be quartzites of the Stirling Range succession. The attitude of these quartzites is not determinable.

The veins appear to be Mesothermal deposits deriving from a deep seated magmatic intrusive body, the presence of which is suggested by the occurrence of the aplite dykes mentioned by F. R. Feldtmann.

The vertical extent of the two larger veins cannot be determined, but, from the evidence offered by the development of the smaller vein, they can reasonably be expected to extend to a depth of more than 80 feet.

The main vein is tabular in nature, and, although no definite evidence is forthcoming, the writer believes this body to have a plunge of approximately 65° to the east.

It is recommended that the main shaft be deepened to determine the vertical extent of the vein, and that the ore body then be driven on to the east and west of the shaft, at as deep a depth as is practical, to explore the lateral extent of the ore body at depth. It is possible that small parallel veins exist, and lateral drilling should be carried out periodically to determine the presence of any such veins.

Surface prospecting for an eastern continuance of the main veins along the strike is strongly recommended, particularly an area approximately 40-50 chains east of the main shaft. Any prospecting carried out should be in the nature of a system of costeans, as surface indications of any barite lode are very poor, and indefinite, in this area.

INSPECTION OF ARTESIAN BORE SITES AT DONGARA AND YARDARINO.

By R. R. Connolly.

Following an enquiry from the Irwin Road, Health, Vermin and Cemetery Board for information about artesian water in the vicinity of Dongara, an attempt was made to fix the exact position of two bores in the area known to have yielded artesian water.

Both bores had been put down under contract for the Public Works Department early in the century with the twofold purpose of locating the westward extension of the Irwin Coal Measures and testing the strata for artesian water supplies.

The original records of both bores have since been lost and no record of the position or condition of the bores could be found.

The area was visited on 20th May, 1953.

Dongara Bore.

References.

G.S.W.A. file 219/99.

Report on the Interstate Conference on Artesian Water, Brisbane, 1914.

Location.

The writer was guided to the approximate locality of the bore by Mr. Clarkson, a local resident, and a thorough search of the area was made. The only evidence of the existence of a bore was an abandoned length of casing found on some higher ground approximately 250 yards due south of the Dongara Post Office.

According to Mr. Clarkson the bore had been sealed off a few years after drilling had been completed in 1909. The area, situated on a terrace of the Irwin River, has probably been subjected to seasonal flooding, the deposits therefrom and a thick growth of vegetation having since completely obscured the collar of the bore.

From the analysis of the water obtained from this bore when flowing (p. 256 Interstate Water Conference) it can be seen that with a total salt content of 1530.2 grains per gallon the water would have been quite useless as a town water supply and no attempts should be made to obtain artesian water from this area for such a purpose.

Yardarino Bore.

References.

G.S.W.A. file 129/01.

Report on the Interstate Conference on Artesian Water, Brisbane, 1914.

Location and Access.

The Yardarino bore was found on the north bank of the Irwin River one mile S.60°W. from the Irwin railway siding. It is marked on the Mingenew sheet of the Army four mile to the inch map series as a hot pool. Access is by track from the Geraldton highway one quarter of a mile from the boresite.

Condition of Bore.

The bore was flowing at the time of inspection although the collar of the bore was covered by an unknown depth of coarse river sand. Small streams of warm water flowed away from the pool which was presumbably immediately above the collar of the bore. The water eventually drained into the main course of the Irwin River.

Quality of Water.

Two samples of water taken from the bore while drilling was in progress gave an analysis 95.90 and 163.68 grains per gallon total solids respectively, the major constituent in each case being sodium chloride. These samples were presumably taken at different depths but no record remains of those depths.

A sample of the water at present flowing from the bore gave the following analysis as determined by the Government Chemical Laboratories.

		Grains per gallon.
Calcium Carbonate	$CaCO_3$	4.27
Magnesium Carbonate	$MgCO_3$	Nil
Sodium Carbonate	Na_2CO_3	Nil
Calcium Sulphate	$CaSO_4$	11.34
Magnesium Sulphate	$MgSO_4$	5.60
Sodium Sulphate	Na_2SO_4	Nil
Magnesium Chloride	$MgCl_2$	20.79
Sodium Chloride	NaCl	130.62
Potassium Chloride	KCl	6.16
All other solids		4.13
Total Solids		182.91

Quantity of Water:

The yield of the bore could not be measured at the time of inspection but would almost certainly be very much less than the 589,000 gallons per day measured when the bore was first brought in.

Conclusions:

The Dongara bore was not located and from existing records artesian water from the area around Dongara would be quite unsuitable for a town water supply.

The Yardarino bore, although located, is at present yielding water of salt content greater than 100 grains per gallon which is the generally accepted maximum salt content for a town water supply.

Index to Geological Survey Annual Progress Report for 1953

Division V.

School of Mines, Western Australia.

The Under Secretary for Mines.

I have the honour to submit for the information of the Honourable the Minister for Mines my report for the year 1953.

KALGOORLIE.

Enrolments.

The total number of enrolments received in 1953 was 401—a decrease of 20 by comparison with the previous year. This decrease is more than accounted for by a decrease from 53 to 18 in the number of E.G.H.S. boys taking geology in preparation for the Junior Certificate Examination. Table I gives the individual and class enrolments for 1951, 1952, and 1953, and table II gives the enrolments in the various subjects for 1953.

TABLE I.

Enrolments—1951, 1952, 1953.

Year.	First Term.		Second Term.		Third Term.	
	Individual.	Class.	Individual.	Class.	Individual.	Class.
1951	368	794	321	652	281	550
1952	391	857	363	711	303	582
1953	365	787	341	699	294	606

TABLE II.

Class Enrolments, 1953.

	First Term	Second Term	Third Term
Peparatory Chemistry	28	21	18
Chemistry IA	14	14	13
Chemistry IB	2	1	–
Analytical Chemistry I	1	1	1
Analytical Chemistry II	7	7	7
Chemical Metallurgy I	1	2	2
Mineral Dressing I	8	9	8
Mineral Dressing (Practical)	4	4	3
Physical Metallurgy I	4	4	4
Assaying	6	6	6
Heat Treatment of Steels	–	5	–
Applied Chemistry	3	3	3
Metallurgy II	6	6	6
Preparatory Mathematics	37	27	24
Mathematics I	52	47	41
Mathematics IIA	20	16	13
Mathematics IIB	7	7	7
Mathematics IIC	6	7	7
Applied Mathematics	14	13	13
Preparatory Physics	12	13	13
Physics I	24	20	21
Physics IIA	6	6	6
Physics IIB	4	4	4
Trade Mathematics I	54	46	21
Preparatory Engineering Drawing	33	31	23
Engineering Drawing I	32	29	24
Engineering Drawing and Design IIA	13	12	7
Engineering Drawing and Design IIB	2	2	2
Engineering Drawing and Design IIC	2	2	2
Engineering Drawing and Design IID	1	1	1
Surveying Drawing II	3	2	2
Mechanical Engineering I	8	9	9
Mechanical Engineering II	2	2	2
Practical Electricity	14	9	8
Electrical Engineering I	10	7	7
Electrical Engineering II	7	7	7
Internal Combustion Engines	36	27	25
Workshop Practice I	38	34	21
Workshop Practice II	13	10	9
Workshop Practice IIIA	5	6	4
Engineering Workshop Practice	3	2	1
Welding I	34	23	22
Welding II	11	11	11
Steam Engine Driving	5	4	3
Structural Engineering I	10	10	10
Structural Engineering II	2	2	2
Machine Design	6	6	6
Materials of Construction	4	5	5
Hydraulics	4	3	3
Preparatory Geology	18	18	16
Geology IA	12	12	12
Geology IB	17	18	16
Geology IIA	14	13	13
Geology IIB	7	6	6
Geology IIIB	1	1	1
Geology IIIC	3	3	3
Mining I	14	11	9
Mining II	5	3	3
Mining IIC	–	–	1
Mining III	9	6	6
Mining IIIA	2	2	–
Mining IIIB	1	–	2
Mine Ventilation	9	8	8
Surveying I	7	7	6
Surveying II	8	7	7
Preparatory English	6	7	6
English IA	18	17	16
Sub-Junior Geology	18	18	18
Totals—1953	787	699	606
1952	857	711	582

The total enrolment was made up as follows:—

(1) Students paying class fees (21 years of age or over)—			
Full time	4		
Part time	121		
			125
(2) Students nominated by Repatriation Department (C.R.T.S. and others)—			
Full time	1		
Part time	15		
			16
(3) Students paying a registration fee of 5s. or students who pay no fees, including E.G.H.S. pupils—			
Full time	14		
Part time	143		
			157
(4) Students who are returned servicemen and are exempt from class fees (General Regulation 5). Not nominated by Repatriation Department—			
Full time	1		
Part time	102		
			103
			401

Revenue.

An amount of £627 13s. 6d. was received as fees from students enrolled under groups 1, 2 and 3, from lecture note fees, and from the sale of official publications. The total amount paid into the Kalgoorlie Metallurgical Laboratory Trust Fund was £376 18s. for fees for work done in the Laboratory.

Staff.

Staff changes as listed below occurred during the year:—

Name.	Position.	Date.	Notes.
Bialecki, G.	Laboratory Assistant	17–11–53	Transferred to Metallurgical Laboratory
Dunstan, H. R.	Laboratory Technician	11–5–53	Appointed.
Field, R. V.....	Cadet	31–12–53	Completed term of appointment.
George, T. J F.	Laboratory Assistant	17–11–53	Appointed.
Griffin, A. F.	Research Metallurgist	9–10–53	Resigned.
Jones, W. R.	Assistant....	6–2–54	Resigned.
Miles, A. T.	Laboratory Technician	3–3–53	Appointed Acting Research Metallurgist.
Shaw, S. C.	Laboratory Assistant	20–3–53	Resigned.
Wheeler. H. W.	Lecturer	6–5 53	Appointed.

During the year the following part-time instructors were employed: Crocos, A. J. (Mining I); D'Alton, A. J. (library); Doran, R. R. H. (Practical Electricity); Hamilton, F. G. (Surveying I); Hayhow, L. O. (Welding I and II); Mitchell, V. (Preparatory English).

Courses of Study.

The revised courses referred to in last year's Annual report were introduced and found to be quite satisfactory. Towards the end of the year a few minor changes were thought desirable, and will be introduced in 1955. The following courses were available for study in 1953:—

Associateship Courses—
- Associateship Course in Mining.
- Associateship Course in Metallurgy.
- Associateship Course in Engineering.
- Associateship Course in Mining Geology.

Certificate Courses—
- Assayer's Certificate Course.
- Surveyor's Certificate Course.
- Mine Manager's Certificate Course.
- Engineering Draughtsman's Certificate Course.
- Electrical Engineer's Certificate Course.
- Mechanical Engineer's Certificate Course.

Technicians' Courses—
- Engine Operation and Maintenance Course.
- Workshop Foreman's Course.

Annual and Supplementary Examinations.

At the Annual Examinations 546 entries for individual subjects were received. This figure is 65 per cent. of the possible number, and is an appreciable improvement on the corresponding figure for 1952, which was 54 per cent. The figure for 1953 compares very favourably with those obtained from 1946 to 1949, when large numbers of C.R.T.S. students were enrolled full-time at the School. The proportion of passes at the Annual Examinations and at the Supplementary Examinations remained approximately the same—if anything there was a slight improvement. Details are given in table III.

TABLE III.

EXAMINATIONS RESULTS, 1946–1953.

KALGOORLIE.

	1946	1947	1948	1949	1950	1951	1952	1953
Class Enrolments = A	1,331	1,834	1,498	1,129	946	833	856	837
Number of Entries for Annual Examinations = B	880	1,196	1,097	750	579	434	458	546
B/A per cent	66	64	73	66	61	51	54	65
Number of passes at Annual Examinations, as a per cent of A	58	53	55	49	48	41	43	54
Number of passes at Annual Examinations, as a per cent of B	88	81	76	74	78	79	80	83
Number of passes at Annual and Supplementary Examinations, as a per cent of A	60	55	57	52	50	44	44	56
Number of passes at Annual and Supplementary Examinations, as a per cent of B	90	84	79	78	81	84	82	85

Scholarships and Prizes.

Mr. G. M. Sainsbury, who was awarded a Mines Department Senior Scholarship at the end of 1952, completed a satisfactory year's work, and his Scholarship will be renewed for 1954. No applications for Mines Department Scholarships were received in 1953. This is difficult to understand as these Scholarships make full-time study at the School possible, and the conditions are reasonably attractive.

The first awards of the Chamber of Mines Scholarships for full-time study were made earlier in 1953. The two scholarships tenable at the School of Mines (Associateship Courses) for two years' full time study were awarded to C. H. Annear and G. M. Sainsbury. Both these students completed a satisfactory year's work. An award was also made to G. J. Dodge for one year's study at the equivalent of Leaving Standard at the School of Mines.

During the year the conditions for other Scholarships and prizes were reviewed and revised with the object of increasing the number of students eligible for any one scholarship or prize. The new conditions will become effective in 1954, and are listed in the Prospectus for that year.

Diplomas and Certificates.

The following Diplomas and Certificates were granted in 1953:—

Associateship Course in Mining	3
Associateship Course in Metallurgy	1
Associateship Course in Engineering	4
Associateship Course in Mining Geology	1
Total	9

Assayer's Certificate	3
Surveyor's Certificate	7
Engineering Draughtsman's Certificate	3
Electrical Engineer's Certificate	1
Mechanical Engineer's Certificate	1
Industrial Chemist's Certificate (pre 1947 course)	1
Total	16
Engine Operation and Maintenance Course	5
Workshop Foreman's Course	—
Total	5

The figures given above include any diplomas or certificates granted to students of a branch school. They do not include any students who have completed the Mine Manager's Certificate Course, for which a certificate is not generally issued. The issue of a certificate for this course could lead to confusion with the Mine Manager's Certificate of Competency issued separately by the Mines Department.

Students nominated by Repatriation Department.

A few students are still enrolled part-time under C.R.T.S., and in 1953 one student commenced full-time study under a new scheme—Disabled Members and Widows' Training Scheme. Details are as follows:—

C.R.T.S.	1951	1952	1953
Full Time	2	—	—
Part Time	40	24	14

D.M.W.T.S.	1953
Full Time	1
Part Time	—

Classes for High School Pupils.

Eighteen pupils required sub-junior geology, and this class was held as in previous years. Insufficient pupils to justify a class required junior geology, and this class was not held. Enrolments were as below:—

	1951	1952	1953
Sub-junior geology	37	37	18
Junior geology	12	15	—

Services to the Public.

During 1953 the School continued to provide services to the Public other than its teaching activities.

More details are given elsewhere about the work done in the Kalgoorlie Metallurgical Laboratory. The Laboratory continued to examine and report upon samples submitted for investigation.

During the year 607 samples were received from prospectors for mineral examination and/or assay. This is a large increase by comparison with the number received in the previous year, which was 374. As in previous years all assays were made in the Kalgoorlie Metallurgical Laboratory, and all mineral examinations were made by Mr. Cleverly, lecturer-in-charge of geology at the School. No charge is made for this work. Details of the work done on the samples are given below:—

	1952	1953
Assay—gold	99	276
Assay—gold and other constituents	16	8
Assay—metals other than gold	18	13
Assay plus mineral examination	22	14
Mineral examination	213	288
Rejected or transferred to Metallurgical Laboratory pay	6	8

As in previous years the Junior and Leaving Examinations and University examinations for external students were held at the School. Various professional bodies continued to meet at the School. In May some members of the Fifth Empire Mining and Metallurgical Congress visited Kalgoorlie, and a technical session was held on 18th May at the School.

Buildings.

No new buildings were added during 1953, and the buildings generally are in fair condition. External painting and some internal painting are required, and it is hoped that these will be done during 1954.

Requirements of the School.

The fume cupboards and the installation of the Aerogen petrol gas system referred to in the Annual Report for 1952 were completed, and both are very satisfactory. The transfer of the Metallurgical Laboratory to A.C. was commenced, and will be completed in 1954. The Mineral Dressing Laboratory for student use is still outstanding.

The major requirements of the School are still as listed in last year's report:—

(1) A mineral dressing laboratory for student use (Estimated cost at 27/9/51, £5,775).

(2) Alterations and extensions to the Kalgoorlie Metallurgical Laboratory (Estimated cost at 9/7/52, £14,550).

(3) A central library and a full-time staff (Estimated cost of library at 29/5/51, £18,500).

The minor requirements as listed in the 1952 report have been completed or commenced except for the strong room in the office. An additional safe has been provided in the office, and reasonably satisfactory storage for School records is now available.

Minor requirements are now as follows:—

(1) Improvements to water supply throughout the School.

(2) A store in the workshop.

(3) A strong room for the office.

Advisory Committee.

The Advisory Committee met six times and attendances were as follows:—

Mr. J. H. Verran (chairman to 1/11/53)	5
Mr. M. Harwood (chairman after 1/11/53)	1
Mr. J. E. Manners	6
Mr. C. H. Warman	4
Mr. J. A. Maloney	2
Mr. F. Collard	2
Mr. R. A. Hobson	6

Towards the end of the year Mr. Verran retired from the position of Senior Inspector of Mines, and resigned as Chairman of the Advisory Committee. Mr. M. Harwood was appointed as Chairman to replace Mr. Verran, and attended his first meeting on 3rd December.

A further grant of £2,000 was received for the Apparatus and Equipment Trust Fund in June. At the end of the year the actual balance in this fund was £2,891 8s. 10d. After allowing for outstanding commitments the estimated balance was £968. Since 1948, £10,000 has been paid into this fund, and much valuable equipment has been purchased for the School. Students have been able to use equipment, which would otherwise have not been available to them.

Kalgoorlie Metallurgical Laboratory.

The volume of work received in the Laboratory was at least equal to that received in previous years. Sixty-three applications for work to be done were received, and 61 reports were issued—some of these had reference to work received during the previous year. The position is summarised in table IV, which gives information for 1951 to 1953.

TABLE IV.

	1953	1952	1951
Investigations Outstanding (1st January)	11	11	....
Investigations asked for	63	48	47
	74	59	....
Investigations completed	61	47*	45
Investigations outstanding (31st December)	12	11	11
Investigations cancelled	1	1	2
	74	59	58

*Including five supplementary reports.

Of the 61 reports issued, 18 had reference to gold, 27 to other metals, and 16 to non-metallics. Thirty-seven reports consisted of assays or analyses only, and in future we propose to separate these from those correctly referred to as investigations, and to issue the results in a different form. Reports of investigations will be issued in the same form as at present, and distributed in the same way. Results which consist of measurements only (assays, analyses, etc.) will be issued in a different form, and will be sent only to the person submitting the sample or samples. This procedure will give a more correct impression of the work of the Laboratory, and will simplify office procedure.

In Appendix 1 the Senior Research Metallurgist has given information about the more extensive investigations and has summarised the year's work.

In addition to the normal work of the Laboratory assays and analyses were made for prospectors, and are referred to in an earlier section of this report.

All outstanding items for the pilot plant were received, and are now being installed. Additional items of equipment were purchased through the Mines Department, through C.S. & I.R.O., and through the Trust Fund for other sections of the Laboratory, and generally the equipment position is satisfactory.

The most urgent need at present is for improvements to the building—the chemical section and the crushing section urgently require attention. In addition there is need for an assay laboratory attached to the Laboratory. At present all assays are made in the School laboratory, which is some distance away from the Metallurgical Laboratory. No funds were available for this work during 1953.

The C.S. & I.R.O. continued to assist the Laboratory, and for the 1953/54 financial year provided £2,400 for salaries and for equipment.

Students' Association.

The Students' Association was reasonably active during the year, and two very successful functions were held—the Annual Ball on the 10th July, and a Dinner on the 13th November. In addition, the Association provided the usual Scholarship.

NORSEMAN.

Enrolments.

The total number of enrolments received during the year was 60—a decrease of three by comparison with 1952. In addition, accommodation, equipment and some assistance was provided to enable a class to be held in General Science for State School children. Thirty-two children attended this class. The number of students enrolled each term was slightly less than in the previous year, but was greater than the number enrolled in 1951. Details of enrolments for 1951 to 1953 are given in table V, which does not include State School children.

TABLE V.

Enrolments—1951, 1952, 1953.

Year.	First Term.		Second Term.		Third Term.	
	Individual.	Class.	Individual.	Class.	Individual.	Class.
1951	49	112	39	90	31	72
1952	55	139	59	142	55	138
1953	54	141	53	124	45	107

Revenue.

The revenue received during the year was £47 13s. 6d.

Staff.

At the end of 1952, Cadet E. J. Lea completed his term of cadetship, and in February, 1953, Cadet S. R. Baker commenced. Otherwise the full-time staff remained as in 1952.

The following part-time instructors were appointed for 1953:—Abotomey, J. (Surveying I); Atkinson, R. V. (Practical Electricity); Burke, J. (Preparatory Physics); Dodd, A. C. (Workshop Practice II); Huxtable, D. A. (Mining II and various drawings); Lambie, R. (Workshop Practice IIIB); Long, B. W. (Assaying, Chemistry IA); Rose, F. G. (Welding); Verran R. J. (Internal Combustion Engines).

Subjects Taught.

Twenty-three School of Mines subjects were taught in 1953. As in previous years Central Norseman Gold Mines made their workshops available for classes in workshop practice and in welding. Without this assistance these classes could not be held, and the thanks of the School are due to this Company.

Examinations.

The number of entries at the Annual Examinations for individual subjects was 84, which is 58 per cent. of the total class enrolments. This figure is lower than the corresponding figure for 1952, and lower than the figure generally obtained at Norseman. Table VI gives a summary of examinations results from 1946 onwards, and table VII gives a comparison of Norseman and Kalgoorlie results over a period of three years.

TABLE VI.

EXAMINATIONS RESULTS, 1946–1953.

NORSEMAN.

	1946	1947	1948	1949	1950	1951	1952	1953
Class Enrolments = A	80	54	130	130	78	112	149	144
Number of entries for Annual Examinations = B	57	47	107	81	47	68	108	84
B/A per cent	71	87	82	62	60	61	72	58
Number of passes at Annual Examinations, as a per cent of A	51	72	59	47	55	53	54	46
Number of passes at Annual Examinations, as a per cent of B	72	83	81	77	91	88	75	80
Number of passes at Annual and Supplementary Examinations, as a per cent of A	51	72	68	50	56	54	58	48
Number of passes at Annual and Supplementary Examinations, as a per cent of B	71	83	85	81	93	89	80	82

TABLE VII

EXAMINATIONS RESULTS, NORSEMAN AND KALGOORLIE.

Note :—The letters "A" and "B" have the same meanings as in Table VI.

	NORSEMAN.			KALGOORLIE.		
	1951	1952	1953	1951	1952	1953
B/A per cent	61	72	58	51	54	65
Total passes as a per cent. of A	54	58	48	44	44	56
Total passes as a per cent. of B	89	80	82	84	82	85

Scholarships and Prizes.

The two students—C. J. Young and L. G. Kerr—who held Reg Dowson Scholarships during 1953 both completed a satisfactory year's work. The Scholarships based on the work done during 1953 were awarded to S. R. Baker and to R. B. Atkinson.

In additions R. B. Atkinson was awarded a Robert Falconer prize in competition with students at Kalgoorlie and at Bullfinch. R. B. Atkinson completed a very good year's work, and obtained two credit passes and one ordinary pass in Preparatory subjects.

Diplomas and Certificates.

Three students gained their Mine Surveyor's Certificates and four their Engine Operation and Maintenance Certificates. Another student completed all the requirements for the Mine Surveyor's Certificate, but has not yet submitted his application. These are the first students to complete courses at Norseman, and they are to be congratulated on their success.

Buildings.

No additions to the building were made during 1953, and it is now very overcrowded. Attention was directed to this condition in the 1952 Annual Report. Only minor repairs were made during 1953 in the hope that additions might be possible in 1954. Repairs and renovations are now urgently required, and should not be deferred beyond 1954 under any circumstances.

Advisory Committee.

The Advisory Committee continued to meet under the chairmanship of Mr. Dutton, and the thanks of the Department are due to members, who gave of their time to assist the School.

Classes for School Children,

Assistance was again given to pupils of Norseman High School, and accommodation and equipment provided to enable a class in General Science to be held for 32 children.

BULLFINCH.

Approval for a branch school at Bullfinch was given late in 1952, and all arrangements were completed for some classes to commence in February 1953.

Enrolments.

The total number of enrolments received during the year was 69. This figure is higher than was anticipated, and higher than we can reasonably expect in future years. Details are given in table VIII.

TABLE VIII.

Enrolments—1953.

Year.	First Term.		Second Term.		Third Term.	
	Individual.	Class.	Individual.	Class.	Individual.	Class.
1953	69	108	42	71	42	71

Revenue.

The revenue received was £34 17s. 6d.

Staff.

Mr. J. C. Browne was appointed as part-time Registrar. The teaching staff were all part-time, and were drawn from the Staff of the Mine. The following part-time staff were appointed: P. Della-Bosca (Workshop Practice I); K. Denham (Trade Mathematics I, Preparatory Mathematics); R. Hooper (Mining I); D. Humfrey (Welding I); R. Munday (Internal Combustion Engines); G. Rasmussen (Drawing—various grades); C. Walker (Practical Electricity).

Subjects Taught.

Ten subjects were taught during 1953. The thanks of the School are due to Great Western Consolidated who not only provided accommodation in their workshops, but also provided a building in which other classes could be held.

Examinations.

Sixty-eight entries were received for individual subjects at the Annual Examinations. This figure is 64 per cent. of the possible entries, and compares quite favourably with the corresponding figures for Norseman and Kalgoorlie. A smaller proportion of those who entered were successful at Bullfinch by comparison with Norseman and Kalgoorlie. This is quite understandable in a new School, particularly as enrolments were higher than might have been reasonably anticipated. More information. is given in table IX, and the corresponding information for Norseman and Kalgoorlie has been added for comparison.

TABLE IX.

EXAMINATIONS RESULTS, 1953.

BULLFINCH.

	BULLFINCH.	NORSEMAN. (For Comparison.)			KALGOORLIE. (For Comparison.)		
		1951	1952	1953	1951	1952	1953
Class Enrolments = A	107	....	....	....	....	....	....
Number of entries for Annual Examinations = B	68	....	....	....	....	....	
B/A per cent.	64	61	72	58	51	54	65
Number of passes at Annual Examinations, as a per cent. of A	35	53	54	46	41	43	54
Number of passes at Annual Examinations, as a per cent. of B	54	88	75	80	79	80	83
Number of passes at Annual and Supplementary Examinations, as a per cent. of A	36	54	58	48	44	44	56
Number of passes at Annual and Supplementary Examinations, as a per cent. of B	57	89	80	82	84	82	85

Scholarships and Prizes.

The Bullfinch Country Club offered a prize each year to the student at Bullfinch under 18 years of age, who does the best year's work. The prize for 1953 was awarded to F. W. Tromans.

Buildings.

During the year classes were held in a building made available by Great Western Consolidated. Towards the end of the year approval was given for removal of a building from Chandler and its re-erection at Bullfinch. The building will be suitably altered to provide two class rooms. Originally it was proposed to provide a physics and a chemistry laboratory and to add a drawing office. This would have enabled all the Preparatory subjects to be done at Bullfinch, but sufficient money was not available, and the proposal had to be modified. Provision should be made as early as possible for Preparatory Chemistry and Preparatory Physics to be taught at Bullfinch.

Advisory Committee.

The following committee was appointed:

L. C. Brodie-Hall (Chairman).
A. B. Smith.
E. A. Harrison.
C. Roberts.
A. Hoffmann.
R. McGillivray.
J. Hodges.
J. C. Browne (Secretary).

ACKNOWLEDGMENTS.

Information for this report has been supplied by the Registrars at Kalgoorlie, Norseman, and Bullfinch, and also by the Senior Research Metallurgist. My thanks are due to these officers for their assistance. Throughout the year all members of the staff have carried out their duties efficiently, and have endeavoured to give the maximum assistance to students or others who come to the School for assistance. Appreciation is also due to the various advisory committees, and also to mining companies at Norseman and at Bullfinch, who have made their workshops available for classes.

R. A. HOBSON,
Director, School of Mines.

Appendix I.

KALGOORLIE METALLURGICAL LABORATORY.

By C. H. S. MEHARRY, A.W.A.S.M. (Min. and Met.), M. Aust. I.M.M., Senior Research Metallurgist.

Introduction.

A total of 61 reports were issued during 1953, of these 37 reports involved assays and analytical work only. The remaining 24 reports covered a wide range of metallurgical investigations.

A brief description of the more comprehensive investigations follows, and a table is included showing the complete list of reports, owners, localities of samples, ore types, and scope of the work.

For further information regarding these reports apply to the—

Senior Information Officer,
Information Service,
C.S. and I.R.O.,
314 Albert street,
East Melbourne, Vic.

from whom copies of the reports can be obtained, usually six months after the date of issue.

Gold Ores and Products.

Report 566.

A complex gold-silver ore from Ora Banda, W.A., containing tetrahedrite and chalcopyrite was investigated. The ore contained 10.6 dwts. of gold per ton, 50 ounces of silver per ton, and 2.5 per cent. copper, with about 0.5 per cent. antimony.

Two methods of treatment were investigated. The first method was crushing to 22 mesh and tabling to yield a concentrate, a sand tailing and a slime tailing. The slime tailing was concentrated by flotation and the sand tailing and flotation tailing were cyanided to recover the gold. The overall recovery of gold, silver, and copper by tabling and flotation was 63.3 per cent., 80.6 per cent., and 81.0 per cent. respectively.

The other method used was fine grinding to minus 72 mesh and flotation. The recovery of gold, silver and copper was 80.5 per cent., 86.6 per cent., and 96.3 per cent.

Report 580.

This report details a method developed to sample churn drill sludge samples. The sludge was deslimed in a desliming cone, the "slime" was discarded and the sand only sent for drying, sampling and assay. Previous work (Report 509) had indicated that the slime portion would be of relatively constant gold content and once this value had been determined a factor representing the gold content of the slime could be added to the assay value of the sand product. In this way the inefficiency of dip sampling and the tediousness of drying slime are avoided.

Report 597.

A comprehensive investigation was made on the gold ore from Sunshine Reward Gold Mine to obtain data for a proposed major alteration in the treatment plant. The proposal was to change over from the current stamp battery crushing and leaching practice to fine grinding and continuous agitation cyanidation.

Grinding tests showed that it would be necessary to grind the ore to minus 100 mesh to obtain cyanidation residues below one dwt. per ton.

Filter capacity tests showed that the ore pulp was not amenable to continuous vacuum filtration.

Settlement test, however, showed that the ore pulp was ideally suited to decantation washing.

The size of units based on a tonnage of 50 tons per 24 hours was calculated. Gold and water balances were calculated on the above tonnage rate and data obtained from the tests.

Tungsten.

Report 526.

A high grade wolframite-chalcopyrite ore from the Northern Territory was examined for the determination of a suitable method of treatment.

Preliminary tests and mineralogical examination showed that the valuable minerals would be liberated from each other and the quartz at minus 8 mesh.

The ore was crushed in laboratory crushing rolls to minus 8 mesh and a jig concentrate was made. This concentrate assaying 70.8 per cent. WO_3 and 0.5 per cent copper contained about 50 per cent. of the tungsten in the feed.

The jig tailing was deslimed and concentrated on a laboratory Wilfley table. The tabling yielded a clean chalcopyrite concentrate product and a mixed chalcopyrite-wolframite concentrate. This mixed concentrate was ground and concentrated by flotation yielding a chalcopyrite concentrate and a wolframite tailing.

Report 568.

Mineral Recovery Ltd. of Kalgoorlie, erected a small treatment plant for the recovery of scheelite etc. from sample parcels of ore. The plant con-

sisted of a small jaw crusher and rolls in closed circuit with a vibrating screen. The crushed ore was fed to a diaphram jig and the jig tailing was pumped to a Humphrey spiral concentrator. The concentrate from the spiral was cleaned on a small shaking table.

Test work on the ore was carried out both in the laboratory and at the treatment plant to determine the best operating conditions.

Sulphur Recovery.

Report 558.

An investigation was carried out to improve the current practice at the pyrite recovery plant of Norseman Gold Mines N.L.

It was found that the pyrite was very closely intergrown with the gangue minerals and fine grinding would be necessary to obtain high grade concentrates and low grade tailings.

Grinding to minus 100 mesh and using soda ash and copper sulphate to condition the pulp, followed by flotation with stage additions of sodium ethyl xanthate gave good results. A concentrate assaying 50 per cent. sulphur was obtained, and neglecting the middling products in a locked batch test the recovery of suphur in the concentrate was 94 per cent.

Pine oil-cresylic acid mixtures and pine oil alone gave a froth that was too brittle and it was found necessary to use Barrett No. 4 frother to produce a stable froth.

Preaeration did not improve the recovery or grade, and it was found necessary to add xanthate to the cleaning and recleaning stages.

Bentonite.

Report 548.

The State Mining Engineer requested that some test work be done on a local bentonite clay from Marchagee to attempt to improve its qualities in a drilling mud.

A detailed test programme showed that the sample of Marchagee clay submitted, when conditioned with three per cent, by weight of sodium carbonate, made a suspension equivalent to "Volclay." The yield, thixotropy, water loss, and wall building properties of the beneficiated Marchagee clay were equivalent to a suspension of the "Volclay"—an imported clay.

Lime Sands.

Report 569.

This report details the application of table flotation to the beneficiation of lime sands from Mullalloo Beach, Perth, W.A. The sands contain 81 per cent. calcium carbonate and about 10 per cent. silica, and the object of the investigation was to develop a method to remove the silica without prior grinding. The resulting high grade calcium carbonate concentrate was to be used for the manufacture of lime.

Table flotation, after conditioning with sulphonated castor oil and diesel fuel oil, yielded a concentrate assaying 90.2 per cent. calcium carbonate and 0.38 per cent. silica. This represented a recovery of 98.69 per cent. of the calcium carbonate. The theoretical grade of concentrate obtainable, assuming that the magnesium carbonate was all contained in the calcium carbonate, was 92.23 per cent. calcium carbonate. Thus the grade of 90.2 per cent. calcium carbonate obtained was 97.8 per cent. of the theoretical grade.

Other Investigations.

A number of smaller reports were issued on subjects such as the beneficiation of graphite ores, lead ores, spodumene, and corundum.

The reports issued covering analyses and assays only included analyses for tungsten, cobalt, nickel, tin, titanium, phosphorus, as well as several complete analyses.

During the year many enquiries from the industry were received and technical assistance was given in many cases.

KALGOORLIE METALLURGICAL LABORATORY.

SUMMARY OF YEAR'S WORK (1953).

Report No.	Owner.	State.	Locality.	Ore Type.	Type of Investigation.	Date available for publication	Number of Metallurgical Tests.	Number of Assays.	
								Gold.	Other Metals, etc.
521	Western Mining Corporation	W.A.	Bullfinch	Gold - tungsten	Recovery of scheelite	24–12–53	3	....	....
526	Wolfram Hill, N.L.	N.T.	Pine Creek	Tungsten - copper	Method of treatment	17–8–53	17	4	108
548	State Mining Engineer	W.A.	Marchagee	Bentonite	Beneficiation	21–1–54	283	....	22
557	Great Boulder Pty., Ltd.	W.A.	Fimiston	Graphite	Beneficiation	22–7–54	10	....	56
558	Norseman Gold Mines. N.L.	W.A.	Norseman	Sulphur	Recovery Tests	10–6–54	44	....	396
566	H. D. Golding	W.A.	Ora Banda	Gold - Silver-copper	Method of treatment	3–9–53	21	118	124
568	King of the Hills Syndicate	W.A.	Comet Vale	Tungsten	Pilot plant tests	3–2–54	13	....	78
569	Department of Industrial Development	W.A.	Perth	Lime sands	Beneficiation	15–4–54	64	....	278
573	R. Ibbotson	W.A.	Uaroo - Onslow District	Lead	Recovery tests	27–8–53	4	....	14
575	Hampton Gold Mining Areas	W.A.	Mt. Marion—near Kalgoorlie	Spodumene	Beneficiation	18–8–53	8	....	....
576	King of the Hills Syndicate	W.A.	Comet Vale	Tungsten	Assays only	5–7–53	....	....	4
577	Mineral Recovery, Ltd.	W.A.	Comet Vale	Tungsten	Assays only	13–7–53	....	....	2
578	Mines Department of W.A.	W.A.	Laverton	Gold	Assays only	6–8–53	....	14	....
579	Mineral Recovery, Ltd.	W.A.	Marble Bar	Tungsten	Recovery tests	1–10–53	6	18	30
580	Western Mining Corporation	W.A.	Bullfinch	Gold	Sampling method for drill sludge	3–4–54	5	26	....
581	Broken Hill, Pty., Ltd.	N.T.	Pine Creek	Tin	Assays only	9–10–53	....	....	8
582	L. Ford	W.A.	Coolgardie	Gold	Amalagamation test	4–9–53	1	6	....
583	Kiesey Lime Supply	W.A.	Naretha	Lime	Assays only	22–9–54	....	....	20
584	Mineral Recovery, Ltd.	W.A.	Comet Vale	Tungsten	Assays only	13–9–53	....	....	2
585	Mines Department of W.A.	W.A.	Higginsville	Gold	Assays only	9–9–53	....	4	....
586	Mines Department of W.A.	W.A.	Higginsville	Titanium	Assays only	19–9–53	....	....	6
587	G. Vujcich	W.A.	Riverina	Water	Analysis	2–10–53	....	....	8
588	R. Hare	W.A.	Roebourne	Copper-Cobalt	Assays only	23–10–53	....	....	16
589	W. A. Kent	W.A.	Coolgardie	Tungsten	Assays only	7–11–53	....	....	2
590	K. J. Finucane	W.A.	Esperance	Guano	Assays only	25–11–53	....	....	8
591	Mineral Recovery, Ltd.	W.A.	Comet Vale	Tungsten	Assays only	3–12–53	....	4	18
592	R. Hare	W.A.	Roebourne	Copper-cobalt....	Assays only	21–11–53	....	....	8
593	G. S. Compton	W.A.	Kalgoorlie	Gold	Treatment tests	25–11–53	3	20	....
594	Broken Hill, Pty., Ltd.	W.A.	Marble Bar	Gold-nickel	Assays only	29–11–53	....	2	2
595	*Cancelled*								
596	Norseman G.M., N.L.	W.A..	Norseman	Sulphur	Analysis of drill core	11–2–54	....	4	38

Kalgoorlie Metallurgical Laboratory—Summary of Year's Work (1953)—continued.

Report No.	Owner.	State.	Locality.	Ore Type.	Type of Investigation.	Date available for publication	Number of Metalurgical Tests.	Number of Assays.	
								Gold.	Other Metals, etc.
597	Sunshine Reward, G.M.	W.A.	Edward's Find via Southern Cross	Gold	Plant design tests	7–3–54	59	287	18
598	Mines Department of W.A.	W.A.	Norseman	Gold	Assays only	3–12–53	....	6	....
599	Mineral Recovery, Ltd.	W.A.	Marble Bar	Tungsten	Assays only	3–12–53	....	2	2
600	Mineral Recovery, Ltd.	W.A.	Comet Vale	Tungsten	Assays only	8–12–53	....	....	2
601	Mineral Recovery, Ltd.	W.A.	Comet Vale	Tungsten	Assays only	23–12–53	....	....	4
602	W. A. Robinson	W.A.	Menzies	Talc	Preparation of powder	23–12–53	....	....	....
603	Clackline Refractories, Ltd.	W.A.	Kathleen Valley	Corundum	Recovery tests	9–5–54	2	....	2
604	Mines Department of W.A.	W.A.	Norseman	Gold	Assays only	23–12–53	....	14	....
605	Mineral Recovery, Ltd.	W.A.	Comet Vale	Tungsten	Assays only	9–1–54	....	....	2
606	Western Mining Coporation	W.A.	Kalgoorlie	....	Analysis of diamond drill scale	11–2–54	....	....	22
608	Paul and Meikle	W.A.	Marble Bar	Tungsten	Assays only	9–1–54	....	....	4
609	R. K. McRae	W.A.	Coolgardie	Tungsten	Assays only	24–1–54	....	....	2
610	Croesus, Pty., Treatment Co.	W.A.	Kalgoorlie	Gold	Investigation of flotation tailing	27–5–54	12	45	20
611	Swan Portland Cement, Coy.	W.A.	Perth	Portland Cement	Infrasizing	14–3–54	12	....	....
612	Mines Department of W.A.	W.A.	Norseman	Gold	Assays only	20–2–54	....	16	....
613	Moonlight Wiluna G.M.	W.A.	Mt. Ida	Water	Analysis	27–2–54	....	....	18
614	Western Wolfram, N.L.	W.A.	Nullagine	Tungsten	Assays only	27–2–54	....	....	2
615	Mines Department of W.A.	W.A.	Coolgardie	Gold	Assays only	25–2–54	....	18	....
616	Broken Hill Pty., Ltd.	W.A.	Kimberleys	Copper	Assays only	25–2–54	....	....	12
617	G. Halbert	W.A.	Esperance	Graphite	Beneficiation	15–6–54	27	....	108
618	L. Ford	W.A.	Coolgardie	Gold	Amalgamation test	30–3–54	1	6	....
619	R. K. McRae	W.A.	Coolgardie	Tungsten	Assays only	29–3–54	....	....	2
620	Hampton Gold Mining Areas	W.A.	Coolgardie	Copper	Analysis	19–4–54	....	2	12
621	W. A. Kent	W.A.	Coolgardie	Tungsten	Beneficiation of concentrate	14–4–54	1	....	2
623	Western Mining Corporation	W.A.	Kalgoorlie	Gold	Mineral determination	10–6–54	3	....	2
627	Wilkinson Bros.	W.A.	Kookynie	Water	Analysis	26–5–54	....	4	14
628	Lake View and Star, Ltd.	W.A.	Kalgoorlie	Gold	Infrasizing of tailings	10–6–54	3	....	....
629	D. Culley	W.A.	Coolgardie	Tungsten	Assays only	4–6–54	....	....	2
631	Mines Department of W.A.	W.A.	Kookynie	Gold	Recovery of alluvial gold	10–6–54	5	10	....
632	J. A. Johnstone & Sons	W.A.	Marble Bar	Tin	Mineral determination	10–6–54	....	....	2
634	Mines Department of W.A.	W.A.	Hope's Hill	Gold	Assays only	16–6–54	....	10	....
	Free Assays	....	....	....	....	....	....	299	27
....	School of Mines	....	....	....	....	....	....	22	50

THE FOLLOWING INVESTIGATIONS WERE INCOMPLETE OR PENDING AT 31st DECEMBER 1953.

514	Vacuum Oil Company	W.A.	....	Detergent	Determination of frothing characteristics	....	36 series of approx. 40 tests each.	....	....
607	I. Walters	W.A.	Whim Creek	Copper	Flotation tests	....	....	2	8
622	L. Ives	W.A.	Marble Bar	Tin	Method of treatment	....	....	....	....
624	Consolidated Gold Mining Areas, N.L.	W.A.	Laverton	Gold	Plant design tests	....	....	....	....
625	Horseshoe Gold Mine	W.A.	Peak Hill	Gold	Settlement tests	....	....	....	2
626	Western Mining Corporation	W.A.	Kalgoorlie	Gold	Elutriation of concentrate	....	....	....	....
630	J. L. Cable	W.A.	Laverton	Tungsten	Method of treatment	....	....	....	2
633	H. Tarlton Phillips	W.A.	Bunbury	Ilmenite	Magnetic separation	....	....	....	....
635	Croesus Pty., Treatment Coy.	W.A.	Kalgoorlie	Gold	Sink-float separation tests	....	....	....	....
636	Swan Portland Cement, Co.	W.A.	Perth	Portland cement	Surface area measurements	....	....	....	....
637	Northern Mineral Syndicate	W.A.	Marble Bar	Columbite	Recovery tests	....	.....	....	....
638	A. Vickery Syndicate	W.A.	Yunndaga	Gold	Treatment tests	....	....	122	....

Division VI.

Annual Report of the Inspection of Machinery Branch of the Mines Department for the Year 1953.

OPERATIONS UNDER THE INSPECTION OF MACHINERY ACT, 1921-1951.

ANNUAL REPORT OF THE CHIEF INSPECTOR OF MACHINERY AND CHAIRMAN OF THE BOARD OF EXAMINERS FOR ENGINE-DRIVERS FOR THE YEAR ENDED 31st DECEMBER, 1953, 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 in the administration of the Inspection of Machinery Act, 1921-1951 for the year ended 1953.

E. E. BRISBANE,
Chief Inspector of Machinery.

Section 1.
INSPECTION OF BOILERS, MAINTENANCE, Etc.

(See Returns Nos. 1, 2, 3.)

Under the Act "Boiler" means and includes—

(a) any boiler or vessel in which steam is generated above atmospheric pressure for working any kind of machinery, or for any manufacturing or other like purposes;

(b) any vessel used as a receiver for compressed air or gas, the pressure of which exceeds 30 lbs. to the square inch, and having a capacity exceeding five cubic feet; but does not include containers used for transport;

(c) any vessel used under steam pressure as a digester, and

(d) any steam jacketed vessel used under steam pressure for boiling, heating, or disinfection purposes.

It also includes the setting, smoke stack, and all fittings and mountings, steam and other pipes, feed pumps and injectors, and other equipments necessary to maintain the safety of the bolier.

Return No. 1.

Registrations of new boilers totalled 193; this represents a decrease of 57 when compared to the number of new registrations during the previous year.

Return No. 2.

In this return is tabulated the numbers of useful boilers of the various types on the register at the close of the year. At the end of the return is shown the total number of boilers registered and the total of those which were not in service.

It is of interest here to record that a Cornish boiler 15 ft x 6 ft. which had been out of use for some years has been in the process of being converted into a Return Multitubular Underfired boiler during recent months. Before the alterations were commenced test pieces were cut from the vicinity of the outer edge of an end course and subjected to tests which produced entirely satisfactory results.

Return No. 3.

The operations of the Inspection of Machinery Branch concerning boilers during the year are indicated therein.

RETURN No. 1.—SHOWING THE NUMBER OF BOILERS OF EACH TYPE, AND COUNTRY OF ORIGIN OF NEW REGISTRATION FOR THE YEAR ENDED 31ST DECEMBER, 1953.

Type.	Country of Origin.					Total.
	United Kingdom.	U.S.A.	Eastern States.	Western Australia.	Unknown Sources.	
Cornish	....	....	....	1	....	1
Vert. Stationary	1	....	....	11	....	12
Return Multi. Stat. Underfired	....	....	....	4	....	4
Multi Tubular (Waste Heat)	....	....	1	....	....	1
Water Tube	2	....	3	18	....	23
Saddle Back	....	....	1	....	....	1
Cast Iron Sectional	....	....	1	....	....	1
Horizontal (Elec. Fired)	....	....	....	1	....	1
Digester	....	....	3	4	....	7
Vulcanizer	....	....	13	8	4	25
Steam-jacketed Vessel	1	....	....	10	....	11
Sterilizer	....	....	7	6	1	14
Air Receiver	10	1	13	53	11	88
Gas Receiver	....	....	....	4	....	4
Totals	14	1	42	120	16	193

RETURN No. 2.—SHOWING CLASSIFICATION OF VARIOUS TYPES OF USEFUL BOILERS IN PROCLAIMED DISTRICTS ON 31ST DECEMBER, 1953.

Types of Boilers.	Districts Worked from PERTH.	Districts Worked from KALGOORLIE.	Totals.	
			1953.	1952.
Lancashire	46	52	98	99
Cornish	157	454	611	611
Semi Cornish	11	37	48	48
Vert. Stationary	432	347	779	770
Vert. Portable	67	17	84	82
Vert. Multi Stat.	51	25	76	76
Vert. Multi Port.	16	3	19	19
Vert. Pat. Tubular	48	....	48	48
Loco. Rect. F/box Stat.	88	61	149	150
Loco Rect. F/box Port.	255	64	319	319
Loco Circ. F/box Port	139	8	147	147
Locomotive	87	37	124	121
Water Tube	426	118	544	525
Ret. Multi U/Fired Stat.	228	58	286	281
Ret. Multi U/Fired Port	1	8	9	9
Ret. Multi Int. fired Stat.	48	12	60	63
Ret. Multi Int. fired Port	2	....	2	2
Egg ended and other types not elsewhere specified	482	36	518	506
Digesters	291	10	301	293
Air Receivers	1,146	537	1,683	1,594
Gas Receivers	38	....	38	35
Vulcanizers	371	10	381	359
Steam Jacketed Vessels	481	13	494	484
Total Registration Useful Boilers	4,911	1,907	6,818	6,641
Total Boilers out of use 31st December, 1952	2,108	1,586	3,694	3,512

RETURN No. 3.—SHOWING OPERATIONS IN PROCLAIMED DISTRICTS DURING YEAR ENDED 31ST DECEMBER, 1953.

Types of Boilers.	Districts Worked from PERTH.	Districts Worked from KALGOORLIE.	Totals. 1953.	Totals. 1952.
Total number of useful boilers registered	4,911	1,907	6,818	6,641
New boilers registered during year	186	9	195	250
Boilers Reinstated	2	....	2	....
Boilers Converted	1	....	1	....
Boilers inspected—thorough	2,323	421	2,744	2,797
Vessels exempt under Act constructed for export—thorough	233	....	233	....
Boilers inspected—working	941	2	943	907
Boilers condemned during year temporarily	11	....	11	6
Boilers condemned during year permanently	16	4	20	38
Boilers sent to other States during the year	2	....	2	3
Boilers sent from other States during the year	2	....	2	2
Transferred to other Departments	....	....	....	....
Transferred from other Departments	1	....	1	4
Number of notices of repairs issued during year	587	79	666	803
Number of Certificates issued, including those issued under Section 30 during year	2,703	421	3,124	3,129

Maintenance, Etc.

In many instances it is obvious that boiler users take a very realistic interest in the maintenance of their respective plants and then again there is a large proportion of owners who make a certain amount of effort toward preservation of their boilers.

With regard to a rather large balance of boilers in use however, care and maintenance during the periods between annual inspections is unfortunately of low order. By far the greatest number of boilers so neglected are those of the small sizes of evaporative capacities in ranges up to 600 lbs. per hour and which are under steam normally for five days a week or less and are shut down over the weekend periods and would be readily available for any minor repairs and washing out as circumstances may demand.

A very common form of neglect in this respect which quickly results in wastage to the plate of a boiler shell or end plate is the ignored leaking boiler door joint which ultimately entails a costly repair.

Section 2.

EXPLOSIONS AND INTERESTING DEFECTS.

No incident involving explosion occurred during the period under review but one boiler suffered very serious damage in circumstances reported as follows:—

The second section of the furnace tube of a Cornish boiler 16 ft. x 5 ft., working pressure 130 P.S.I., collapsed as a result of overheating due to shortage of boiler water.

The fusible plug failed to give protection due to scale depositing in the annular space of the plug shell by reason of a slight leakage down the side of the plug.

Shortage of water was obviously due to the error of the attendant in mistaking the total absence of water in the water gauge glasses for more than full glasses.

By a fortunate circumstance an Inspector of this Branch had occasion to make an inspection of other plant on the premises where the boiler is located, and on his arrival he was questioned by the owner as to what he considered to be the reason for the water level failing to appear at the top of the glasses.

The Inspector quickly appreciated the deception caused and on applying the recognised tests proved the water level as being dangerously low, and then immediately discovered the crown of one section of the furnace tube to be down several inches.

At this time the pressure gauge registered 80 P.S.I. with a normal fire in the furnace and had it not been for the coincidence of the Inspector's visit the occurrence may have resulted in disaster.

In my two preceding annual reports I referred with emphasis to damage of boilers caused by negligence of attendants in not taking necessary precautions to prove correct or otherwise the water levels as indicated by the water gauges. It is most difficult of understanding why this vitally important part of the duties attached to boiler attention is so much ignored.

Section 3.

INSPECTION OF MACHINERY.

(See Returns Nos. 4, 5 and 6.)

The number of groups of machinery now registered is 33,025, an increase of 2,795 over the number for the previous year.

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, 1953.

Classification.	Districts Worked from PERTH.	Districts Worked from KALGOORLIE.	Totals. 1953.	Totals. 1952.
No. of Groups driven by steam engines	330	391	721	779
No of Groups driven by oil engines	2,296	1,102	3,398	3,307
No. of Groups driven by gas engines	48	168	216	246
No. of Groups driven by Compressed air	2	61	63	66
No. of Groups driven by Electric motors	24,573	4,051	28,624	25,827
No. of Groups driven by hydraulic pressure	3	....	3	5
Totals	27,252	5,773	33,025	30,230

RETURN No. 5.—SHOWING OPERATIONS IN PROCLAIMED DISTRICTS DURING YEAR ENDED 31ST DECEMBER, 1953.

(*Machinery Only.*)

Classification.	Districts Worked from PERTH.	Districts Worked from KALGOORLIE.	Totals. 1953.	Totals. 1952.
Total registrations useful machinery	27,252	5,773	33,025	30,230
Total inspections made	21,950	4,301	26,251	22,155
Certificates (bearing fees)	5,338	756	6,094	5,313
Certificates (steam without fees)	27	25	52	65
No. of extension certificates issued under Sec. 42 of Act	....	....	....	....
Notices issued (Mach. dangerous)	535	32	567	309

RETURN No. 6.—SHOWING CLASSIFICATION OF LIFTS ON 31ST DECEMBER, 1953.

Types.	How Driven.	Totals. 1953.	Totals. 1952.
Passenger	Electrically driven	198	196
	Hydraulically driven	1	1
Goods	Electrically driven	104	103
	Hydraulically driven	3	3
	Belt driven	4	4
Service	Electrically driven	46	45
		356	352

Accidents to Machinery.

Case A.

Goods Lift.

This lift was registered for one ton maximum lod and the installation is of traction drive type and has been in service for 45 years.

At the time of the accident the cage had been loaded with goods at ground floor level for conveyance to the basement. Upon the attendant entering the cage it immediately slid through the shaft for a distance of two to three feet without manual operation and then dropped precipitately to the basement, fortunately without causing injury to the attendant. The counterweight also fell to the pit.

Investigation strongly indicated that the two rope grips securing each of the two ropes to the counterweight had permitted the looped ends of both ropes to slip simultaneously. All four of these grips were found to be of inferior type and fitted with bolts of inadequate size.

On the ropes becoming detached from the counterweight, the safety grippers operated but only those on one side of the cage fully engaged and this had the effect of snapping the timber guide skid on that side approximately six feet up from the pit floor. The serrated jaws of the grippers on the opposite side of the cage failed to fully engage, due apparently to the width across the guide skid on that side of the lift shaft having become more reduced by wear from the guide shoes than the opposite member. This probably prevented equal engagement of the safety grippers on both sides of the cage. The cage was not extensively damaged.

Case B.

Thicknesser Machine.

A cutter blade became dislodged from the head of this machine during its operation and caused some damage to various parts in addition to destroying itself. The owner and his assistant were injured to some degree by flying fragments of metal; it is remarkable that they escaped receiving far more serious injuries.

There appeared to be no doubt that the main contributing cause of the accident was overspeed.

A change of frequency in the power supply from 40 to 50 cycles had been effected but due to some confusion of opinions adjustment of the pulley ratio to prevent increase of speed of the machine was not carried out.

From inquiries it was ascertained that subsequent to the alterations severe vibration of the cutter head was in evidence and it appeared conclusive that the small screws securing the blade had loosened under this influence. Considerable work had been done with the machine during the period from the last occasion of the setting of the blades up to the time speed was increased, but following this the thicknesser had been worked for only a comparatively short duration when the mishap occurred.

To avoid errors respective of maximum speeds for which various classes of high speed machines are designed manufacturers should attach plates to their products stamped thereon with this most necessary information.

Case C.

Radial Saw and Trenching Head.

This accident resulted in not only damage to the machine but also serious eye injury to the owner who was operating it at the time.

In this instance a cutter blade fractured and inspection strongly suggested that the cutter head was not of sufficiently solid construction and permitted the blade to flutter and ultimately become work hardened as a result.

The manufacturers have subsequently designed a more robust head in accordance with proposals from this Department.

Case D.

Mine Skip Detaching Hook.

This accident was contributed to by a detaching hook of the Omeroid type which failed with the result that a skip fell from the sky shaft to the bottom of the mine. The jaws of the three-plate hook opened out and released the pin on the winding rope shackle to which it was attached.

When the incident occurred a skip of ore was being hauled, and as the skip entered the tipping track one of the pair of tipping wheels fouled the tipping wheel guide of the tipping track. The stress imposed in the hook by this obstruction caused deformation of the hooked sections of the two outer plates sufficiently to release the shackle.

It was not determined what may have eventuated had the hook not failed but it is to be noted that in the investigation of the accident calculations revealed that it was of rather frail construction for the service required of it even under favourable conditions.

This matter emphasises the necessity of all mining executives ensuring that detaching hooks and attachments be designed and manufactured in accordance with specifications not less stringent than those specified in the code of the Standards Association of Australia.

Section 4.

PROSECUTIONS FOR BREACHES OF THE ACT.

There were no prosecutions during the year for breaches of the Act.

Section 5.

ACCIDENTS TO PERSONS.

During the year 110 accidents were reported to the Department and investigated. Among these there were two fatalities, and injuries in 28 instances were classed as being of minor nature. Returns Nos. 7 and 7A show the industries and descriptions of machinery to which the accidents were related and the number of persons injured under each group.

The following are reports of the circumstances surrounding the fatalities, and prominence is also given to a serious accident which was associated with unusual features. Three other accidents involving bodily injuries are reported under the heading Accidents to Machinery, Section 3.

Case A.

Driving Belt Accident.

The machinery which was the cause of this accident consisted of a circular saw belt driven by a tractor and being operated on a farm for cutting firewood. This machinery had not been registered with the Department.

The operator who received injuries from which he died was working without assistance and no other person was present at the time of the accident.

The circumstances leading up to the occurrence leave much to conjecture, but from a brief statement before his death it would seem that the driving belt was causing trouble by slipping on the pulleys and somehow it caught the deceased's leg and threw him against the tractor.

Driving belts located near ground level for immobile plants such as are installed in factories or workshops are customarily encased or guarded with permanent fences of some type or other, and without much difficulty the same precautions can be taken with mobile machinery by constructing wire mesh fences on framework supported by reasonably heavy timber sleepers laid on the ground.

Such type of guard has been designed by the Department for mobile machinery and drawings are available for the information of owners.

Case B.

Mine Kibble Monkey.

In this accident a mine employee whilst engaged in shaft sinking was killed by being hit by the crosshead or monkey of a kibble on which he was descending and knocked to the bottom of the shaft.

Apparently, unknown to deceased and another man who was in the kibble, the monkey had held up on the shaft skids until the kibble had been lowered approximately 70 ft. and then, probably due to the whip of the rope passing through its centre, freed itself and fell onto the capel immediately above the kibble bridle.

It is understood that deceased was riding on the rim of the kibble and would therefore be within distance of the monkey when it landed on and telescoped the capel.

There are monkeys in service which are fitted with a type of device which engages the underside of the capel attached to the rope and would suspend the kibble should the monkey meet with obstruction to its descent.

The device is so designed that a kibble can be released as desired from the monkey by manually operated stops attached to the skids in the vicinity of the tipping position, or by fixed stops on the skids near the bottom of the shaft which can be re-secured at lower positions as the shaft is deepened.

Case C.

Thicknesser Machine.

The safety bar on this machine had become distorted in such a manner that timber could be fed into the machine and dressed with an overheavy cut. On this occasion it would appear that a piece of timber kicked up by reason of the excessive cut and thrust the chip breaker against the cutter blades. The chip breaker was broken into fragments and one of these struck the operator on the forehead inflicting serious injuries.

Subsequent to this accident the safety bar was renewed in order to restrict the depth of cut, and the chip breaker was also redesigned in such fashion that it would not contact the cutter blades if kicked upwards.

General.

Woodworking and metalworking machines have been by far the main sources of accidents during the year. Of the various types of machines in these categories, buzzers and power presses have been the principal causes of injuries, especially buzzers.

In most instances of buzzer accidents guards were available for use but were not in position on the machines.

In respect to power presses it is often difficult to design effective guards to suit some machines required for particular purposes without unduly hindering the machines' work, but by gradual processes owners are being induced to give more study to these problems with a view to installing satisfactory safeguards.

Returns Nos. 7 and 7A—See Page 109.

Section 6.

EXAMINATION OF ENGINE DRIVERS, CRANE DRIVERS AND BOILER ATTENDANTS.

During the year 1953 the Board of Examiners granted 112 engine drivers', 83 crane and hoist drivers' and 85 boiler attendants' certificates.

In comparison with the previous year these figures represent decrease 12, increase 7, increase 10 respectively.

Section 7.

AMENDMENT TO ACT.

The Inspection of Machinery Act has been amended to include within its provisions the inspection of any hand powered crane having a capacity exceeding one ton. Prior to this amendment all hand powered machinery was exempt.

Section 8.

Staff.

There has been no change in the number of staff personnel during the year.

The steady expansion of industry in this State has resulted in the greater frequency with which heavy demands have been made on the work of members of the inspection section in carrying out their inspection duties together with that phase of their work involving stress calculations in connection with boiler and unfired pressure vessel construction and crane structures.

This industrial growth reflects itself also in the increase of work placed upon each member of the clerical section in matters pertaining to correspondence, registrations, records and collection of fees.

The willing manner in which the inspectorial and clerical members of the staff made every effort in responding to circumstances as they arose is much appreciated.

J. F. WINZAR,
Deputy Chief Inspector of Machinery.

1st June, 1954.

RETURN No. 7.—SHOWING NUMBER OF SERIOUS ACCIDENTS BOTH FATAL AND NON-FATAL WHICH OCCURED IN PROCLAIMED DISTRICTS DURING THE YEAR ENDED 31st DECEMBER, 1953.

"F" denotes "Fatal."

Industry.	Circular Saw.	Docking Saw.	Trenching Machine.	Buzzer.	Four Sider.	Boring Machine.	Thicknesser.	Spindle Moulder (Shpr.).	Brush Trimmer.	Foundry Sand Mill.	Printing Press.	Stapler.	Leather Cutting Press.	Nailing Machine.	Bottle Labeller.	Press (Metal).	Emery Wheels.	Spiral M/c. (Wireworking).	Rolls.	Buffing Machine.	Guillotine.	Cement Mixer.	Seaming Machine.	Lathe.	Belts and Shafting.	Gearing.	Conveyor (Belt, Chain, Screw).	Elevator, (Bag, Bucket).	Direct Acting Air Hoist.	Mixer (Stock Food).	Lift.	Kibble.	Fish Sealer.	Fibrolite Sheet Machine.	Air Compressor.	Bottle Making Machine.	Totals per Industry.
Woodworking and Furniture	5	3	1	13	1	1	2	5	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1 (F)	....	....	....	....	....	....	....	....	....	....	....	33 (1F)
Metalworking and Engineering	1	....	....	....	....	....	....	....	....	1	....	....	....	....	....	5	1	3	....	1	....	....	1	1	1	1	....	....	....	....	....	....	....	....	....	....	16
Leather Processing	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Printing and Allied Industries	1	....	....	....	....	....	....	....	....	....	1	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Fertiliser Manufacturing	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	1	....	....	....	....	....	....	....	....	3
Mining	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1 (F)	....	....	....	....	....	1 (1F)
Food and Drink Processing	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	1	1	1	2	1	1	....	....	1	....	....	....	9
Building Materials and Building	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	2	....	2	....	....	....	....	....	....	1	....	....	7
Glassmaking	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	3
Other	1	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1	....	....	....	1	....	5
Totals per Type of Machine	8	3	1	13	1	1	2	5	1	1	1	2	1	1	1	5	1	3	1	1	1	1	1	1	6 (1F)	4	3	3	1	1	1	1 (F)	1	1	1	2	82 (2F)

RETURN No. 7A.—SHOWING NUMBER OF ACCIDENTS NOT CLASSED AS SERIOUS UNDER THE ACT AND NOT INCLUDED IN RETURN No. 7 BUT WERE REPORTED AND INVESTIGATED DURING THE YEAR ENDED 31st DECEMBER, 1953.

Industry.	Circular Saw.	Docking Saw.	Buzzer.	Thicknesser.	Spindle Moulder.	Brush Trimmer.	Printing Press.	Metal Stitcher.	Belts and Shafting.	Elevator (Bag or Bucket).	Box Filling Machine.	Shale Feeder.	Stacker.	Taping Machine.	Loom.	Confectionery Machines.	Totals per Industry.
Woodworking and Furniture	....	1	4	1	1	....	....	....	....	....	....	....	....	....	....	....	7
Metalworking and Engineering	1	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	2
Printing and Allied Industries	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	1
Fertiliser Manufacturing	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	2
Food and Drink Processing	....	....	....	....	....	....	....	....	1	2	1	....	1	....	....	3	8
Building Materials and Building	1	....	....	....	....	....	....	....	2	....	....	1	....	....	....	....	4
Glassmaking	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1
Other	....	....	....	....	....	1	....	....	....	1	....	....	....	....	1	....	3
Totals per Type of Machine	2	1	4	1	1	1	1	1	4	4	1	1	1	1	1	3	28

Annual Report of the Government Chemical Laboratories for 1953.

Contents.

Division VII.

Annual Report of the Government Chemical Laboratories.

Under Secretary for Mines,

I have the honour to present to the Honourable the Minister for Mines my Annual Report on the operations of the Government Chemical Laboratories for the year ending 31st December, 1953.

The numerical strength of the Laboratories as at the 31st December, 1953, was 63, comprising 46 professional officers, 10 general officers and seven clerical officers.

Staff changes during the year were as follows:—

Resignations, 6.

Appointments, 7.

Miss N. L. Wilson, B.Sc., was transferred from the position of Librarian to that of Chemist and Research Officer in the Agricultural Division and Miss Crane was appointed to the position of Librarian.

ADMINISTRATION.

The Laboratories as constituted consist of five Divisions, a central office and a library which are under the control of the Director (Government Mineralogist, Analyst and Chemist) as follows:

Director: H. P. Rowledge, A.W.A.S.M., F.R.A.C.I.

Food, Drugs and Toxicology: J. C. Hood, O.B.E., F.R.A.C.I., Deputy Government Analyst.

Agriculture, Water Supply and Forestry: L. W. Samuel, Ph.D., Lond., Deputy Government Agricultural Chemist.

Mineralogy, Mineral Technology and Geo. Chemistry Division: C. R. LeMesurier, A.W.A.S.M., A.R.A.C.I., Deputy Government Mineralogist.

Fuel Technology Division: R. P. Donnelly, M.A., B.Sc. (Oxon), Fuel Technologist.

Chemical Engineering Division: A. Reid, M.A., B.Sc. (Aber.), Chief Industrial Chemist.

Library: Miss M. E. Redman, B.Sc., Librarian.

Office: Miss D. E. Henderson, Senior Clerk.

During the year the Laboratories took over the control of the Pyrometry Centre in this State for the Department of Industrial Development. Mr. L. G. Wilson was appointed to the position of Pyrometry and Research Officer and attached to the Fuel Technology Division.

Mr. L. Brennan, Fuel Chemist and Research Officer continued his work at the Collie Annexe Laboratory. Messrs. E. Hodgson and D. P. Carter, Analysts and Research Officers of the Food and Drug Division were employed at the Lincoln Street Annexe Laboratory.

The Laboratories have now an up-to-date and well indexed library covering many specialised branches of the profession of Chemistry including Chemical Engineering. A modern library of books and current literature of world wide coverage is essential to an organisation such as this which is called upon for information and advice on many chemical problems associated with the development and expansion of industry.

The slow rate of progress in the construction and fitting out of the new Unit Process Plant for the Industrial Chemistry Division of these Laboratories is disappointing. The equipment is on the site and it is hoped that its installation will be speeded up so as to enable us to commence the programme of work laid down for the development of the natural resources of this State.

NEW EQUIPMENT.

In pursuance of a policy to bring these Laboratories up-to-date by the purchase of modern equipment a Unicam S.P. Photo-electric Quartz Spectrophotometer was received during the year. Also approval was given for the purchase of other major items of equipment to bring the Laboratories abreast with modern requirements. Orders were placed for the following items which were considered necessary to cope with required investigations into the development of the natural resources of this State.

Hilger Automatic large quartz spectrograph.

Mueller Micro 60 X-Ray Diffraction Unit.

Unicam X-Ray Powder Camera.

Universal Stage Microscope (Cooke, Troughton & Sims.)

Beta-Gamma Counter—"Autoscaler".

Various items for Construction of Differential Thermal Analysis Apparatus with Automatic Control and Recorder.

GENERAL.

The total number of samples registered for analysis, chemical and mineral examinations this year was 18,439. The volume of work of advisory nature on chemical matters for Government Departments and various Industries is considerable and is apart from the actual analytical work entailed in connection with samples registered.

The Source of Samples was as follows:—

Mines Department	1,481
Agriculture Department	2,681
Public Health Department (Royal Perth Hospital) (112 + 10)	122
Metropolitan Water Supply Sewerage & Drainage Department	9,898
Government Stores and Tender Board	36
Department of Industrial Development	7
Police Department	331
Commonwealth Departments	15
Dairy Products Committee	10

Other Departments—	
War Service Land Settlement Scheme, Factories, Public Works, Native Affairs, Local Governing Bodies, Railways, Tramways, Main Roads, Milk Board, Education Department, Government Printer, Midland Junction Abattoirs Board	1,538
State Industries—	
Wundowie Wood Distillation, Charcoal, Iron and Steel Industry	16
Forests	17
State Housing Commission	5
State Brickworks	31
State Sawmills	4
Wyndham Meat Works	1
Public (Pay and Free)	2,246
	18,439

These are classified in detail according to the actual sources from which they were received as follows:

Table I.

Samples received during 1953.

Source.	Total.
State Mining Engineer	63
Chief Coal Mining Engineer	16
State Batteries	247
Government Geologist	516
Explosives	22
Departmental	617
Industrial Development Department	7
Wood Distillation Charcoal Iron & Steel Industry	16
Works and Labour Department	1,366
Metropolitan Water Supply	9,898
Public Health Department	112
Agriculture Department	2,681
Factories	1
Police and Coroner	294
Police C.I.B.	26
Police L.I.B.	11
Government Stores and Tender Board	36
Royal Perth Hospital	10
War Service Land Settlement Scheme	60
Education Department	2
Native Affairs Department	1
Interdepartmental Dairy Produce Committee	10
Free	568
Pay, Public	1,678
Pay, Taxation Department	2
Pay, Civil Aviation Department	11
Pay, Department of Navy	1
Pay, Aeronautical Inspection Directorate	1
Pay, Forests Department	17
Pay, Milk Board of W.A.	51
Pay, Government Printer	2
Pay, West Australian Government Tramways	2
Pay, West Australian Government Railways	39
Pay, State Brickworks	31
Pay, State Housing Commission	5
Pay, State Sawmills	4
Pay, Midland Junction Abattoirs Board	7
Pay, Wyndham Meat Works	1
Pay, Main Roads Department	3
Pay, Local Governing Bodies	4
	18,439

Samples are allocated to the various Divisions according to the specialised nature of the Chemical work undertaken by each Division.

Visits were undertaken to the Eastern States during the year as follows:

Dr. L. W. Samuel, Deputy Government Agricultural Chemist attended a conference on "Soil Science" at Adelaide organised by C.S.I.R.O. and Adelaide University.

Mr. A. Reid, Chief Industrial Chemist visited Melbourne and Sydney on matters in connection with the establishment of the Industrial Chemistry Unit Process Plant.

Mr. H. P. Rowledge, Director visited Melbourne to attend a meeting of the Australian Institute of Mining and Metallurgy and to hold discussions with Technical Officers of C.S.I.R.O. and others in connection with a programme of work to be initiated for the development of the natural resources of this State.

Visits within the State were made by various Officers in connection with their duties as follows:

Mr. J. C. Hood, Deputy Government Analyst visited Northam with Officers of his Division in connection with sewage installation in that town.

Dr. L. W. Samuel, Deputy Government Agricultural Chemist attended various Field Days organised by the Department of Agriculture.

Mr. Donnelly, Fuel Technologist with Officers of his Division visited Collie and various Timber Mills in the South West to investigate and advise on fuel efficiency problems.

Mr. A. Reid and Mr. H. P. Rowledge visited Perenjori in connection with studies into the alkaloidal content of Duboisia Hopwoodii.

Food, Drugs, Toxicology and Industrial Hygiene Division.

During the year 12,112 samples were allocated to this Division and covered a wide variety of materials both from Government Departments and General Public. As shown in Table 2 this large number is due mainly to systematic sampling in connection with sewer corrosion research, trade wastes, ocean and river pollution.

The activities of this Division are concerned mainly with the chemical work required by the Department of Public Health and the Police Department and in part by the Department of Agriculture and the Metropolitan Water Supply, Sewerage and Drainage Department. There is however a certain amount of work of a specialised nature for other Departments which is also handled by this Division.

The examination of foodstuff continues to be an important function of these Laboratories as by this means a check is kept upon the quality of food products supplied to the General Public and Public Institutions.

The total number of samples examined under this heading was 314. Of these 52 were for the Department of Public Health and 51 for the Milk Board. 172 were examined for the Department of Agriculture in connection with their research into the composition of various food products 83 of which were grapes received for maturity tests, 46 cheese and butter samples from various cheese and butter factories in the State and 31 samples of sugar cane from the Kimberley Research Project.

331 samples were examined for the various branches of the Police Department and the Coroner. These included exhibits in connection with Criminal Investigations, deaths under anaesthetic, human and animal toxicology. Of these 116 were exhibits of blood and urine for alcoholic content in connection with deaths due to traffic accidents and other causes.

In connection with animal toxicology 20 exhibits were examined for the Department of Agriculture in connection with the death of cows, dogs, koala bears, pigs, sheep, fowls etc.

Under the heading of Industrial Hygiene, investigations were carried out in co-operation with Officers of the Public Health and Factories Departments to determine hazards to health. 66 samples in all were examined, 64 were samples of urine and blood for suspected lead poisoning of which 39 were from the W.A. Government Railways.

34 samples of Drugs and Medicine were examined for the Government Stores, Tender Board and Royal Perth Hospital for identification, purity or conformity to the British Pharmacopoeia Standards.

57 samples of various insecticides including fly sprays and weedicides were examined. 37 of these were mainly for the Department of Agriculture, Government Stores Department and Tender Board.

The Laboratories are represented on the Swan River Pollution Committee by the Deputy Government Analyst, Mr. J. C. Hood and the Division was responsible during the year for the collection and examination of the 270 samples in connection with pollution problems. The pollution survey of Bunbury Harbour was continued during the year and 264 samples collected and examined.

This Division handles all the samples in connection with the chemical control of sewage for the Metropolitan Water Supply, Sewerage and Drainage Department. During the year 11,016 samples in all were examined, 2,603 of which were weekly routine control samples taken in connection with the operations of the various sewage treatment works and 7,034 were investigational samples. A large number of the latter were taken in connection with an Australia wide investigation on the hydrogen sulphide corrosion of concrete sewers.

During the year a number of oils were examined both manufactured and natural. The latter included those received in connection with the important oil strike at Exmouth Gulf.

A large number of miscellaneous materials were examined by this Division during the year as follows:

Mine air and gas samples, explosives and fireworks for the Mines Department; fluorine in phosphatic materials, sunflower seed, safflower seed, linseed, lupins, cattle dip, oiled apple wraps, rabbit poison, D.D.T. Super for the Department of Agriculture; building materials such as paint pigments, vehicles and thinners for the Public Works Department; floor polishes, soap powder, detergents, tobacco leaf for the Government Tender Board; and various items for the Commonwealth Department of Civil Aviation.

Table II, see pages 114 and 115.

Agriculture, Forestry and Water Supply Division.

The activities of this Division are concerned with the chemical work required by the Department of Agriculture and the examination of water samples from the Metropolitan, Town and Country water supplies and for the General Public.

The total number of samples handled during the year was 3,977, slightly more than last year. Apart from this, chemical advice was given to a number of departments and the general public in connection with problems encountered in Agriculture and Water Supplies. The detailed classification of samples is shown in Table 3.

A large number of water samples, 1566 were received during the year. 1,275 of these were done for the General Public mainly bona fide primary producers. These were done to advise as to their potability and suitability for domestic, irrigation and stock purposes. 93 were examined for the Public Works Department, 84 for the Metropolitan Water Supply, Sewerage and Drainage Department, 58 for the War Service Land Settlement Scheme, the remainder being for various local bodies, Forests Department, Education Department, State Batteries, Government Geologist, Civil Aviation, State Sawmills, etc.

The routine examination of existing water supplies to cities and towns was continued again this year. In this connection, samples were regularly analysed from the Canning Dam, Churchmans Brook, Victoria Reservoir, Attadale Bore, Mundaring Weir, Mt. Charlotte Reservoir and Wellington Dam, as well as supplies from smaller towns throughout the State.

This year the total number of soil samples received for examination was 322 of which 289 were for the Department of Agriculture, the remainder being for the General Public, 30, and Metropolitan Water Supply 3.

55 limestone samples were received to determine their neutralising value as a soil dressing for Agricultural purposes, 24 of which were for the Department of Agriculture and 31 for the General Public both free and pay samples.

A number of fertilisers and feeding stuffs were examined during the year as well as a number of samples of a general nature. The chemists in this Division are registered analysts under the Fertiliser and Feeding Stuffs Acts and undertake examination of official samples to check their registered composition. 46 fertiliser and 86 feeding stuffs were examined during the year for compliance with the Act.

A great variety of plant materials were examined for the Department of Agriculture in connection with research projects at the various Agricultural Research Stations. These mainly included pastures, clover, lucerne, various varieties of hay, wheat plants, oat plants, barley plants, vetch, silage, wheat-meal, wheat grain, oat grain, etc.

Analyses of fertilisers and plant material for various elements in connection with plant nutrition experiments were carried out for the Department of Agriculture mainly for: (i) the study of the effect of various fertiliser treatments; (ii) the diagnosis of unhealthy plants and, (iii) the effect of various fertiliser treatments in connection with unthriftiness of plants.

91 samples of tobacco leaf were examined for the Tobacco Branch of the Department of Agriculture in connection with growth of tobacco plants and tobacco quality.

Spectographic examination of a number of various materials were undertaken during the year by this Division. Metals were examined to check their composition and a number of gold ores and flue dusts received from various sources were examined in connection with a survey for rarer elements in the natural resources of this State.

The experiments into the bacterial decomposition of sewage sludge in saline water were continued again this year in an effort to determine the safe upper limit of salinity of water for septic tank systems.

Analytical work was undertaken during the year by this Division in connection with a collaborative inter-laboratory survey of cereal methods aimed at standardisation of procedures arranged by the Cereal Group of the Royal Australian Chemical Institute.

Table III, see page 116.

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TABLE II.

FOOD AND DRUG DIVISION, 1953.

	Public Health Department.	Agriculture Department.	Metropolitan Water Supply, Sewerage and Drainage Department.	Police and Coroner.	Police—C.I.B.	Police—L.I.B.	State Mining Engineer.	Departmental.	Chief Coal Mining Engineer.	Government Stores and Tender Board.	Works and Labour Department.	Royal Perth Hospital.	Explosives Branch.	Factories—Chief Inspector.	War Service Land Settlement Scheme.	Interdepartmental Dairy Products Committee.	Free.	Pay—Public.	Pay—Milk Board of W.A.	Pay—State Sawmills.	Pay—W.A.G.R.	Pay—Midland Junction Abattoirs.	Pay—Wyndham Meat Works.	Pay—A.I.D.	Pay—Government Printer.	Pay—Main Roads Department.	Total.
Foods—																											
Lemon Butter	2																										2
Bread	3																										3
Tea	1																						1				2
Cow's Milk	12			1												10			51								74
Canned Peas	7																										7
Hog Casings	2																										2
Butter	1																										1
English Fillet	3																										3
Smoked Fish	1																										1
Soft Cured Fish	2																										2
Lactose	2																										2
Cheese		45																									45
Tallow		2																13				4					19
Sugar Cane		31																									31
Vinegar	3																										3
Fruit Mince	1																										1
Jam	1																										1
Prunes and Rice	3																										3
Grapes		83																									83
Apples		8																									8
Oranges		2																									2
Potatoes		1																									1
Essence of Lemon	1																										1
Fruit Juice	1																										1
Aerated Waters	6																										6
Sauces										7																	7
Margarine										2																	2
Cornflour										1																	1
Human Toxicology—																											
Exhibits—Alcohol				116														4									120
Anaesthetic	1			8																							9
Exhibits—Human Toxicology	4			164	11													2									181
Animal Toxicology—																											
Specimens—Death of Cows, Dogs, Koala Bears, Pigs, Sheep, Fowls, etc.		20						2										3									25
Industrial Toxicology—																											
Urine	14																				39						53
Blood (Lead)	11																										11
Respirator Pad	1																										1
Stancol—Metal Coating														1													1
Sewage—																											
Weekly Routine			2,603																								2,603
Investigational			7,034																								7,034
Trade Waste			40																								40
Ocean Beach Survey			109																								109
Country Sewage											696																696
Swan River Pollution											270																270
Bunbury Pollution											264																264

Liquors—																															
Wine								27																							27
Beer												5																			5
Gin												1																			1
Whisky												4																			4
Sherry												1																			1
Insecticides—								37																							37
Chlordane																								1							1
Fly Spray														17										1							18
Weedicide								1																							1
Drugs and Medicines, etc.—																															
Toxoid Aluminium Phosphate							1																								1
Insulin Tablets							1																								1
A.P.C. Tablets							2			1																					3
Tablets							2																								2
Cocaine														1																	1
Codeine Tablets														1																	1
Bandages							3																								3
Ether Supplies															8																8
Human Milk							14																								14
Oils—																															
Nat. Petroleum Tests																							3	1							4
Lubricating Oil																								3							3
Fuel Oil													1																		1
Crude Oil Fluid											2																				2
Oil (Harbour)									1																						1
Criminal Cases—																															
Exhibits												14																			14
Water							2																	2		1					5
Coal Mine Air													2		16																18
Gas from Mine																								1							1
Specimens—Mine Accident													5																		5
Lime (Water Treatment)																								1							1
Paint																9				1											10
Fluid (Steel Coating)																								1							1
Deposit from Pipes																2															2
Cement Pipe Lining																2															2
De-icing Fluid																												1			1
"Versil" Pipe Coating									1																						1
B.H.C. Solution and Plugs (Corrosion)									2																						2
Petrol and Carburettor (Sugar)										3																					3
Horsefeed (Poison)											1																				1
Explosives and Fireworks																		22													22
Nitelite Road Signs																													2		2
Glue																												2			2
Dung Bitumen																							1								1
Floor Polish														4																	4
Soap Powder														2																	2
Tobacco Leaf								1																							1
Teeth, Bones, etc. (Fluorine)								56																							56
Dried Grass Cake								1																							1
Lupins								3																							3
Linseed								46																							46
Safflower Seed								5																							5
Sunflower Seed								1																							1
Cattle Dip								18																							18
Oiled Apple Wraps								1																							1
Cool-Store Air								3																							3
Wool								1																							1
Rabbit Poison								3																							3
D.D.T. Super								2																							2
							108	398	9,789	294	26	11	7	4	16	36	1,243	8	22	1	1	10	4	33	51	1	39	4	1	1	2	2	12,112

TABLE III.

AGRICULTURE DIVISION, 1953.

	Agriculture Department.	Works and Labour Department.	Metropolitan Water Supply, Sewerage and Drainage Department.	War Service Land Settlement Scheme.	Forests Department.	Public Health Department.	Departmental.	Education Department.	Government Geologist.	State Batteries.	Wood Distillation, Charcoal Iron and Steel Industry.	Native Affairs Department.	Free.	Pay—Public.	Pay—Local Government Bodies.	Pay—Civil Aviation Department.	Pay—Main Roads Department.	Pay—State Sawmills.	Pay—Taxation Department.	Pay—Midland Junction Abattoirs Board.	TOTAL.
Water	17	93	84	58	17	3	2	2	1	1	....	1	4	1,271	4	2	1	3	2	....	1,566
Gravel	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8	....	....	....	....	8
Soils	289	....	3	....	....	....	....	....	....	....	....	....	....	30	....	....	....	....	....	....	322
Soil Extracts	116	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	116
Bauxite and Soil	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Limestone and Limesand	24	....	....	....	....	....	....	....	....	....	....	....	5	26	....	....	....	....	....	....	55
Fertiliser	46	....	....	....	....	....	....	....	....	....	....	....	....	5	....	....	....	....	....	....	51
Superphosphate and Solutions	8	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	9
Potato Manure	15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	15
Animal Fertiliser	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2
Poultry Manure	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Litter	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Zinc and Oxide	2	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	3
Urea	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Soil Dressing	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1
Wood Ash	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	2
Bat Manure	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Blood and Bone	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	2
Cave Guano	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	2
Oxides	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Compost	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Copper (Fertiliser)	5	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	6
Fertiliser Act	55	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	55
Guano	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	2
Bartsia Sp.	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Pasture	48	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	48
Clover	109	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	109
Lucerne	13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	13
Wheat Plants	242	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	245
Meadow Hay	10	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	11
Oat Plants	84	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	84
Barley Plants	39	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	39
Vetch	11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	11
Baled Hay	9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9
Oaten Hay	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Wheaten Hay	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Lupin Hay	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Wheat Grain	321	....	....	1	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	324
Oat Grain	36	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	36
Vetch and Oats	9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9
Vetch Seed	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Broom Millet Seed	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Wild Turnip Seed	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Safflower Seed	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Silage	20	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	20
Wheatmeal	81	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	81
Wheat Roots	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Tree Lucerne	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Old Man Saltbush	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Sorghum Leaves	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Maize	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Paspalum Vaginatum	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Pea Kibble	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Pea Pollard	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Chicken Feed	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Pig Food	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Dried Butter Milk	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Oyster Flour (Poultry Food)	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Limestone (Poultry Food)	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	2
Kikuyu	16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	16
Meatmeal	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	1	3
Poultry Mash	10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10
Poultry Foods	13	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	14
Flax Meal	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Flax Offal	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Flour	2	....	....	....	....	....	2	....	....	....	....	....	....	2	....	....	....	....	....	....	6
Wheat, F.A.Q.	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Wheat	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Unknown	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Dog Biscuit	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Whalemeal	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	3
Whale Meat	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	2
Whalebone Meal	2	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	3
Feeding Stuffs Act	86	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	86
Tobacco Leaf	91	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	91
Vine Leaves, Petioles and Stalks	94	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	94
Apple Leaves	99	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	99
Plum Tree Leaves	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Orange Leaves	199	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	199
Tomato Plants	11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	11
Tomato Fruit	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Hop Leaves	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Molybdenum Wire	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Iron	....	....	....	....	....	....	....	....	....	....	6	....	....	....	....	....	....	....	....	....	6
Gold Ores	....	....	....	....	....	....	....	....	....	....	....	....	....	4	....	....	....	....	....	....	4
Flue Dust	....	....	....	....	....	....	8	....	....	....	....	....	....	....	....	....	....	....	....	....	8
Fire Extinguisher	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Iron Oxide	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Salt	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Total	2,280	95	91	59	17	3	15	2	1	1	6	1	10	1,373	4	10	1	3	2	3	3,977

The Mineralogy, Mineral Technology and Geo-Chemistry Division.

The activities of this Division are chiefly concerned with the chemical and mineralogical examination of samples required for the various branches of the Mines Department—Government Geologist, State Batteries, State Mining Engineer and the General Public. The work undertaken in this respect includes assays for the precious and base metals, the rarer elements and general mineral and rock analyses.

Apart from this class of work, certain investigations of a specialised nature related to inorganic chemistry are undertaken for other Government departments. These include the study of the corrosion of metal and alloys, examination of building materials, metallurgical products and ceramic materials.

The total number of samples received during the year was 1425 of which 553 were examined for the general public as assistance to prospecting and development of the Mineral Industry in this State. 303 samples were examined for the Government Geologist, 246 for the State Batteries and 56 for the State Mining Engineer as shown in the detailed classification in Table 4.

The samples received from the Government Geologist covered a wide range of ores and minerals of potential economic value and of scientific interest. These included 162 samples from the Kooly-anobbing Drilling project, 42 from various manganese deposits, and a number of samples of miscellaneous natures including radio active ores for uranium assay.

Of the 246 samples examined for the State Batteries, 162 were check gold assays, 39 gold umpire assays, 18 rider weights for standardisation, 14 caustic lime samples and others of a miscellaneous nature.

The examination of economic minerals is an important function of this Division in connection with the development of the Mineral Industry of this State. The Division is responsible for keeping the mineral records which enables these laboratories to answer the many enquiries received regarding mineral distribution and market potentialities. In this connection 347 specimens and samples were received for free mineral determination and evaluation and thus provided assistance to those concerned with prospecting and development of the Mineral Industry.

The search for radio-active minerals in this State has been responsible for the submission of many samples for determination and uranium assay, both from the Government Geologist, General Public and Mining Companies. As an aid to this search it is now routine practice to test all samples received for mineral determination also for radio activity.

Twenty-four samples of alloys and metals were analysed during the year for one or more constituents. 14 of these were for the Public Works Department, the remainder being for the Wundowie Charcoal and Iron Industry and the general public.

This division is called upon to examine the corrosion of metals and alloys and to advise as to its cause and prevention. In this connection 16 samples were examined of which seven were for the Metropolitan Water Supply, Sewerage and Drainage Department and five for the Public Works Department.

A number of miscellaneous materials were also examined during the year as follows:—

Thirteen samples of construction and building materials for the State Housing Commission, Public Works Department and Department of Industrial Development.

Ten specimens of cement pipes and linings from the Metropolitan Water Supply, Sewerage and Drainage Department and the Public Works Department.

Table IV—See page 118.

Fuel Technology Division.

A total number of 894 samples were received during the year for examination. Of these 761 were samples of coal and coke from various sources; 99 were samples in connection with coked briquette project; the remainder being miscellaneous products obtained as a result of various industrial treatments of fuel.

The number of samples received from the Government Geologist this years was considerably greater than last year, as a result of the increased scope of the coal drilling programme at Collie. Two hundred and twelve samples in all were received from this source.

The Division's own programme of sampling and examination of coal samples from various sources in the Collie coalfield was continued this year with a view to advising as to the types of coal and the best method of their utilisation in Industry. A systematic survey of the working faces of each mine was continued as development proceeded. By this means any variation in the composition and ash content of the coal can be detected and a check kept on the quality of the coal mined.

Apart from analytical work undertaken a considerable amount of investigational work has been carried out in the Laboratory and in Industrial Plants.

Research projects undertaken during the year were:—

Bricoke from Collie Coal.

1. In these Laboratories the present stage of development is that a satisfactory method has been evolved of making coked briquettes from Collie coal. The economics of the project have not yet been proved however and further investigation is necessary to a pilot plant stage. This is at present being carried out in co-operation with officers of the Department of Industrial Development. Developments are under constant review but have not yet reached a stage where it could go into commercial production.

2. The coal washing investigation at the Collie Annexe Laboratory was completed late this year and a report on the washability of Collie coal is in course of preparation. Three hundred and sixty samples were examined during the year in this connection.

3. Investigations were carried out during the year into the more efficient use of coal and sawdust in boiler plants. Various sawmills throughout the South West were visited and reports issued. Twenty-nine samples were examined in connection with an investigation undertaken at the State Brickworks on the use of Collie coal.

The investigation into the determination of Collie coal by weathering and storage was further investigated and is being continued.

Table V—See page 119.

Industrial Chemistry Division.

This Division has not yet been able to function to its proper extent owing to the lack of proper facilities. For a number of reasons the construction and fitting out of the Unit Process Plant was disappointingly slow. Practically all of the equipment ordered is to hand from the Eastern States, England, the Continent and U.S.A.

The principal work undertaken during the year was the continuance of the gypsum survey and an investigation into the nicotine content of one of our native plants Duboisia Hopwoodii.

One hundred and ninety samples of the former were received last year from the Geological Survey for analysis and beneficiation tests. This work is intended to indicate which deposits if any could be satisfactorily and economically worked in connection with a number of research projects.

With regard to the latter and following reports by the Drug Panel, it was decided to continue investigations into the potential economic use of Duboisia Hopwoodii as a source of nicotine. A number of samples from different sources were collected by the Government Botanist and analysed. This investigation is still proceeding.

The information service established by the Division has again functioned actively during the year. In the six years of the Divisions operation the number of calls on technical matters has risen from 400 to 1500. The enquiries as usual covered a broad range and are an indication of the increasing tempo of secondary industry in this State.

H. P. ROWLEDGE,
Director
Government Chemical Laboratories.

TABLE IV.

MINERAL DIVISION, 1953.

Material.	Pay—Public.	Free.	State Batteries.	Government Geologist.	State Mining Engineer.	Departmental.	Royal Perth Hospital.	Industrial Development Department.	Metropolitan Water Supply, Sewerage, and Drainage Department.	Works and Labour Department.	Agriculture Department.	Public Health Department.	Charcoal Iron and Steel Industry.	State Housing Commission.	State Brickworks.	Department of Navy.	Civil Aviation Department.	TOTAL
Alloys and Metals	4	....	....	....	....	....	....	....	....	14	....	....	5	....	....	1	....	24
Corrosion	....	....	....	....	....	1	1	....	7	5	2	....	....	....	....	....	....	16
Ceramics—																		
Clays	....	5	....	3	....	....	....	....	....	....	....	....	....	....	2	....	....	10
Refractories	19	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	20
Natural Mineral Pigments—																		
Ochres and Oxides	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Metallic Ores and Minerals—																		
Beryllium	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Copper Ores	6	29	....	....	9	....	....	....	....	....	....	....	....	....	....	....	....	44
Gold Ores	14	44	....	2	2	....	....	....	....	....	....	....	....	....	....	....	....	62
Zinc Gold Precipitate	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Gold Concentrates	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Gold Umpire	....	....	39	....	....	....	....	....	....	....	....	....	....	....	....	....	....	39
Gold Tailings	....	....	162	....	....	....	....	....	....	....	....	....	....	....	....	....	....	162
Heavy Sands	2	7	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9
Iron Ores	....	2	....	162	....	1	....	....	....	....	....	....	....	....	....	....	....	165
Lead Ores	1	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Chromite	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Manganese	3	12	....	42	....	1	....	....	....	....	....	....	....	....	....	....	....	58
Columbite	8	16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	24
Tantalite	10	13	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	23
Mangano-Tantalite	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Tin/Tant. Concentrate	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Tant./Columbite Concentrate	....	....	....	....	43	1	....	....	....	....	....	....	....	....	....	....	....	44
Tin Concentrate	2	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
Tin Ore	3	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Titanium	....	7	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7
Bismuth	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Tungsten	10	....	8	....	1	....	....	....	....	....	....	....	....	....	....	....	....	19
Lithia	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Silver Ore	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Battery Sands	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Antimony	2	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Uranium	....	1	....	10	....	....	....	....	....	....	....	....	....	....	....	....	....	11
Minerals for R.A. Test	....	19	....	....	....	5	....	....	....	....	....	....	....	....	....	....	....	24
Other Economic Minerals—																		
Corundum	2	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	3
Limestone and Lime	21	4	....	8	....	3	....	2	....	3	....	....	....	....	....	....	....	41
Gypsum	1	1	....	....	....	4	....	....	....	1	....	....	....	....	....	....	....	7
Calcite	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Barite	2	10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12
Graphite	....	10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10
Phosphate	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	2
Magnesite	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Vermiculite	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Feldspar	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Kaolin	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Pyrite	5	....	....	36	....	....	....	....	....	....	....	....	....	....	....	....	....	41
Mineral Specimens for Determination	48	347	....	38	1	3	....	....	....	....	....	....	....	....	....	....	....	437
Allanite	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	2
Miscellaneous—																		
Construction and Building Materials	....	....	....	....	....	....	....	4	....	4	....	....	....	5	....	....	....	13
Cement Pipes and Lining	....	....	....	....	....	....	....	....	9	1	....	....	....	....	....	....	....	10
Water	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Photographic Solution	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1
Caustic Lime	....	....	14	....	....	....	....	....	....	....	....	....	....	....	....	....	....	14
Riders	....	....	18	....	....	....	....	....	....	....	....	....	....	....	....	....	....	18
Efflorescence	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1
Industrial Hazard	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1
	173	553	246	303	56	25	2	6	16	28	2	1	5	5	2	1	1	1,425

Table V.

FUEL TECHNOLOGY.

Samples Received during 1953.

	Government Geologist.	Industrial Development Department.	Departmental.	Pay.	Western Australian Government Tramways.	Wood Distillation Charcoal-Iron and Steel Industry.	State Brickworks.	Total.
Coal and Coke	....	....	....	76	....	....	....	76
Coal—								
Drilling	212	....	....	....	....	....	....	212
Fuel Laboratory Survey	....	....	20	....	....	....	....	20
State Electricity Commission	....	....	10	....	....	....	....	10
Miscellaneous	....	....	40	....	....	....	....	40
Fines	....	1	....	....	....	....	....	1
Shatter Tests	....	....	4	....	....	....	....	4
Washing	....	....	360	....	....	....	....	360
Storage	....	....	9	....	....	....	....	9
Brick Kiln Investigation	....	....	....	....	....	....	29	29
Briquetting Samples	....	....	99	....	....	....	....	99
Limestone and Coal	....	....	....	4	....	....	....	4
Sawdust	....	....	....	2	....	....	....	2
Briquette (Cupola Test)	....	....	1	....	....	....	....	1
English Coal (Coking)	....	....	3	....	....	....	....	3
Gas	....	....	....	1	....	....	....	1
Coal Drier	....	....	....	1	....	....	....	1
Bricks	....	....	....	8	....	....	....	8
Cement Clinker	....	....	....	1	....	....	....	1
Thermoscope Bars	....	....	....	5	....	....	....	5
Carbon Inserts	....	....	....	....	2	....	....	2
Pitch (Yeadons)	....	....	1	....	....	....	....	1
Tar	....	....	....	....	....	5	....	5
	212	1	547	98	2	5	29	894

Division VIII.

Annual Report of the Chief Inspector of Explosives for the Year 1953.

The Under Secretary for Mines:

I have the honour to submit for the information of the Hon. Minister for Mines, in compliance with Section 45 of the Explosives Act, 1895, my report on the working of the Branch for the year 1953.

The quantity of explosives imported into the State during the past year is shown in Table No. 1 also comparison of quantities imoprted during the past four years.

TABLE No. 1.

Explosives.	1949	1950	1951	1952	1953
	lb.	lb.	lb.	lb.	lb.
Gelignite	3,098,900	3,215,850	4,170,400	5,499,550	5,194,450
Gelatine Dynamite	437,500	180,300	123,850	288,850	204,850
Permitted Explosives	932,500	179,800	188,450	257,950	341,500
Blasting Powder	55,000	52,300	30,500	4,500	5,000
Detonators	3,750,000	3,626,000	2,222,376	3,931,943	4,447,870
Fuse (yards)	4,845,600	5,324,800	5,820,000	5,368,000	6,438,400

The following tests were made during the year for the purpose of determining the suitability for use, chemical stability, and velocity of detonation of explosives:—

Explosives	2,043
Fuse	549
Fireworks	338

The following table shows the number of licenses issued during the year:—

Magazines on Government Reserves	55
Magazines used by Government Departments and on private property	150
Store Licenses Mode A	74
Store Licenses Mode B	1
Fireworks Licenses	329
Importation Licenses	2

The quantities of explosives used in the different classes of industry for the years 1952 and 1953 are given hereunder:—

	1952 lb.	1953 lb.
Gold Mining	3,734,400	4,133,250
Coal Mining	386,700	549,200
Agriculture	125,765	150,000
Quarrying	291,700	324,900
Mining (Base Metals)	232,450	361,350
Government Departments	78,100	72,300
Miscellaneous	70,235	56,950
	4,919,350	5,647,950

Except for small direct shipments to Cockatoo Island, the State's explosives requirements were met by eight consignments in shallow-draft vessels able to berth at Woodman's Point Jetty. Safety fuse was unloaded from freighters at the Fremantle wharf; it is now all magazined pending distribution, superseding the former practice of warehouse storage. Detonators, always handled through the Reserve and isolated in special buildings, arrived both by train and ship. Of the grand total comprising 2824 tons of explosives and accessories, practically all was manufactured in Australia.

No explosives were condemned because of nitroglycerin exudation or low heat-test, but deterioration by moisture in transit necessitated several large-scale overhauls. Although damage directly attributable to sea water was often slight, past experience has shown that each damp case and even nearby seemingly dry ones must be subjected to individual plug examination. This detailed work, combined with the inspections generally, revealed defects in packaging technique and materials. Whilst outer wooden containers, criticized previously, have improved, their liners are frequently holed and torn. Another trouble is explosive composition external to the wrappers, accentuated where apparent over-filling leaves insufficient paper for proper end closure. Insecure longitudinal wax bonding, found mainly with Semigel, tends to form a capillary channel permeable by moisture, the presence of which may be demonstrated analytically in the explosive along a line corresponding with the inner end of the wrapper. All these observations have of course been brought under notice of the manufacturers. Mechanised cartridging, without which the factory's output would fall short of demand, is connected with some of the trouble, but it cannot be blamed for the occasional poor waxing and high incidence of imperfect liners.

Country inspections covering the South-West of the State, and the Eastern and Mt. Margaret Goldfields, were combined with investigations at Collie and Kalgoorlie, respectively. With the Branch's present small staff the desirable project of visiting every licensed magazine at least once annually cannot be attained, especially since more comprehensive inspection of explosives on arrival has been instituted. Nevertheless, opportunity was found for a check-up on magazines licensed by various storekeepers, quarrymen and public works undertakings with results which in the main were satisfactory. As usual, quantities of unserviceable explosives ranging from a few plugs to many cases were seized for destruction. It is not intended this year to give the customary itemized list, which

takes up space to the exclusion of more important matter; suffice it to say that of 89 cases and another 100 lb. of oddments all except a dozen or so plugs had deteriorated through water absorption. Two part-reels of safety fuse and several hundred old-type electric detonators which proved unreliable were also destroyed after the mine inspections at Kalgoorlie.

Interesting questions bearing on the effects of transmitted ground vibration from blasting came under notice around mid-year. The first related to the safety of an intended high-pressure oil main passing in proximity to quarries between Kwinana and Fremantle. About the same time the State Housing Commission sought advice as to whether exploding charges at the Main Roads Department's Medina quarry could be blamed for damage to residences in the vicinity. The problems were tackled by application of a formula relating amplitude of vibration to the weight of explosive and distance from the point under investigation. Although the result in each instance was shown to be a small fraction of the minimum amplitude considered harmful to buildings, a lack of information regarding tolerance of buried pipes did not permit of so ready an answer in this direction. Other points considered, however, such as the sand cushion supporting the line in its limestone trench and the fact that quarry faces were receding from the route traversed left little doubt as to the feasibility of the project.

Under chairmanship of the Coal Industry Co-ordinator, a conference was held in Collie on April 22nd to consider means for adjusting the relative output of coarse and fine coal to satisfy respective requirements of the W.A.G.R. and S.E.C.. Although blasting practice is only one of several factors influencing the result, obviously no subsequent treatment other than briquetting can be of avail if the coal is fragmented by high-brisance gelignite or over-charged shotholes. The case for general usage of lower-velocity explosives, presented both by the Chief Coal Mining Engineer and the writer, was followed later with practical demonstrations by one of Messrs. Nobels' technical experts. It is therefore felt that such remedial measures as lie within the domain of explosives technology are open to exploitation. The hesitant attitude toward departure from established practice, noticeable among a minority of explosives users, calls for modification if an uneconomic surplus of one grade of coal to the detriment of another is to be avoided.

Complaints from the Eastern Goldfields regarding unexploded butts in shotholes were investigated last September. Sensitivity tests by the A.D.C. method disclosed that Semigel in particular could be so desensitized by moisture absorption that failure to detonate in end contact with an exploding plug was common, whereas with perfect materials explosion communicated over a six inch air gap. Continuance of the work showed that any cartridges softened more than about half an inch at one or both ends should be rejected as unreliable. Aggravating factors, revealed by the Mines Inspectorate's analysis of current practice, included wrong positioning of the detonator, failure to clean out holes and the separating of charges by spacers which in some instances exceeded the proven striking distance of the present-day small diameter plugs. Although no overall solution of the problem was apparent, the first steps were to destroy several lots of wet explosives and then to demonstrate before gatherings of mine officials the advantages gained from good materials properly placed and detonated. In November another technologist from the Nobel organization carried on and enlarged the scope of the earlier investigations. His findings substantiated those above and, when subsequently reporting, he stressed the necessity for inculcating the principles and practice of correctly using explosives.

A Bill introduced into the House of Representatives on October 9th, 1952, and later emerging as the Commonwealth Explosives Act (1952) caused consternation when its full potential impact was realised by port and explosives authorities throughout Australia. As construed from the draft, its most disturbing provision was the Commonwealth's assumed right of berthing explosives vessels to the exclusion of shipping already alongside commercial wharves or jetties. However justifiable in war-time, such practices were denounced by the General Manager of the Fremantle Harbour Trust as likely to disrupt normal port working. Should a major explosion occur, say at Victoria Quay, the devastation might well be better imagined than described. It must be borne in mind that large quantities of up to 5,000 tons were under consideration and yet we, in the commercial explosives field, maintain that the usual consignment comprising one-twentieth to one-twelfth of this amount is none too isolated at Woodman's Point Explosives Reserve Jetty, six miles south of Fremantle Harbour and townsite. When regulations were duly framed under the new Act, representatives of Australasian explosives departments were invited to join with harbour masters as a sub-committee at inaugural meetings in Melbourne on 18th and 19th June. That the Act was constitutional and valid had already been established legally. Motions of protest were therefore unavailing, leaving as the only course open a critical examination of draft regulations with the intention of formulating the most satisfactory code in the circumstances. Under guidance of the Legal Officer to the Maritime Services Board of N.S.W. this task was carried out in meticulous detail. Although uncertainty still exists as to what extent the amended schedule will prove acceptable to the Commonwealth, the fact remains that each State through its port and explosives authorities has recorded the strongest disapproval of potentially dangerous practices, and pointed out the means for ensuring safety.

In reporting on the abovementioned conference, the writer observed that had each main port been provided with an isolated explosives jetty or wharf, as was understood to be the Commonwealth's intention, the question of handling explosives and similar hazardous goods in commercial harbours need never have arisen. Although representatives of the Operational Safety Committee have visited W.A. at intervals to examine possible sites, a practical outcome is still awaited. With industrial development south of Fremantle there now remains no reasonably accessible sheltered position, unless perhaps consideration be given to Sulphur Bay in Garden Island. Approachable through the Success Channel and advantaged by five to six fathoms of water near shore, the Bay is six miles from the nearest mainland. The Island's undulating terrain offers natural mounding for magazines should storage whilst awaiting transit be necessary. Admittedly, explosives would have to be lightered on occasions to and from the Bay and the jetties at Naval Base or Woodman's Point, but surely the extra time and cost must be regarded as insignificant by comparison with the risks inherent in similar movements in Fremantle Harbour.

The year has marked considerable progress at Woodman's Point Explosives Reserve, our main importation, storage and distribution centre. An additional 35 chains of road, completed in July, now provides direct vehicular access to the jetty, with advantages surpassing expectation. Regarding mechanised traction of explosives vans, early difficulties mentioned last year have been overcome. The main haulage unit is fitted with a hydraulically operated bogie device enabling steel-flanged or rubber-shod wheels to be lowered for rail or road travel, respectively. Another smaller tractor with pneumatic tyres all round is kept as a standby and for shifting driftsand. Safety devices such a flame-proofed induction, spark-suppressed exhaust and shielded electrical systems are installed on both machines. To cope with the greater weights and speeds, the permanent way has been trued to gauge, partly resleepered and renewed where necessary. Except for about 10 chains controlled by the Fremantle Harbour Trust, the work was undertaken by our resident staff. The railway siding platform was paved and is shortly to be roofed as further protection for portable magazines awaiting transit. Lastly, two other improvements, although now in their second year's operation, must

be commended as contributing to the Reserve's expeditious throughput. Reference is to the supplementing of standard explosives vans by other suitable types, and increased loadings permissible to Robb's Jetty siding. For the right to institute these latter innovations gratitude is expressed to he W.A.G.R. Commission.

Several explosives are at present under prolonged testing prerequisite to authorisation, and a revised definition permitting the inclusion of an additional component in gelatin dynamite has been received. Safety fuse, for so long grey or blue, is now dyed yellow for better contrast against the usual dark background. Although burning rate and general characteristics remain unchanged, occasional complaints are received. For instance, a South-West storekeeper, interviewed during inspections, averred that sales had fallen because yellow fuse burnt at half the normal rate. A test on the spot, giving an exact 90 seconds per yard, soon dispelled the illusion. A few months ago the packaging of fuse was improved by substitution of alkathene bags for paper wrapping. Investigations locally have demonstrated greatly enhanced resistance to humidity and even artificially-applied spray.

Although no accidents involving explosives came directly under the Branch's notice in 1953, opinion and information were furnished to the Kalgoorlie Mines Inspectorate on a fatality at Norseman. Damage to a car on Naval Base Road, Coogee, through flyrock from an adjoining quarry, was inquired into. The incident served to focus attention on the need for control of blasting, particularly at quarries near highways or residences. Several bodies such as the police, local authorities and ourselves are all anxious to establish some measure of orderliness in place of the virtual "open go" obtaining at present. The Act and Regulations, whilst definite on the importation, conveyance and storage of explosives, are mute as to their use, and hence quarry blasting is outside the inspector's jurisdiction.

No breaches of the Act warranted legal proceedings during the year, but under Fremantle Harbour Trust Regulation 239a the occupants of two boats within the quarter-mile prohibited ocean zone adjoining the Reserve were successfully prosecuted. Trespassing on the beach, still fairly prevalent, is unlikely to abate until the fence running from our north-west boundary corner to the water has been reconditioned.

Fireworks importations, stimulated by liberalised quotas, comprised 837 cases brought by 23 vessels from Great Britain and Hong Kong. The goods were satisfactorily packaged and strangely no manufacturer had availed himself of the right to substitute non-metallic liners for the usual tinplate. This concession was introduced at the request of English pyrotechnical firms faced with supply difficulties. Several hundred percussion tests, together with firing trials and chemical analysis where necessary, established that all firework varieties for the local market were of acceptable safety and composition. One importer, apparently in ignorance of a ban on a line known as Drops, included a case in his order. The contents were voluntarily submitted to the Department for destruction.

Using fireworks originally purchased for the anticipated Royal Visit of 1952, a public display was presented during Coronation celebrations on 4th June. A similar function, to be staged on this occasion at Mill Point, is being planned as part of the festivities during Her Majesty the Queen and H.R.H. the Duke of Edinburgh's presence in March, 1954. After several months' recess, the small committee responsible for general arrangements and safety measures resumed meetings last October.

For their faithful performance of duty, thanks are expressed to Messrs. Wood and Jensen, both sub-inspectors under the Act. Similarly, the staff at the Explosives Reserve did a good year's work. Appreciation of assistance rendered by colleagues in the Mines and other State Departments must particularly be directed to the Police for their country inspectional services regarding firework sales, and to the Government Laboratories in undertaking the Branch's chemical and analytical investigations.

F. F. ALLSOP,
Chief Inspector of Explosives.

Division IX.

Report of Chairman, Miner's Phthisis Board, and Superintendent Mine Workers' Relief Act.

The Under Secretary for Mines:

I have the honour to submit, for the information of the Honourable Minister for Mines, my report on this branch of the Mines Department for the year 1953.

Under arrangements similar to previous years the Commonwealth Health Department continued the periodical examination of mine workers, the work being carried on continuously 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 and Phillips River, which are all remote and contain few mine workers.

MINE WORKERS' RELIEF ACT.

The examinations under the Mine Workers' Relief Act during the year totalled 4,809 compared with 5,359 for the previous year, a decrease of 550. The results of the examinations for 1953 together with the figures for previous years are shown in the tables annexed hereto. A graph is also attached illustrating the trend of the examinations since their inception in 1925. In explanation of these figures, I desire to make the following comments.

Normal Etc.—These number 4,474, or 93.03 per cent. of the men examined, and include men having first class lives or suffering from Pneumoconiosis only, the figures for the previous year being 5,073, or 94.6 per cent.

Early Silicosis.—These number 299 of which 74 were new cases and 225 had been previously reported, the figures for 1952 being eight and 234 respectively. Early Silicotics represent 6.22 per cent. of the men examined, the percentage for the previous year being 4.5. The new cases show an unaccountable increase from eight in 1952 to 74 in 1953.

Advanced Silicosis.—Of the 32 cases reported, eight were men who advanced from Early Silicosis during the year the other 24 having been reported previously. Advanced Silicotics represent 0.67 per cent. of the men examined, the percentage for the previous year being 0.60.

Silicosis Plus Tuberculosis.—Two cases were reported compared with two for the previous year.

Tuberculosis Only.—Two cases were reported, compared with seven for the previous year.

MINES REGULATION ACT.

Examinations under the Mines Regulation Act totalled 1,496. This was in addition to the 4,809 examinations under the Mine Workers' Relief Act. These show a decrease of 325 compared with the previous year. The 1,496 men comprise 993 new applicants and 503 re-examinees for the Initial Certificate.

Particulars of the examinations are as follows:—

New Applicants.

Normal	965
Pneumoconiosis	1
Silicosis Early	1
Silicosis Advanced	–
Query Tuberculosis	8
Tuberculosis	2
Other conditions	16
	993

Of the above Applicants for admission into the industry 965 received the Initial Certificate (Form 2), eleven received temporary Rejection Certificates (Form 3), nine received permanent Rejection Certificates (Form 4), three received Re-Admission Certificates (Form 5), and in five cases no certificates were issued. Thus of 993 applicants, 965 or 96 per cent. were eligible for employment anywhere on a mine.

Re-Examinations.

Normal	361
Pneumoconiosis	75
Early Silicosis	17
Advanced Silicosis	2
Query Tuberculosis	10
Pneumoconiosis plus Query Tuberculosis	6
Early Silicosis plus Query Tuberculosis	3
Other conditions	29
Total	503

These men had previously been examined and some were engaged in the industry prior to this examination, 361 received the Initial Certificate (Form 2), twelve received temporary Rejection Certificates (Form 3), four received permanent Rejection Certificates (Form 4), 52 received Re-Admission Certificates (Form 5), 66 received Special Certificates (Form 9), and in eight cases no Certificates were issued. Thus of the 503 men examined 413 were eligible for employment anywhere on a mine, 66 were eligible for employment on the surface only and 23 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.

Initial Certificate (Form 2)	1,326
Rejection Certificate (Form 3)	23
Rejection Certificate (Form 4)	13
Re-Admission Certificate (Form 5)	55
Special Certificate (Form 9)	66
No Certificate	13
Total	1,496

The percentage of men of normal health to the number examined was 88 compared with 87 for the previous year.

MINERS' PHTHISIS ACT.

The amount of compensation paid during the year totalled £21,393 13s. 4d., compared with £24,115 2s. 8d. for the previous year, a decrease of £2,121 9s. 4d., which is attributable to the death of some of the beneficiaries and the attainment of the age of 16 years by some of the dependent children.

The number of beneficiaries remaining under the Act on the 31st December, 1953, was 189 being 17 ex-miners and 172 widows.

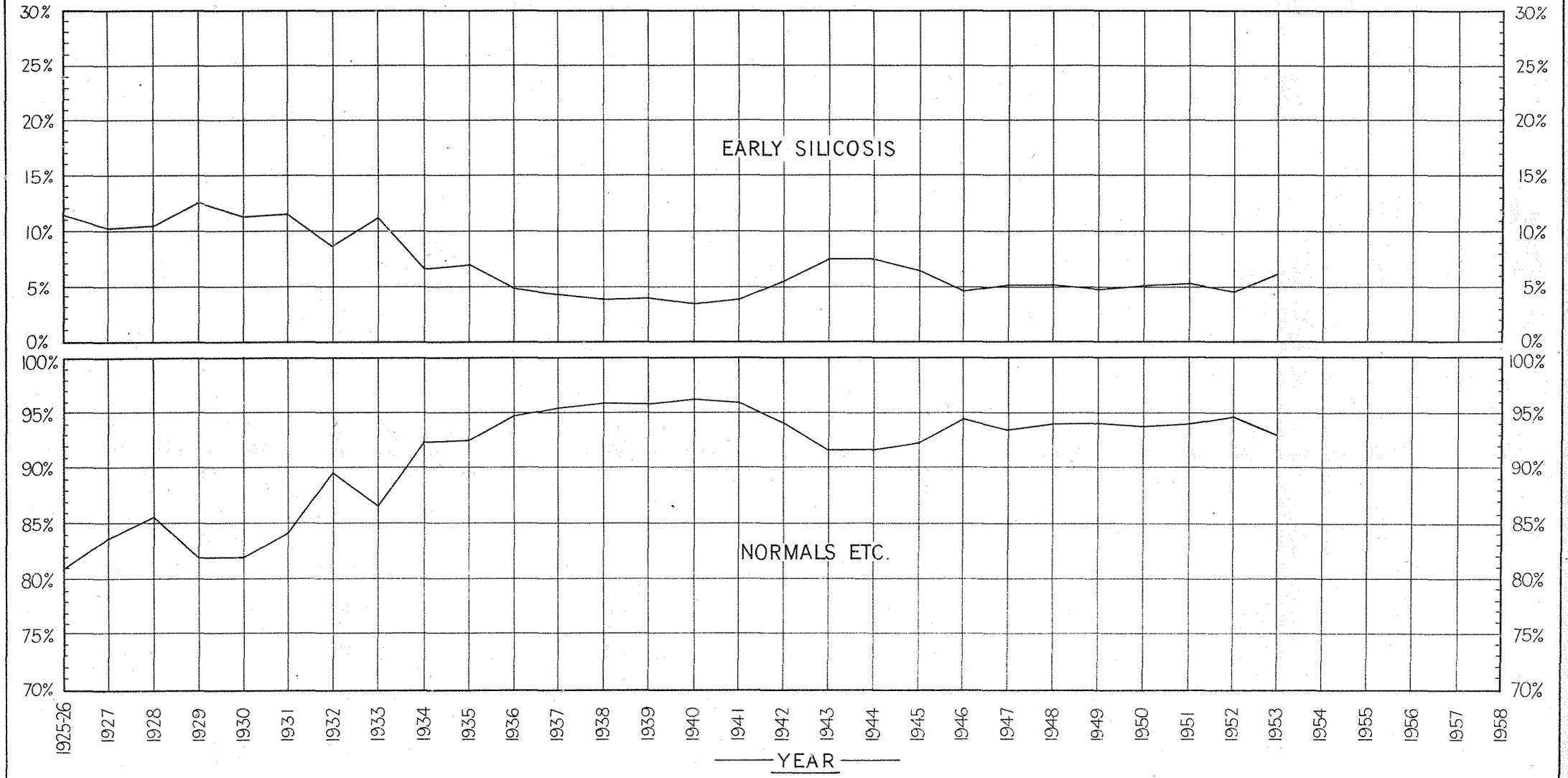
J. THOMAS,

Chairman Miners' Phthisis Board and Superintendent Mine Workers' Relief Act.

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.

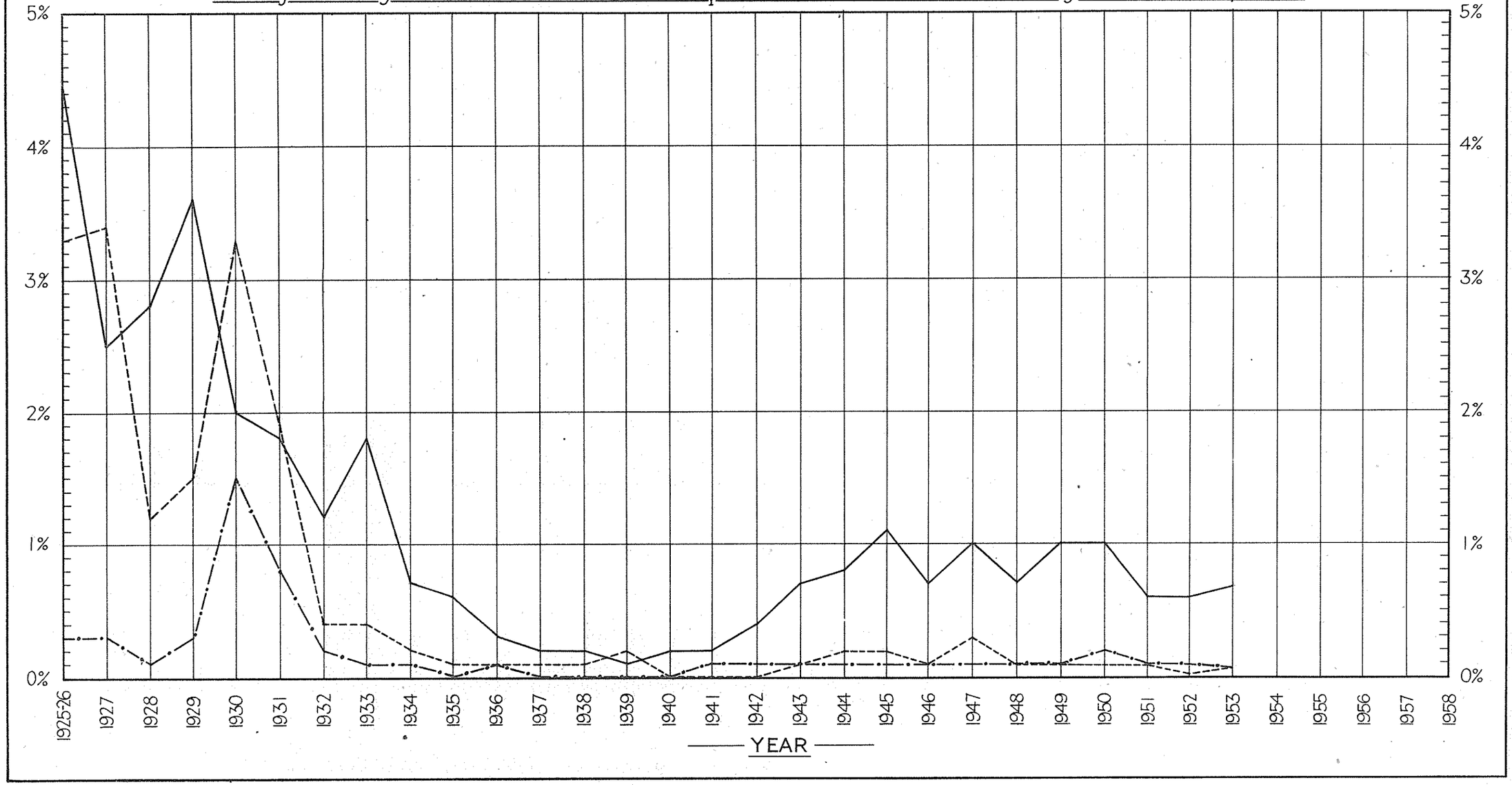


TABLE SHOWING RESULTS OF PERIODICAL EXAMINATION OF MINE WORKERS FROM INCEPTION OF EXAMINATIONS (1925).

Year of Examination.	Normal, etc.				Silicosis Early.					Silicosis Advanced.						Silicosis plus Tuberculosis.							Tuberculosis Only.				Total number of men Examined.
	Previously reported as Normal, etc.	New Cases.	Total.	Per cent.	Previously reported as Normal, etc.	Previously reported as Silicosis Early.	New Cases.	Total.	Per cent.	Previously reported as Normal, etc.	Previously reported as Silicosis Early.	Previously reported as Silicosis Advanced.	New Cases.	Total.	Per cent.	Previously reported as Normal, etc.	Previously reported as Silicosis Early.	Previously reported as Silicosis Advanced.	Previously reported as Silicosis, plus Tuberculosis.	New Cases.	Total.	Per cent.	Previously reported as Normal, etc.	New Cases.	Total.	Per cent.	
1925–1926	....	....	3,239	80·5	....	....	....	459	11·4	....	....	....	....	183	4·5	....	....	....	....	....	131	3·3	....	....	11	0·3	4,023
1927	2,290	826	3,116	83·6	....	348	33	381	10·2	....	....	85	8	93	2·5	13	27	62	....	26	128	3·4	....	....	10	0·3	3,728
1928	2,738	239	2,977	85·5	47	303	12	362	10·4	1	16	79	2	98	2·8	10	14	10	....	8	42	1·2	3	1	4	0·1	3,483
1929	2,099	21	2,120	81·9	100	224	2	326	12·6	....	34	60	....	94	3·6	8	14	19	....	....	41	1·6	7	....	7	0·3	2,588
1930	2,751	34	2,785	81·9	133	247	3	383	11·3	....	22	43	2	67	2·0	6	60	46	....	2	114	3·3	47	3	50	1·5	3,399
1931	2,530	....	2,530	84·0	94	252	....	346	11·5	....	18	35	...	53	1·8	4	35	19	....	....	58	1·9	25	....	25	·8	3,012
1932	3,835	....	3,835	89·5	35	338	....	373	8·7	....	6	47	....	53	1·2	3	9	4	....	....	16	·4	8	....	8	·2	4,285
1933	2,920	....	2,920	86·5	57	322	....	379	11·2	1	15	44	....	60	1·8	2	9	4	....	....	15	·4	3	....	3	·1	3,377
1934	5,140	....	5,140	92·4	54	315	....	369	6·6	1	24	12	....	37	·7	6	6	....	....	....	12	·2	5	....	5	·1	5,563
1935	4,437	....	4,437	92·3	35	303	....	338	7·0	....	24	2	....	26	·6	....	5	....	....	....	5	·1	2	....	2	·0	4,808
1936	6,972	....	6,972	94·7	29	323	....	352	4·8	1	15	4	....	20	·3	3	8	....	....	....	11	·1	8	....	8	·1	7,363
1937	7,487	....	7,487	95·4	15	319	....	334	4·3	....	14	4	....	18	·2	1	10	....	....	....	11	·1	2	....	2	·0	7,852
1938	6,833	....	6,833	95·7	13	266	....	279	3·9	....	15	2	....	17	·2	1	8	....	....	....	9	·1	3	....	3	·0	7,141
1939	6,670	....	6,670	95·6	18	264	....	282	4·0	....	7	3	....	10	·1	1	9	1	....	....	11	·2	2	....	2	·0	6,975
1940	7,023	....	7,023	96·2	12	245	....	257	3·5	....	10	1	....	11	·2	....	4	....	....	....	4	·0	4	....	4	·0	7,299
1941	6,840	....	6,840	95·8	32	248	....	280	3·9	....	11	3	....	14	·2	....	....	....	....	....	....	....	7	....	7	·1	7,141
1942	5,469	....	5,469	93·9	61	264	....	325	5·6	....	20	5	....	25	·4	....	2	....	....	....	2	·0	3	....	3	·1	5,824
1943	3,932	....	3,932	91·5	63	262	....	325	7·6	....	25	7	....	32	·7	....	5	....	....	....	5	·1	4	....	4	·1	4,298
1944	4,079	....	4,079	91·5	70	270	....	340	7·5	....	21	14	....	35	·8	1	7	....	....	....	8	·2	6	....	6	·1	4,468
1945	3,071	....	3,071	92·1	54	166	....	220	6·6	....	26	10	....	36	1·1	3	2	....	....	....	5	·2	2	....	2	·1	3,334
1946	5,294	....	5,294	94·4	89	172	....	261	4·7	1	36	2	....	39	·7	3	1	2	....	....	6	·1	6	....	6	·1	5,606
1947	6,021	....	6,021	93·3	101	237	....	338	5·2	....	49	9	....	58	1·0	13	11	1	....	....	25	·3	8	....	8	·1	6,450
1948	4,827	....	4,827	94·0	24	239	....	263	5·1	....	18	17	....	35	·7	1	3	....	....	....	4	·1	5	....	5	·1	5,134
1949	5,162	....	5,162	94·0	24	239	....	263	4·8	....	20	31	....	51	1·0	3	2	....	1	....	6	·1	7	....	7	·1	5,489
1950	5,077	....	5,077	93·6	14	269	....	283	5·2	....	14	41	....	55	1·0	....	1	....	2	....	3	·1	8	....	8	·2	5,426
1951	4,642	....	4,642	93·9	13	248	....	261	5·3	....	9	20	....	29	·6	....	4	1	1	....	6	·1	4	....	4	·1	4,942
1952	5,073	....	5,073	94·6	8	234	....	242	4·5	....	4	31	....	35	·6	....	2	....	....	....	2	·1	7	....	7	·1	5,359
1953	4,474	....	4,474	93·03	74	225	....	299	6·22	....	8	24	....	32	·6	....	2	....	....	....	2	·1	2	....	2	·1	4,809

Division X.

Report of the Chief Coal Mining Engineer for the Year 1953.

Under Secretary For Mines:

Sir,—I have the honour to submit to the Hon. Minister for Mines, the Annual Report on the operation of the Collie Coalfield for the year ending 31st December, 1953.

No serious interruption of work occurred at any of the mines during the year, except that restrictions were imposed to limit the amount of open cut coal.

The aggregate amount of coal sold for the year was 885,448 tons as compared with 830,857 tons for the previous year, an increase of 54,591 tons or 6.5 per cent.

The respective tonnages sold from each of the individual mines is shown on Schedule "A".

The deep mines show an increase of 70,284 tons to make a total of deep mined coal of 492,302 tons as compared with 422,018 tons the previous year. However the output for 1952 was adversely affected by the metal trade workers strike to the extent of approximately 45,000 tons and consequently the results for the two years are not comparable.

The open cut mines show a decrease of 15,693 tons to make a total of 393,146 tons as compared with 408,839 tons the previous year. The proportion of deep mined coal and open cut coal are 55.60 per cent. and 44.40 per cent. respectively, as compared with 50.79 per cent. and 49.21 per cent. the previous year.

During the year, late in August, the Collie Burn Open Cut ceased and production at the Western No. 1 and No. 2 deep mines was increased in an endeavour to replace the tonnage lost from the open cut. The total amount of coal produced from the Collie Burn since it commenced in December, 1950, was 186,790 tons.

Late during the year two new deep mines were commenced; one at Ewington and the other at Westralia. Each of these mines will ultimately produce from two seams and will be mechanised from their inception to deal with large outputs.

LOSS OF OUTPUT.

Table "B" shows the loss of output during the year of only 12,790 tons as compared with 18,245 tons for the previous year. The majority of the loss incurred was due to the shortage of railway wagons during the early part of the year. It took the Railway Department many months during 1953 to recover its former position and a total loss in output of only 6,445 tons due to a shortage of railway wagons is not, in this instance, a matter for serious complaint.

The employers and employees have every reason to be proud of the fact that an output of only 2,025 tons was lost for industrial causes.

APPORTIONMENT OF OUTPUT.

Table "C" shows the apportionment of output during the year. The Railway Department was by far the largest user of coal, consuming 370,382 tons or 41.83 per cent. of the aggregate produced.

During 1952 the railway consumed 298,587 tons or 35.94 per cent. of the total produced. It will be recalled that during 1952 the Railway consumption was materially reduced due to the metal trade workers' strike. Reference to Table "D" shows that the consumption by the railway for 1953 was normal.

The next largest users were the State Electricity Commission who were supplied with 314,433 tons (including Collie Power Station), or 35.51 per cent. of the total produced. This compares with 377,160 or 45.39 per cent. of the total produced during 1952.

These statistics for the S.E.C. are not, on their face value, comparable without making reconciliation for stocks held during the two periods which is as follows:—

1952.	tons.
Stocks on hand, 1st January	12,463
Supplied during 1952	377,160
	389,623
On hand, 31st December, 1952	56,924
Consumed during year	332,699

1953.	tons.
Stocks on hand, 1st January	56,924
Supplied during 1953	314,433
	371,357
On hand, 31st December, 1953	40,724
Consumed during year	330,632

It is rather a significant point that although the load in the Metropolitan area increased considerably the amout of coal consumed was approximately the same, due presumably, to the much higher efficiency of the South Fremantle station.

The Collie Power Station consumed 44,689 tons as compared with 38,247 tons in the previous year. This increase is attributed chiefly to new mines as well as increased mechanisation and will continue to increase as the new mines expand.

The Cement Works again increased their consumption from 53,826 tons during 1952 to 66,846 tons during 1953. It is estimated that the Cement Works will further increase their consumption during 1954 up to approximately 80,000 tons.

Private consumers increased from 101,284 tons in 1952 to 108,493 tons during 1953.

The following is an approximate estimate of coal requirements for 1954:—

	tons.
Railway Department	390,000
State Electricity Commission	360,000
Cement Works	80,000
Private Consumers	110,000
Kalg. Elect. & Power Corporation	45,000
Total	985,000

The above consumptions are well within the productive capacity of the industry. The following is an estimate of production from the deep mines during 1954:

	tons.
Amalgamated Collieries (Deep Mines)	350,000
Western Collieries (Deep Mines)	100,000
Griffin Collieries (Deep Mines)	120,000
Total	570,000

If the above estimates are reasonably correct, the remaining 415,000 tons can easily be produced from the four open cuts.

The threat to the use of coal as a basic fuel by the use of alternate fuels must be accepted, and every effort made to produce clean coal at attractive prices.

Modernisation of the mines should go a long way in this respect but probably the most effective method would be to develop the deep mines into larger units yielding much larger tonnages.

All the Collie mines are comparatively small units, and all things being equal, cannot produce coal as economically as large units.

The managements at Collie would therefore be well advised to give this suggestion their serious consideration.

It is appreciated that to expand a mine which was not initially designed for large outputs is often impossible and the suggestion for expansion is intended more for new mines than the old, but the old mines should be brought up to the maximum of which they are capable.

Mechanisation.

The relative outputs of hand mined coal and mechanically produced coal from the deep mines were 87,608 tons and 405,679 tons, or 7.76 per cent. and 82.24 per cent. respectively, as compared with 33 per cent. and 67 per cent. in the previous year. This indicates satisfactory progress in the process of mechanisation, especially as it has been accomplished in only four years. The Collie Coalfield is now more highly mechanised than any coalfield in Australia.

As the output of the deep mines increases the percentage of mechanically produced coal will also increase. All the new mines will be mechanised from their inception which will further increase the percentage of mechanically produced coal.

STATISTICS.

Labour Disposition—Outputs Individual Mines—Output per Manshift.

Table "F" shows the persons employed at each individual mine as well as the output per manshift in each deep mine.

A reduction in the output per manshift occurred from 1.74 tons to 1.57 tons which is due to a more intensified programme of development as well as the non-productive labour engaged in the opening up of new deep mines.

The percentage of manshifts worked at the coal face shows a slight improvement from 23.94 per cent. during 1952 to 24.99 per cent. during 1953. This percentage is still too low and is due chiefly to the programme of re-organisation and development at almost all the deep mines.

The effect of opening up new deep mines is shown in the percentage of surface workers which increased from 23.24 per cent. during 1952 to 30.02 per cent. during 1953. This is a matter of some significance as to open up new additional deep mines must inevitably increase the percentage of surface workers to the total employed, thus upsetting the balance of economy.

The new deep mines must be developed for large outputs in order to obtain a fair return of the capital involved and much larger outputs will be required from each mine.

As the ultimate amount of deep mined coal is limited to the local demand so also must the number of deep mines be limited. If Collie is to retain its prosperity and economic stability then the required amount of deep mined coal must ultimately be obtained from, say, six well-planned and equipped deep mines.

In Europe during recent years all new mines are developed, if possible, for a potential output of 10,000 tons per day or two and a half million tons per year, under the control of one manager and one superintendent.

In the United States where the geological conditions are better than in Europe during recent years mines are developed with a potential output of 20,000 tons per day or five millions tons per year.

This principle of large, modern, well-planned mines must be recognised and ultimately established at Collie as it is the only way coal can economically compete with alternative fuels.

Development.

The following is a brief description of the reorganisation and developments at each of the individual mines:—

Amalgamated Collieries:

Co-operative.—During the year the programme of reorganisation was considerably accelerated. The installation of the main trunk belts in the East Tunnel was completed and were in operation early in August. The mine was thus completely mechanised, the whole of the output being filled and transported to the surface by mechanical means.

The potentialities of the mine were thus enormously increased and when the three mechanical units are in operation the output of this mine should be no less than 600 tons per day.

Arrangements have been made to prove the fault on the South side of the East Tunnel and to open panels to replace the existing panels, also for a further increase in output.

Much work has also been in progress on the surface of this mine. A new screening plant has been partly erected, also new bath and change houses. The latter are of the same design as at Neath except of a greater capacity. It is hoped to have both the above mentioned projects completed during 1954.

Proprietary.—A progressive programme of reorganisation continued at this mine during the year. It is a most difficult mine to reorganise and keep in production simultaneously.

The top or No. 1 seam was won during the year and developments were commenced as soon as a system of ventilation was established. The seam is heavily watered and progress has been considerably hampered on this account and it will be some considerable time before the development is sufficiently advanced to yield an economical output.

In the meantime it is the intention of the Company to develop this seam at another position on the same haulage road, thus concentrating their output to one haulage system. These new developments should be commenced and well under way during next year.

The winning of the No. 4 seam still continues and the work in connection with establishing a return airway is now in progress. Developments in this seam will be commenced when the system of ventilation is established. This seam, due to its thickness, which is variable, will never be a large producer but will serve as a useful reserve in case of serious geological disturbances interrupting production in the other seams.

Neath.—Good progress was made with developments at this mine. The policy of forewinning the existing coal headings in the Neath seam, by driving a stone heading from the Cardiff seam into the Neath seam and coal headings to the rise to meet the existing coal headings in the Neath seam, was completed. A permanent system of drainage for the Neath seam at this level was thus established.

The working conditions in the Neath seam were immediately improved and the output was considerably increased. All the output from this mine is obtained from development. A comparatively large area has been developed which, if so desired, could be brought into production.

If the developments are continued for another two years as at present then an area of coal will be available sufficient to provide the output of this mine for approximately eight to ten years.

It is the intention of the Company to repeat the process of forewinning the main dip headings from the dip side. If this policy is pursued and all roads in the Neath Seam driven to the rise then the difficulty experienced with water should be entirely eliminated.

Stockton.—No policy of reorganisation has yet been designed for this mine. As stated in previous reports no policy for reorganisation on a mechanised basis can successfully be designed until adequate geological information is available. This information can only be obtained by considerable surface boring and having regard to the fact that this mine is the only mine at Collie for which no reorganisation or mechanisation has been provided there is every justification for the boring programme to be implemented as early as possible.

The Geological Department hope to commence the programme during 1954-1955. When the programme is completed and the geological information available, plans for the reorganisation and mechanisation will be completed.

The Amalgamated Company commenced two new deep mines, one on the Ewington Leases and the other on the Westralia Leases. Both these mines will each develop two seams for production on a mechanised basis.

It is the intention of the Company to advance the main dip headings at both mines at least 50-60 chains before commencing any lateral work in order to develop large areas prior to bringing the mines into production. This policy is sound and indisputable.

The Westralia Seam unfortunately has a band of dirt varying in thickness up to 30in. approximately in the middle of the seam, and unless the management arrange for this band of dirt to be loaded separately contamination of the output will be inevitable.

At present the output from this mine passes through the screening plant at the Co-operative Mine and much of the extraneous dirt is removed on the picking belt. Somewhat similar circumstances prevail at the Ewington deep mine where a band of dirt approximately 12in. thick exists on the top of the seam. The installation of washing plants at these two mines should be considered.

Griffin Company.

Wyvern.—The working conditions at this mine continue to be adversely affected by serious geological disturbances such as faults and washouts. Production is obtained from a comparatively small area which is bounded by serious faulting on both the Northern and Southern sides of the mine. Under such circumstances adverse geological conditions can be expected.

Due to the fact that these two faults appear to be converging on each other the working conditions will not improve; on the contrary one can expect the conditions to deteriorate.

The output of this mine will consequently fluctuate depending upon the geological conditions and one cannot expect a permanent increase in output.

Griffin.—The working conditions at this mine continue to be difficult due to the high gradients and the fact that the strata is heavily watered, also the presence of numerous minor faults.

As suggested in previous reports the retreating system of work could be adopted to advantage at this mine and it is difficult to understand the reluctance of the management to do so.

No increase in output can be expected from this mine and the management will have difficulty, on the present system of work, in maintaining the output.

Phoenix.—This mine is still in the development stage and reasonable outputs are obtained.

The management would be well advised to continue their development programme until large areas are proved. This policy should be strictly adhered to, especially so having regard to the fact that the geological conditions encountered in the Wyvern Seam will probably repeat themselves in the Phoenix Seam.

When the mine has been sufficiently developed production should then commence on the retreating system of work.

Centaur.—The development of this mine has once more been seriously affected due to a serious fall to the surface.

This is the fourth serious fall at this mine, all of which have penetrated to the surface.

The consequence of these falls has been a serious retardation in the development programme, causing loss of valuable machinery, loss of output and considerable expense.

The cause of these falls has not been established but the Department is satisfied that bed separation has had a considerable influence on the cause. It is important and, in fact, essential, that the cause of these falls be established as otherwise the future safe working conditions and efficiency of the mine will be jeopardised.

As bed separation is such a prolific cause of falls and as the symptoms at this mine indicate that bed separation does take place, the reluctance of the management to study this phase of roof control is incomprehensible.

Bed separation is usually caused during the process of under-cutting and/or over-cutting, and with the use of convergence recorders is not difficult to detect. Once it is detected and the cause ascertained then normally it is not difficult to eliminate same.

The essence of good mining practice is in the efficient control of the roof and as the matter is a subject unto itself one cannot deal adequately with it in this report other than to state and reiterate previous suggestions that the managements would be well advised to devote to the subject the time and study it warrants.

It will be many months before all the dip headings at the Centaur Mine will be recovered and in working condition.

It is the intention of the mangement to produce only from these headings and not to commence any lateral headings until the dip headings have advanced sufficiently, and, it is hoped, the cause of the falls established.

Western Collieries.

Western No. 1.—This mine has continued with its development both on the surface and underground.

During the year the mine produced an output of 42,104 tons or an average of 164 tons per day. At the beginning of the year the output was approximately 80 tons per day and this progressively increased to over 250 tons per day. A further increase should take place during next year.

The working conditions cannot be considered good and much difficulty is experienced at times with the roof. The use of a 9ft. jib is not conducive to good roof control and the management would be well advised to discontinue this practice.

This seam and roof conditions are very similar to the Neath Seam and as the Continuous Miner has given such very good results at the Neath Mine the Western Company would be well advised to consider the installation of a Continuous Miner at this mine.

The shape of the leases lend themselves to the "retreating system" of work as with the exception of the main headings all the lateral roads will be comparatively short.

Another feature, lending itself to the abovementioned system, is the fact that the leases contain three workable seams in close proximity and if the lower seam was developed first the workings in that seam would tend to drain the two upper seams and eliminate much of the difficulties caused by water.

Western No. 2.—The short history of this mine is one of unfortunate circumstances caused by the frequent adverse geological disturbances in the form of "washouts" (vugs).

Such washouts are not an uncommon occurrence in coal mining and are usually found in seams overlain by sandstone. Unfortunately at this mine most of the washouts encountered are heavily saturated with water which produces difficulties almost impossible to control. The main dips were stopped on this account.

It is known, from surface bores, that at a distance of approximately 20 chains in advance of the dip headings the seam is overlain by shale and in all probability the washouts would cease from this point onwards.

In an endeavour to reach this area the management commenced three headings to the west so as to reach the country with the shale roof as quickly as possible, but unfortunately washouts were met in two of these headings considerably retarding progress in this direction and it may well be that it may not be possible to continue this policy and an alternative plan will have to be considered.

Accidents.

The total number of accidents during the year was 128 as compared with 94 during 1952.

The increase in the number of accidents is not comparable with the increase in the number of employees which has resulted in an increase in the rate per 100 men employed from 10.79 to 12.69; per 100,000 tons of coal produced from 22.80 to 26.15; and per 10,000 manshifts worked from 3.97 to 4.37.

Some of the mines show a decrease whereas others show an increase. A phenomenal increase is shown at Stockton which is the only hand-getting mine at Collie.

The number of miscellaneous accidents during 1953 was 339 as compared with 279 during 1952, an increase of 60 or 21.5 per cent. One cannot but once more stress the necessity for each manager to investigate this most prolific source of accidents which appears to be common to each mine.

There were two fatal accidents during the year. One at the Centaur Mine, caused by an electric shock, and the other at the Proprietary Mine, caused by explosives.

These two fatal accidents increased the progressive total from 1.31 per 1,000 men employed in 1952 to 1.32 during 1953.

Staff.

Mr. Henry Sweeney, who acted as Senior Inspector for a temporary period of three months, resigned on March 31st and was succeeded by his brother, Mr. Cyril K. Sweeney. Mr. Sweeney was formerly manager of the Stockton Mine for many years.

I would once again record my thanks to the Mines Inspectorate at Collie, the administrative staff at Perth, the managerial staff at all the individual mines, and the workmen's representatives for their assistance and co-operation during the year.

G. MORGAN,
Chief Coal Mining Engineer.

(9)—88619.

TABLE "A."

TABULATED DATA AND ESTIMATED VALUE OF COAL SOLD IN 1953 FROM INDIVIDUAL MINES AS COMPARED WITH 1952.

Mines.	1952.		1953.		Increase on 1952.	Decrease on 1952.	Estimated Value, 1952.	Estimated Value, 1953.
	Output.	Percentage of Total.	Output.	Percentage of Total.				
Deep Mines—								
Co-operative	62,325	7·50	59,802	6·75	....	2,523	182,137	201,988
Proprietary	57,749	6·95	50,030	5·65	....	7,719	169,331	172,643
Cardiff-Neath	63,860	7·68	66,512	7·51	2,652	....	187,986	233,943
Stockton	66,219	7·97	62,843	7·10	....	3,376	196,783	214,121
Black Diamond Tunnel	2,501	·30	4,358	·49	1,857	....	....	12,881
Westralia	....	....	9,883	1·12	9,883	....	....	32,939
Ewington	....	....	3,850	·43	3,850	....	....	12,666
Griffin	48,450	5·83	52,416	5·92	3,966	....	161,815	190,724
Wyvern	64,122	7·72	63,269	7·15	....	853	210,048	229,586
Phoenix	17,037	2·05	28,003	3·16	10,966	....	59,618	100,640
Centaur	32,572	3·92	32,742	3·81	170	....	106,313	121,523
Western No. 1	5,164	·62	42,104	4·76	36,940	....	12,622	149,464
Western No. 2	2,019	·25	16,490	1·86	14,471	....	5,315	58,046
Total	422,018	50·79	492,302	55·60	70,284	....	1,291,968	1,731,164
Open Cuts—								
Stockton	171,707	20·67	138,795	15·68	....	32,912	499,200	472,312
Black Diamond	93,717	11·28	6,004	·68	....	87,713	275,831	22,673
Ewington	81,909	9·86	210,412	23·76	128,503	....	252,181	717,553
Muja	....	....	6,693	·64	6,693	....	....	19,979
Collie Burn	61,506	7·40	31,242	3·53	....	30,264	138,116	109,392
Western No. 3	....	....	....	....	....	....	....	....
Total	408,839	49·21	393,146	44·40	....	15,693	1,165,328	1,341,909
Deep Mines	422,018	50·79	492,302	55·60	70,284	....	1,291,968	1,731,164
Open Cuts	408,839	49·21	393,146	44·40	....	15,693	1,165,328	1,341,909
Grand Total	830,857	100·00	885,448	100·00	54,591	....	2,457,296	3,073,073

TABLE "B."

Comparison of Overall Production Losses for 1952 *and* 1953 *showing where Losses Occurred.*

Year.	Pit Top Meetings.	Railway Wagon Shortage.	Strikes.	Other Causes.	Total.
1952	2,285	280	....	15,680	18,245
1953	2,025	6,445	....	4,320	12,790
Increase on 1952	....	6,165	....	....	....
Decrease on 1952	260	....	....	11,360	5,455

TABLE C.

Tabulation showing Apportionment of Coal Sold during 1953.

Colliery.	Locos.	%	Trams (Power)	%	Private Large.	%	Private Small.	%	Cement Works.	%	Kalgoorlie Electric Power and Lighting Corpn. Ltd.	%	Collie Power House.	%	Total Sold.
Co-operative .... Black Diamond Open Cut .... Black Diamond Tunnel .... Westralia .... Proprietary	65,583	50·71	20,819	16·10	8,570	6·63	80	·06	223	·17	....	....	34,047	26·33	129,322
Ewington Open Cut Ewington	99,348	46·20	43,477	20·22	37,628	17·50	2,491	1·16	26,349	12·26	....	....	5,726	2·66	215,019
Cardiff .... Neath .... Stockton	3,947	5·93	32,935	49·52	11	·02	....	....	29,454	44·28	....	....	163	·25	66,510
Stockton Open Cut	137,965	68·42	46,015	22·82	2,085	1·03	....	....	10,820	5·37	....	....	4,753	2·36	201,638
Griffin	5,758	10·98	19,266	36·76	12,474	23·80	10,356	19·76	....	....	4,562	8·70	....	....	52,416
Wyvern	4,615	7·29	34,882	55·13	9,969	15·76	7.308	11·55	....	....	6,495	10·27	....	....	63,269
Pheonix	3,204	11·44	19,312	68·96	1,719	6·14	3,768	13·46	....	....	....	....	....	....	28,003
Centaur	12,543	37·19	16,448	48·77	1,981	5·87	2,398	7·07	....	....	372	1·10	....	....	32,742
Muja Open Cut	1,709	30·02	429	7·54	1,119	19·65	1,039	18·25	....	....	1,397	24·54	....	....	6,693
Western No. 1	11,706	27·80	14,291	33·94	3,489	8·29	312	·74	....	....	12,306	29·23	....	....	42,104
Western No. 2.... Western No. 3 O/C	24,004	50·29	21,870	45·82	975	2·04	721	1·51	....	....	162	·34	....	....	47,732
Total	370,382	41·83	269,744	30·46	80,020	9·04	28,473	3·21	66,846	7·55	25,294	2·86	44,689	5·05	885.448

TABLE D.

Tabulation showing Apportionment of Collie Coal Sold during the Five Year Period 1949–1953.

Year.	Railways.	%	S.E.C.	%	Collie Power Station.	%	Cement Works.	%	Kalgoorlie Electric Power and Lighting Corpn. Ltd.	%	Private Consumers.	%	Total.
1949	356,118	47·45	266,030	35·45	24,035	3·20	37,520	5·00	....	....	66,763	8·90	750,466
1950	371,510	45·61	276,156	33·91	32,288	3·96	41,692	5·12	....	....	92,850	11·40	814,496
1951	373,866	44·07	299,156	35·26	27,586	3·25	49,082	5·79	....	....	98,657	11·63	848,347
1952	298,587	35·94	338,912	40·79	38,247	4·60	53,826	6·48	....	....	101,284	12·19	830,857
1953	370,382	41·83	269,744	30·46	44,689	5·05	66,846	7·55	25,294	2·86	108,493	12·25	885,448
Increase or Decrease since 1949	14,264	....	3,714	....	20,654	....	29,326	....	25,294	....	41,730	....	134,982
Per cent. Increase or Decrease since 1949	4·00	....	1·40	....	85·93	....	78·16	....	100·00	....	62·50	....	17·98

TABLE E.

Collie Coal Produced 1943–1953 (*as officially reported to the Mines Department by the Producers*).

———	1943.	1944.	1945.	1946.	1947.	1948.	1949.	1950.	1951.	1952.	1953.
Open Cuts	2,308	66,779	112,781	154,392	148,345	145,948	206,650	258,310	368,330	411,344	392,147
Deep Mines	529,238	491,543	430,582	487,895	582,161	586,990	543,944	556,042	480,145	419,117	493,035
Aggregate All Mines	531,546	558,322	543,363	642,287	730,506	732,938	750,594	814,352	848,475	830,461	886,182
Percentage Open Cuts to Aggregate	0·43	11·96	20·76	24·04	20·31	19·91	27·53	31·72	43·41	49·53	44·36
Percentage Deep Mines to Aggregate	99·57	88·04	79·24	75·96	79·69	80·09	72·47	68·28	56·59	50·47	55·64
Persons Employed	838	880	860	955	1,032	1,064	1,044	1,099	1,125	1,281	1,463

TABLE F.

Table Showing :—

1. *Average Number of Men Employed at each Deep Mine and Percentage Each Category to Total Employed.*
2. *Manshifts actually worked during Year at each Deep Mine and Percentage each Category to Total Worked.*
3. *Output per Manshift in each Category.*

1953.

Name of Mine.	Face Workers.	Haulage.	Underground Maintenance.	Pump Attendants.	Officials.	Total Underground.	Total Surface.	Total Employed.
Co-operative—								
No. of Men Employed	27	23	40	4	10	104	61	165
Percentage to Total Employed	16·36	13·94	24·24	2·43	6·06	63·03	36·97	100·00
Manshifts worked during year	7,539	6,234	10,616	1,811	2,912	29,112	18,269	47,381
Percentage Manshifts to total worked	15·91	13·16	22·40	3·82	6·15	61·44	38·56	100·00
O.M.S. in each category	7·93	9·59	5·63	33·02	20·54	2·05	3·27	1·26
Proprietary—								
No. of men employed	24	34	62	6	10	136	38	174
Percentage to total employed	13·79	19·54	35·63	3·45	5·75	78·16	21·84	100·00
Manshifts worked during year	6,223	8,975	16,460	2,326	3,424	37,408	11,242	48,650
Percentage Manshifts to total worked	12·79	18·45	33·83	4·78	7·04	76·89	23·11	100·00
O.M.S. in each category	8·04	5·57	3·04	21·51	14·61	1·33	4·45	1·03
Cardiff-Neath—								
No. of men employed	20	12	56	3	8	99	44	143
Percentage to total employed	13·99	8·39	39·16	2·10	5·59	69·23	30·77	100·00
Manshifts worked during year	5,648	3,425	15,560	1,143	2,549	28,325	13,109	41,434
Percentage Manshifts to total worked	13·63	8·27	37·55	2·76	6·15	68·36	31·64	100·00
O.M.S. in each category	11·77	19·42	4·27	58·19	26·09	2·35	5·07	1·60
Stockton—								
No. of men employed	38	25	21	3	7	94	31	125
Percentage to total employed	30·40	20·00	16·80	2·80	5·60	75·20	24·80	100·00
Manshifts worked during year	9,527	6,624	5,523	1,145	2,315	25,134	9,593	34,727
Percentage Manshifts to total worked	27·43	19·08	15·90	3·30	6·67	72·38	27·62	100·00
O.M.S. in each category	6·59	9·49	11·38	54·88	27·14	2·50	6·55	1·81
Black Diamond—								
No. of men employed	5	....	3	1	1	10	8	18
Percentage to total employed	27·78	....	16·66	5·56	5·56	55·56	44·44	100·00
Manshifts worked during year	1,461	14	920	308	487	3,190	2,485	5,675
Percentage Manshifts to total worked	25·74	·25	16·21	5·43	8·58	56·21	43·79	100·00
O.M.S. in each category	2·98	311·28	4·73	14·15	8·95	1·36	1·75	·77
Westralia—								
No. of men employed	6	1	4	1	1	13	10	23
Percentage to total employed	26·08	4·35	17·39	4·35	4·35	56·52	43·48	100·00
Manshifts worked during year	1,712	388	1,359	405	345	4,209	3,038	7,247
Percentage Manshifts to total worked	23·62	5·36	18·75	5·59	4·76	58·08	41·92	100·00
O.M.S. in each category	5·77	25·47	7·27	24·40	28·64	2·35	3·25	1·36
Ewington—								
No. of men employed	....	....	1	....	....	1	....	1
Percentage to total employed	....	....	100·00	....	....	100·00	....	100·00
Manshifts worked during year	86	....	131	....	36	253	....	253
Percentage Manshifts to total worked	33·99	....	51·78	....	14·23	100·00	....	100·00
O.M.S. in each category	44·76	....	29·39	....	106·94	15·21	....	15·21

Total Amalgamated Deep Mines—							Total Surface.	Central Work-Shops.	Total Employed
No. of men employed	120	95	187	18	37	457	106	86	649
Percentage to total employed	18·49	14·64	28·81	2·78	5·70	70·42	16·33	13·25	100·00
Manshifts worked during year	32,196	25,660	50,569	7,138	12,068	127,641	30,634	27,102	185367
Percentage Manshifts to total worked	17·37	13·84	27·28	3·85	6·51	68·85	16·53	14·62	100·00
O.M.S. in each category	7·99	10·02	5·08	36·04	21·32	2·01	8·40	9·49	1·39

Griffin—							Total Surface.	Total Employed.
No. of men employed	32	17	29	3	7	88	32	120
Percentage to total employed	26·67	14·16	24·17	2·50	5·83	73·33	26·67	100·00
Manshifts worked during year	8,676	4,553	7,915	1,197	2,433	24,774	9,745	34,519
Percentage Manshifts to total worked	25·13	13·19	22·93	3·47	7·05	71·77	28·23	100·00
O.M.S. in each category	6·04	11·51	6·62	43·79	41·54	2·11	5·38	1·52

Table F—*continued.*

Name of Mine.	Face Workers.	Haulage.	Underground Maintenance.	Pump Attendants.	Officials.	Total Underground.	Total Surface.	Total Employed.
Wyvern—								
No. of men employed	38	5	24	3	5	75	18	93
Percentage to total employed	40·86	5·38	25·81	3·22	5·38	80·65	19·35	100·00
Manshifts worked during year	10,414	1,300	7,006	1,190	1,655	21,565	5,361	26,926
Percentage Manshifts to total worked	38·67	4·83	26·02	4·42	6·12	80·09	19·91	100·00
O.M.S. in each category	6·07	48·67	9·03	53·17	38·23	2·93	11·80	2·35
Phoenix—								
No. of men employed	18	2	7	1	3	31	11	42
Percentage to total employed	42·86	4·76	16·67	2·38	7·14	73·81	26·19	100·00
Manshifts worked during year	5,097	553	1,819	398	981	8,848	3,262	12,110
Percentage Manshifts to total worked	42·09	4·57	15·02	3·28	8·10	73·06	26·94	100·00
O.M.S. in each category	5·49	50·64	15·39	70·36	28·54	3·16	8·58	2·31
Centaur—								
No. of men employed	24	6	13	3	5	51	16	67
Percentage to total employed	35·82	8·96	19·40	4·48	7·46	76·12	23·88	100·00
Manshifts worked during year	6,854	1,589	4,020	1,096	1,596	15,155	4,769	19,924
Percentage Manshifts to total worked	34·40	7·98	20·17	5·50	8·01	76·06	23·94	100·00
O.M.S. in each category	4·92	21·22	8·39	30·77	21·13	2·22	7·07	1·69
Total Griffin Deep Mines—								
No. of men employed	112	30	73	10	20	245	77	322
Percentage to total employed	34·78	9·32	22·67	3·11	6·21	76·09	23·91	100·00
Manshifts worked during year	31,041	7,995	20,760	3,881	6,665	70,342	23,137	93,479
Percentage Manshifts to total worked	33·20	8·55	22·21	4·16	7·13	75·25	24·75	100·00
O.M.S. in each category	5·71	22·19	8·54	45·71	26·62	2·52	7·67	1·90
Western No. 1—								
No. of men employed	44	6	3	....	4	57	26	83
Percentage to total employed	53·01	7·23	3·61	....	4·82	68·67	31·33	100·00
Manshifts worked during year	11,392	1,571	859	....	1,561	15,383	8,168	23,551
Percentage Manshifts to total worked	48·37	6·67	3·65	....	6·63	65·32	34·68	100·00
O.M.S. in each category	3·69	26·80	49·01	....	26·97	2·74	5·15	1·78
Western No. 2—								
No. of men employed	14	4	2	1	3	24	18	42
Percentage to total employed	33·33	9·53	4·76	2·38	7·14	57·14	42·86	100·00
Manshifts worked during year	3,967	1,216	414	190	926	6,713	5,379	12,092
Percentage Manshifts to total worked	32·81	10·06	3·42	1·57	7·66	55·52	44·48	100·00
O.M.S. in each category	4·15	13·56	39·83	86·79	17·80	2·45	3·06	1·36
Total Western Collieries—								
No. of men employed	58	10	5	1	7	81	44	125
Percentage to total employed	46·40	8·00	4·00	·80	5·60	64·80	35·20	100·00
Manshifts worked during year	15,359	2,787	1,273	190	2,487	22,096	13,547	35,643
Percentage Manshifts to total worked	43·09	7·82	3·57	·53	6·98	61·99	38·01	100·00
O.M.S. in each category	3·81	21·02	46·03	308·39	23·56	2·65	4·32	1·64
Grand Total All Deep Mines—								
No. of men employed	290	135	365	29	64	783	313	1,096
Percentage to total employed	26·46	12·32	24·18	2·64	5·84	71·44	28·56	100·00
Manshifts worked during year	78,596	36,442	72,602	11,209	21,220	220,069	94,420	314,489
Percentage Manshifts to total worked	24·99	11·59	23·09	3·56	6·75	69·98	30·02	100·00
O.M.S. in each category	6·27	13·53	6·79	44·01	23·24	2·24	5·22	1·57

TABLE G.

SERIOUS ACCIDENTS—COLLIE COALFIELD, 1953.

Month 1953.	Major Injuries—Exclusive of Fatal.																					Minor Injuries.											
	Fractures.											Amputations.						Loss of Eye.	Serious Internal.	Hernia.	Dislocation.	Other Major.	Total Major.	Fractures.											
	Head.	Shoulder.	Arm.	Hand.	Spine.	Rib.	Pelvis	Thigh.	Leg.	Ankle.	Foot.	Arm.	Hand.	Finger.	Leg.	Foot.	Toe.							Finger.	Toe.	Head.	Eyes.	Shoulder.	Arm.	Hand.	Back.	Rib.	Leg.	Foot.	Other Minor.	Total Minor.
Jan.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1
Feb.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	4	7
Mar.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	1	....	1	1	....	1	1	1	1	1	....	8
Apr.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	1	....	1	....	....	1	2	....	....	....	5
May	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1	....	....	2	....	1	4	....	....	....	....	1	....	1	1	4	12
June	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	3	....	....	....	....	4	....	3	1	....	12
July	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	1	2	3	....	1	....	4	11
Aug.	....	....	....	....	....	1	....	....	....	....	....	1	....	1	....	....	....	....	....	1	....	....	4	1	1	....	....	1	1	....	4	....	1	1	3	13
Sept.	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	1	1	1	1	2	2	....	2	4	4	18
Oct.	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	2	....	....	....	....	1	....	3	3	....	1	1	....	9
Nov.	1	....	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	3	1	....	....	....	1	....	2	2	....	2	....	2	10
Dec.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	1	....	....	2	....	2	6
Total	3	....	2	1	....	3	....	....	1	....	....	1	....	2	....	....	....	....	....	3	....	2	18	3	4	10	2	6	3	11	24	3	14	9	23	112

TABLE H.

ACCIDENT RATE FOR INDIVIDUAL MINES, SHOWING COMPARISON WITH 1952 (NOT INCLUDING CENTRAL WORKSHOPS AND OPEN CUTS).

Serious Accidents.

Name of Mine.	Number of Accidents.				Total Number Accidents.		Number Employed.		Rate per 100 men Employed.		Rate per 100,000 tons Produced.		Rate per 10,000 man-shifts Worked.	
	Surface.		Underground.											
	1952.	1953.	1952.	1953.	1952.	1953.	1952.	1953.	1952.	1953.	1952.	1953.	1952.	1953.
Co-operative	1	2	18	10	19	12	155	137	12·26	8·76	30·49	20·07	4·55	2·53
Proprietary	1	6	23	22	24	28	200	159	12·00	17·61	41·56	55·97	4·59	5·76
Cardiff-Neath	1	2	9	13	10	15	124	127	8·06	11·81	15·66	22·55	2·91	3·62
Stockton	1	6	13	16	14	22	110	115	12·73	19·13	21·14	35·01	4·89	6·34
Westralia*	....	....	....	4	....	4	....	14	....	28·57	....	40·47	....	5·52
Black Diamond Tunnel*	....	....	....	2	....	2	....	10	....	20·00	....	45·89	....	3·52
Griffin	3	2	6	14	9	16	115	120	7·83	13·33	18·58	30·53	2·79	4·64
Wyvern	2	1	10	8	12	9	85	93	14·12	9·68	18·71	14·22	4·99	3·34
Phoenix	....	....	1	2	1	2	30	42	3·33	4·76	5·87	7·14	11·90	1·65
Centaur	....	....	5	5	5	5	52	67	9·62	7·46	15·35	14·82	3·27	2·51
West. No. 1*	....	....	....	8	....	8	....	83	....	9·64	....	19·00	....	3·40
West. No. 2*	....	1	....	4	....	5	....	42	....	11·90	....	30·32	....	4·13
Total	9	20	85	108	94	128	871	1,009	10·79	12·69	22·80	26·15	3·97	4·37

* Not comparable, as these mines were in development stage only during 1952.

TABLE I.

TABLE SHOWING FATAL ACCIDENT RATE PER 1,000 PERSONS EMPLOYED FOR EACH YEAR AND PROGRESSIVELY SINCE 1929 TO DATE.

Year.	Men Employed.		Fatal Accident.		Death Rate per 1,000.	
	Current.	Progress.	Current.	Progress.	Current.	Progress.
1929	858	858	4	4	4·66	4·66
1930	896	1,754	....	4	....	2·28
1931	752	2,506	1	5	1·33	2·00
1932	604	3,110	....	5	....	1·61
1933	626	3,736	1	6	1·59	1·61
1934	624	4,360	....	6	....	1·38
1935	689	5,049	2	8	2·90	1·58
1936	768	5,817	....	9	....	1·37
1937	723	6,540	....	9	....	1·22
1938	765	7,305	1	9	1·31	1·23
1939	752	8,057	1	10	1·33	1·24
1940	713	8,770	3	13	4·21	1·48
1941	781	9,551	2	15	2·56	1·57
1942	822	10,373	2	17	2·43	1·64
1943	838	11,211	1	18	1·19	1·60
1944	880	12,091	1	19	1·13	1·57
1945	860	12,951	1	20	1·16	1·54
1946	955	13,906	1	21	1·05	1·51
1947	1,032	14,938	....	21	....	1·40
1948	1,064	16,002	....	21	....	1·31
1949	1,044	17,046	1	22	0·96	1·29
1950	1,099	18,145	1	23	0·91	1·27
1951	1,125	19,270	2	25	1·77	1·29
1952	1,281	20,551	2	27	1·56	1·31
1953	1,463	22,014	2	29	1·37	1·32

Coal Mines Regulation Act, 1946-51.

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

Office of the Chief Coal Mining Engineer,
Mines Department,
Perth, W.A.
23rd December, 1954.

The Under Secretary for Mines:

We submit herewith for the information of the Hon. Minister for Mines, the Annual Report of the Board of Examiners for the year 1953.

APRIL EXAMINATIONS.

There were three candidates for First Class Certificate of Competency, only one of whom succeeded in obtaining a pass and was issued with a Certificate.

There was one candidate for Second Class Certificate of Competency, he was successful and issued with a Certificate.

There were eight candidates for Third Class Certificates of Competency, two of whom were successful and were issued with Certificates.

OCTOBER EXAMINATIONS.

There were two candidates for First Class Certificates of Competency, both of whom were successful and issued with Certificates.

There were no candidates for Second Class Certificates of Competency.

There were 10 candidates for Third Class Certificates of Competency, five of whom were successful and issued with Certificates.

Owing to restrictions imposed by the Miners' Union on the duration of time that a person could act as Deputy on a provisional Certificate, it was decided that in order to meet the new circumstances examinations for Deputies in future be held every three months. Previously the arrangement was that Deputies could operate on a provisional Certificate for a period of six months, but the Unions imposed a restriction reducing the period to three months. Two special examinations were held in order to meet these new circumstances.

At special examinations held on 21st September and 12th October, 1953, respectively, there were seven candidates, four of whom were successful and issued with Certificates.

During the year fifteen Certificates were issued as follows:—

First Class Certificates of Competency:
- Cullen, H. A.
- Fogarty, A.
- Hodgson, J.

Second Class Certificate of Competency:
- Gillespie, L.

Third Class Certificates of Competency:
- Banks, W. H.
- Briggs, D.
- Brown, R.
- Evans, A. L.
- Francis, R. A.
- Harris, G. A. J.
- Mathers, J.
- McVee, H.
- Parker, R. C.
- Tomasini, J. N.
- Tyler, W.

First Class Reciprocal Certificate of Competency was issued to J. R. Williams, holder of First Class Certificate of Competency issued by the Board of Trade, England.

It is disappointing to state that after the controversy regarding technical classes at Collie most of the candidates for Certificates of Competency do not attend the classes now arranged and as a consequence many candidates find difficulty in passing the examinations which are still of a low standard.

When the new Regulations are gazetted the standard of examinations will be improved to that of New South Wales and Great Britain and it will hardly be possible for any candidate to be successful unless he has received a good technical training.

All candidates are therefore advised to take full advantage of the technical classes available.

G. MORGAN,
Chief Coal Mining Engineer, Chairman.

H. A. ELLIS,
Government Geologist, Member.

C. K. SWEENEY,
Senior Inspector of Mines, Member

Mining Statistics to 31st December, 1953.

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 1953, 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. † denotes mainly derived from Silver/Lead Ores and Concentrates. ‡ denotes mainly derived from Copper Ores and Concentrates.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953.					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 lb.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.).	Fine ozs.	Fine ozs.
Kimberley Goldfield.												
Brockman		Voided leases	....	....	....	....	....	....	....	1,545·75	1,455·34	....
		Sundry claims	....	....	....	....	....	7·62	7·62	2,484·00	1,871·92	....
Hall's Creek		Voided leases	....	....	....	....	....	....	....	423·00	477·76	....
		Sundry claims	....	....	12·50	19·89	....	27·73	....	217·05	179·57	12·64
Mary		Voided leases	....	....	....	....	....	82·66	951·52	399·00	210·03	....
		Sundry claims	....	....	....	....	....	....	14·36	46·85	53·66	....
Mt. Dockrell		Voided leases	....	....	....	....	....	9·17	13·66	1,173·70	1,206·09	93·00
		Sundry claims	....	....	....	....	....	18·89	31·31	160·00	89·64	....
Panton	(114)	Granite Leases	....	....	....	....	....	....	....	8·25	1·77	....
		Voided leases	....	....	....	....	....	....	....	34·70	138·70	....
		Sundry claims	....	....	....	....	....	....	....	6·15	18·01	....
Ruby Creek	(98)	Goliath	....	....	....	....	....	....	....	120·70	103·72	....
	97	Ruby Queen	....	....	40·00	6·38	....	....	....	2,959·25	1,637·68	2·14
	(100)	St. Lawrence	....	....	....	....	....	....	....	10·00	11·32	....
		Voided leases	....	....	....	....	....	....	16·05	12,771·50	9,504·78	....
		Sundry claims	....	....	....	....	....	12·71	....	281·25	183·30	....
		From District Generally :— Sundry claims : Reported by Banks and Gold Dealers	151·74	60·51	....	....	....	8,723·68	1,464·41	·75	2·53	†20·98 ....
		Totals	**151·74**	**60·51**	**52·50**	**26·27**	....	**8,882·46**	**2,498·93**	**22,641·90**	**17,145·82**	**128·76**

West Kimberley Goldfield.

Napier Range	M.L. 29	Devonian Silver Lead Mine	....	....	....	....	†3,820·29	....	....	....	....	†11,456·85
Mt. Broome	....	Sundry claims	....	....	....	....	....	....	13·76	....	....	....
Richenda	....	Sundry claims	....	....	....	....	....	....	....	1·00	2·49	....
	From District generally :— Reported by Banks and Gold Dealers		....	....	....	....	....	1·30	10·92	....	....	....
		Totals	....	....	....	....	**3,820·29**	**1·30**	**24·68**	**1·00**	**2·49**	**11,456·85**

Pilbara Goldfield.

MARBLE BAR DISTRICT.

Bamboo Creek	1126	Abbey	....	....	10·50	3·32	·22	....	....	10·50	3·32	·22
	1107	Bulletin	....	....	230·00	81·71	2·02	....	....	845·50	416·91	2·02
	850	Federation	....	....	264·00	100·83	4·27	....	8·22	2,972·00	2,165·60	4·37
	1118	Kitchener	....	....	12·00	6·45	....	....	....	12·00	6·45	....
	(1010)	Mickey	....	....	12·00	8·20	....	....	....	1,800·00	488·20	1·42
	1096, etc.	Mt. Prophecy Leases	....	....	430·00	195·12	21·92	....	....	1,677·00	813·87	38·96
	817	Prince Charlie	....	....	88·00	20·33	2·53	....	3·68	3,915·00	3,603·86	54·82
	1072	Princess May	....	....	....	....	....	....	....	68·50	21·36	....
	924	True Blue	....	....	....	....	....	....	....	2,093·25	85·22	....
		Voided leases	....	....	....	....	....	13·54	560·19	44,422·35	53,012·47	·75
		Sundry claims	....	....	74·00	20·15	2·32	8·97	307·83	5,174·85	3,022·97	7·21
Boodalyerri	....	Voided leases	....	....	....	....	....	....	292·07	120·25	587·86	....
		Sundry claims	....	....	....	....	....	....	7·16	....	....	....
Braeside	....	Sundry claims	....	....	....	....	†5,104·61	....	....	....	....	†15,481·51
Lalla Rookh	....	Voided leases	....	....	....	....	....	....	4·78	3,612·00	4,696·33	574·01
		Sundry claims	....	....	....	....	....	....	....	7,943·00	7,675·09	....
Marble Bar	930	Alexander Leases	....	....	30·00	7·79	·81	....	....	354·50	120·94	·81
	1094	Blue Bar	....	....	....	....	....	....	....	361·00	51·05	....
	927, etc.	Halley's Comet	....	....	2,440·00	1,179·73	137·85	....	....	5,670·00	4,993·83	454·41
	912	Homeward Bound	....	....	....	....	....	....	....	6,292·25	3,111·75	....
	1125	Laura Dawn	....	....	28·00	6·02	·73	....	....	28·00	6·02	·73
	1121	Little Portree	....	....	30·00	30·38	2·42	....	....	30·00	30·38	2·42
	1127	New Atlas	45·98	....	....	....	2·72	45·98	....	....	....	2·72
	1089	Repeater	....	....	....	....	....	....	....	548·20	123·83	6·26
		Voided leases	....	....	....	....	....	....	199·09	159,638·04	148,525·67	583·57
		Sundry claims	....	....	....	....	....	67·08	251·77	20,113·29	12,637·49	6·59
North Pole	1122, etc.	Normay Leases	....	....	1,465·00	631·13	575·15	....	....	1,465·00	1,240·02	1,697·74
		Voided leases	....	....	....	....	....	....	....	4,339·00	1,930·51	260·08
		Sundry claims	....	....	....	....	....	....	....	669·75	298·62	15·82
North Shaw	....	Voided leases	....	....	....	....	....	7·53	....	1,072·45	996·29	....
		Sundry claims	....	....	....	....	....	2·84	579·91	179·75	121·72	....

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.	Total Production. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.
PILBARA GOLDFIELD—continued.												
MARBLE BAR DISTRICT—*continued.*												
Pilgangoora	....	Voided leases	....	....	....	....	....	16·65	....	2,255·00	403·60	....
		Sundry claims	....	....	....	....	....	161·08	45·64	481·60	146·39	....
Sharks	1081, etc.	Table Top Leases	....	....	722·00	428·03	3·20	....	....	959·25	548·05	17·28
		Voided leases	....	....	....	....	....	1·43	....	1,739·50	1,969·65	1·16
		Sundry claims	....	....	....	....	....	163·14	47·93	1,150·75	1,668·11	·97
Talga Talga	....	Voided leases	....	....	....	....	....	....	93·15	1,799·00	1,760·68	....
		Sundry claims	....	....	....	....	....	76·17	85·18	1,975·90	1,499·86	·70
Tambourah	....	Voided leases	....	....	....	....	....	....	73·90	1,576·50	1,882·29	....
		Sundry claims	....	....	....	....	....	89·52	294·75	3,742·25	2,689·78	....
Warrawoona	(1087)	Town Talk	....	....	....	....	....	....	....	300·45	127·91	13·34
	1013	Trump	....	....	....	....	....	....	....	3,999·55	626·90	9·91
		Voided leases	....	....	....	....	....	....	16·99	12,748·80	18,830·50	....
		Sundry claims	....	....	....	....	....	70·98	623·67	6,632·79	4,247·38	·08
Western Shaw	....	Voided leases	....	....	....	....	....	....	....	1,222·50	957·80	....
		Sundry claims	....	....	....	....	....	22·34	67·47	71·50	81·49	....
Wodgina	....	Sundry claims	....	43·37	·50	....	3·25	....	43·37	·50	....	3·25
Wyman's Well	1084	New Copenhagen	....	....	60·00	10·09	·61	....	....	410·00	82·99	1·19
		Voided leases	....	....	....	....	....	....	42·86	2,977·29	1,258·44	....
		Sundry claims	....	....	....	....	....	4·47	51·52	2,604·46	1,291·29	1·47
Yandicoogina	....	Voided leases	....	....	....	....	....	....	140·76	3,159·20	6,218·83	....
		Sundry claims	....	....	....	....	....	4·32	239·89	574·50	642·82	40·96
		From District generally :—										
		Sundry Parcels treated at :										
		State Battery, Bamboo Creek	....	....	....	*95·06	....	....	....	40·00	*10,762·16	190·95
		State Battery, Marble Bar	....	....	....	*250·80	....	....	....	12·00	*11,181·91	1·15
		L.T.T. 1274H Blackwell H.V.	....	....	....	*7·60	4·89	....	....	....	*7·60	4·89
		Various Works	....	....	....	....	....	....	....	237·95	*1,900·64	·65
		Reported by Banks and Gold Dealers	7·54	8·31	....	....	1·53	14,389·95	449·16	....	10·95	5·75
		Totals	**53·52**	**51·68**	**5,896·00**	**3,082·74**	**5,871·05**	**15,145·99**	**4,530·94**	**326,098·67**	**321,585·65**	**19,490·14**

NULLAGINE DISTRICT.

Eastern Creek	276L	Rose	....	....	....	....	....	....	....	333·00	287·21	2·99
		Voided leases	....	....	....	....	....	8·96	8·19	5,261·00	9,567·00	11·77
		Sundry claims	....	....	....	....	....	....	12·74	1,409·10	1,600·71	16·90
Elsie	....	Voided leases	....	....	....	....	....	....	....	586·25	1,675·91	....
		Sundry claims	....	....	....	....	....	....	8·28	58·00	188·08	....
McPhee's Creek	....	Voided leases	....	....	....	....	....	....	....	113·00	137·92	....
		Sundry claims	....	....	....	....	....	....	....	134·00	197·09	....
Middle Creek	279L	All Nations	....	....	....	....	....	....	....	1,135·50	314·86	·15
	229L	Barton	....	....	576·00	651·55	33·65	1·22	....	6,283·00	3,558·87	35·28
	231L, etc.	Blue Spec Mining Co., N.L.	....	....	2,297·15	3,794·64	·21	....	....	43,389·02	27,559·41	·21
	300L	Middle Creek	....	....	....	....	....	....	....	310·00	91·38	....
		Voided leases	....	....	....	....	....	....	1·02	16,872·15	11,271·20	7·50
		Sundry claims	....	....	25·00	4·61	....	....	....	5,573·10	2,335·57	....
Mosquito Creek	....	Voided leases	....	....	....	....	....	1·07	30·12	8,392·30	12,839·13	....
		Sundry claims	....	....	5·00	3·33	....	....	181·64	3,707·44	3,789·21	....
Nullagine	292L	Alice	....	205·06	28·00	64·06	34·32	....	746·14	94·10	209·42	48·67
	311L	Conglomerate	....	....	84·00	6·43	·43	....	....	84·00	6·43	·43
	294L	Nullagine View	....	....	....	....	....	....	289·63	41·00	397·35	23·69
	289L	Paul's Leader	....	....	....	....	....	....	269·40	25·50	348·52	12·60
		Voided leases	....	....	....	....	....	....	40·56	9,042·25	12,624·16	·20
		Sundry claims	....	9·42	62·00	25·80	2·06	315·53	678·24	6,002·55	10,319·86	7·30
Spinaway Well	314L	Copper Hill	....	....	....	....	‡269·46	....	....	....	....	‡320·18
Twenty-mile Sandy	(256L)	Bill Jim	....	....	....	....	....	....	....	2,022·50	1,036·51	....
		Voided leases	....	....	....	....	....	....	16·97	5,221·20	7,971·21	·32
		Sundry claims	....	....	....	....	....	33·10	30·50	7,654·85	6,255·56	2·76
	From District generally :—											
	Sundry Parcels treated at :											
	Barton Battery (T.A. 9L)	....	....	....	....	....	....	....	....	....	*45·19	....
	McKinnon, W. M. (D.Cs. 10L, 14L, 15L)	....	....	....	....	....	....	3·89	2·23	....	....	....
	Various Works	....	....	....	....	....	....	....	....	124·50	*8,110·35	1·37
	Reported by Banks and Gold Dealers	20·76	....	....	....	....	9,877·28	100·89	....	29·81	5·08
	Totals	**20·76**	**214·48**	**3,077·15**	**4,550·42**	**340·13**	**10,241·05**	**2,416·55**	**123,869·31**	**122,767·92**	**497·40**

West Pilbara Goldfield.

Croydon	....	Voided leases	....	....	....	....	....	....	....	8·00	5·44	....
Hong Kong	....	Voided leases	....	....	....	....	....	....	....	331·00	442·45	....
		Sundry claims	....	....	....	....	....	21·40	·02	9·00	3·15	....
Lower Nicol	....	Voided leases	....	....	....	....	....	....	1·10	653·20	402·22	....
		Sundry claims	....	....	....	....	....	10·44	2·71	10·00	11·51	....

Table I.—*Production of Gold and Silver from all sources*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.	Total Production. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.
WEST PILBARA GOLDFIELD—continued.												
Mallina	....	Voided leases	....	....	....	....	....	....	....	141·60	128·44	....
Nicol	....	Voided leases	....	....	....	....	....	....	....	30·00	11·47	....
Pilbara	....	Voided leases	....	....	....	....	....	....	48·12	267·00	413·59	....
		Sundry claims	....	....	....	....	....	1·11	86·24	163·00	255·42	....
Roebourne	173	Corderoy Mines, Ltd.	....	....	....	....	....	....	....	1,954·50	471·13	10·79
		Voided leases	....	....	....	....	....	....	....	442·36	952·91	374·36
		Sundry claims	....	....	....	....	....	15·47	3·29	1,934·85	754·91	114·06
Station Peak	....	Voided leases	....	....	....	....	....	177·74	41·37	11,016·00	11,388·18	·08
		Sundry claims	....	....	....	....	....	....	....	86·50	77·23	....
Towranna	....	Voided leases	....	....	....	....	....	....	2·62	3,965·80	5,187·51	....
		Sundry claims	....	....	....	....	....	....	....	22·00	12·35	....
Upper Nicol	....	Sundry claims	....	....	....	....	....	....	....	6·50	2·57	....
Weerianna	....	Voided leases	....	....	....	....	....	....	....	3,200·15	3,214·45	....
		Sundry claims	....	....	....	....	....	....	....	336·00	135·26	1·29
Whim Creek	....	Voided leases	....	....	....	....	....	....	....	....	....	‡883·80
	From District Generally :—											
		Sundry Claims and Leases	....	3·80	....	....	†28·25	....	11·77	....	....	†491·10
		Various Works	....	....	....	....	....	....	....	....	*102·39	4·90
		Reported by Banks and Gold Dealers	....	....	....	....	....	6,087·15	177·43	103·50	228·32	·11
		Totals	....	**3·80**	....	....	**28·25**	**6,313·31**	**374·67**	**24,680·96**	**24,200·90**	**1,880·49**
Ashburton Goldfield.												
Belvedere	....	Voided leases	....	....	....	....	....	....	9·88	1,560·00	435·86	176·48
Dead Finish	....	Voided Leases	....	....	....	....	....	....	....	1,699·00	874·60	·03
		Sundry claims	....	....	....	....	....	....	11·89	104·25	245·08	....
Lyndon Station	....	Sundry claims	....	....	43·00	83·17	....	....	....	49·35	100·52	....

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
Goldfield generally :—												
Sundry claims			....	....	....	....	†5,237·67	....	....	....	....	†28,167·43
From Banks and Gold Dealers			·62	....	....	....	....	8,885·73	120·11	....	7·12	....
		Totals	**·62**	....	**43·00**	**83·17**	**5,237·67**	**9,262·77**	**479·40**	**6,728·10**	**2,810·44**	**36,351·14**

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			....	....	....	....	....	604·47	1·80	....	....	....
		Totals	....	....	....	....	....	**693·44**	**41·57**	**387·00**	**517·29**	....

Peak Hill Goldfield.

Bulloo Downs	....	Voided leases	....	....	....	....	....	....	....	....	....	†50·09
Egerton	(556P)	Egerton	....	....	40·00	16·61	....	1·45	193·77	2,119·00	3,755·38	....
	590P	Wyndham	....	....	....	....	....	....	....	96·00	7·08	....
		Voided leases	....	....	....	....	....	60·86	30·91	5,077·25	2,842·45	....
		Sundry claims	....	....	....	....	....	235·35	23·51	1,501·77	791·34	....
Horseshoe	568P, etc.	Anglo-Westralian Mining Pty., Ltd.	....	....	54,923·00	8,896·01	624·36	....	....	90,525·00	14,323·52	1,039·54
		Prior to transfer to present holders	....	....	....	....	....	....	....	3,914·00	894·44	....
	575P	Labouchere Main Lode	....	....	....	....	....	....	....	535·00	60·38	....
		Voided leases	....	....	....	....	....	15·57	1,975·37	4,371·38	2,684·27	2·00
		Sundry claims	....	....	63·50	25·66	....	20·12	829·58	1,939·55	728·57	....
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	....	....	....	....	....	....	....	1,089·35	803·12	....

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953.					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 lb.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.).	Fine ozs.	Fine ozs.
PEAK HILL GOLDFIELD—continued.												
Peak Hill	512P	Atlantic	....	....	....	....	....	1·69	2·87	4,703·75	589·15	....
	511P	Commercial	....	....	180·00	31·25	....	....	....	3,204·75	542·22	....
	584P	Dazzle Star	....	....	....	....	....	....	....	207·00	70·21	....
	567P	Miner Bird	....	....	62·00	25·19	....	....	....	1,333·50	630·69	....
	553P	Morning Star	....	....	....	....	....	....	4·43	2,804·25	410·09	....
	587P	Murray Heath	....	....	....	....	....	....	....	15·00	4·15	....
	506P	No. 1 North	....	....	220·00	17·85	....	....	86·47	6,769·20	1,568·27	....
	492P	North Star	....	....	....	....	....	23·20	69·63	13,186·50	2,079·21	....
	593P	Swanie	....	....	....	....	....	....	....	97·00	3·87	....
		Voided leases	....	....	....	....	....	7·39	920·21	521,744·33	247,050·17	2,285·63
		Sundry claims	....	....	....	....	....	61·51	306·63	34,239·85	8,936·50	....
Ravelstone	....	Voided leases	....	....	....	....	....	....	101·64	4,219·85	3,117·68	....
		Sundry claims	....	....	....	....	....	....	....	553·60	283·17	....
Wilgeena	(572P)	O.K.	....	....	....	....	....	....	....	66·00	6·10	....
		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 District generally :—										
		Sundry Parcels treated at :										
		State Battery, Peak Hill	....	....	....	....	....	....	3·05	15·00	*7,168·89	....
		Australian Machinery & Investment Co. (T.Ls. 1P, etc.)	....	....	....	....	....	....	....	....	*1,686·20	....
		Various Works	....	....	....	....	....	....	....	30·00	*5,661·37	23·12
		Reported by Banks and Gold Dealers	1·00	....	....	....	....	2,847·65	444·36	....	12·51	....
		Totals	**1·00**	....	**55,488·50**	**9,012·57**	**624·36**	**3,376·86**	**5,300·33**	**714,743·93**	**311,370·52**	**3,400·96**
East Murchison Goldfield.												
LAWLERS DISTRICT.												
Kathleen Valley	....	Voided leases	....	....	....	....	....	....	144·85	80,503·66	49,020·54	....
		Sundry claims	....	....	32·00	14·13	....	14·37	526·03	5,615·75	2,601·75	....

Lawlers	1236	Waroonga	....	....	....	....	....	....	....	....	....	....	*99·40	·50
	(1236, etc.)	Australian Gold Production, Ltd.	....	....	....	*21·06	....	5·78	....	1,030·00	419·35	·15
	(1236, etc.)	Prior to transfer	....	....	....	....	....	13·02	....	336,532·18	83,317·15	452·00
		Voided leases	....	....	....	....	....	6·71	692·45	1.285,355·22	491,414·15	14,350·93
		Sundry claims	....	....	....	....	....	400·21	451·61	17,347·48	9,568·69	268·34
Sir Samuel	(1351)	Lucky	....	....	72·00	67·44	....	....	....	184·00	189·46	....
		Voided leases	....	....	....	....	....	....	359·03	275,193·55	141,637·58	10,234·80
		Sundry claims	....	....	155·00	32·79	....	53·89	64·96	7,498·00	4,530·58	·02
	From District generally :—											
	Sundry Parcels treated at :											
	Australian Machinery & Investment Co. (T.Ls. 87H, etc.)		....	....	....	....	....	....	....	5·00	*4,291·25	29·00
	Prior to transfer (T.Ls. 87H, etc.)		....	....	....	....	....	....	....	....	*1,371·33	15·64
	Australian Machinery & Investment Co. (T.A. 26)		....	....	....	....	....	2·12	....	12·03	*4,268·05	....
	State Battery, Sir Samuel		....	....	....	....	....	....	....	53·50	*2,356·81	....
	Vanguard Cyanide Plant		....	....	....	·94	....	....	....	4·00	*1,014·04	3·18
	Various Works		....	....	....	....	....	....	2·35	1,699·50	*26,520·71	936·21
	Reported by Banks and Gold Dealers		....	....	....	....	....	6,408·20	101·91	·05	9·84	....
	Totals		....	....	**259·00**	**136·36**	....	**6,904·30**	**2,343·19**	**2,011,033·92**	**822,630·68**	**26,290·77**

WILUNA DISTRICT.

Cole's	662J	Black Adder	....	....	47·00	42·60	....	....	....	1,856·00	1,068·47	....
		Voided leases	....	....	....	....	....	....	....	830·50	156·85	....
		Sundry claims	....	....	....	....	....	....	21·03	3,844·50	1,507·23	....
Corboy's	....	Voided leases	....	....	....	....	....	5·24	1·25	14,946·29	11,036·71	5·00
		Sundry claims	....	....	....	....	....	21·58	....	8,964·35	5,173·34	....
Gum Creek	....	Voided leases	....	....	....	....	....	20·75	....	1,380·00	595·73	....
		Sundry claims	....	....	....	....	....	....	1·36	407·25	131·08	....
Mt. Eureka	....	Voided leases	....	....	....	....	....	....	....	142·25	96·36	....
		Sundry claims	....	....	....	....	....	....	....	783·75	548·56	....
Mt. Keith	....	Voided leases	....	....	....	....	....	....	44·54	20,259·50	13,551·08	....
		Sundry claims	....	....	....	....	....	4·81	227·29	3,862·50	2,480·03	....
New England	....	Voided leases	....	....	....	....	....	5·74	95·70	5,364·25	3,490·87	....
		Sundry claims	....	....	....	....	....	9·31	5·78	4,534·75	3,111·97	....
Wiluna	679J	Lone Hand	....	....	....	....	....	....	....	1,604·75	127·50	....
	(280J, etc.)	Wiluna Gold Mines, Ltd.	....	....	....	349·64	....	....	....	7,345,465·00	1,334,704·58	8,605·91
		Prior to transfer to present holders	....	....	....	....	....	....	....	341,730·57	133,457·92	89·32
		Voided leases	....	....	....	....	....	....	574·76	1,089,186·33	320,610·16	1,349·40
		Sundry claims	....	6·74	40·00	13·31	....	105·39	225·82	27,419·40	10,885·40	·33

(10)—8988.

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953					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 lb.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.).	Fine ozs.	Fine ozs.
EAST MURCHISON GOLDFIELD—continued.												
WILUNA DISTRICT—*continued.*												
From District generally :—												
Sundry Parcels treated at :—												
Black Adder Battery			....	....	....	....	....	....	....	....	*154·02	....
State Battery, Wiluna			....	....	....	*1·58	1·00	....	....	637·00	*23,679·00	219·70
Wiluna, East Battery			....	....	....	....	....	....	....	....	*202·13	....
Woosnam H.G. (L.T.T. 1251H)			....	....	....	*26·70	....	....	....	....	*52·00	·04
Various Works			....	....	....	....	....	....	....	139·00	*4,807·90	12·68
Reported by Banks and Gold Dealers			....	....	....	....	....	52·03	56·58	....	58·49	....
Totals			....	6·74	87·00	433·83	1·00	224·85	1,254·11	8,873,357·94	1,871,687·38	10,282·38
BLACK RANGE DISTRICT.												
Barrambie	....	Voided leases	....	....	....	....	....	....	22·49	18,443·92	17,355·15	125·60
		Sundry claims	....	....	....	....	....	5·07	170·20	833·55	915·51	....
Bellchambers	....	Voided leases	....	....	....	....	....	....	111·80	4,349·27	3,130·56	....
		Sundry claims	....	....	....	....	....	....	....	1,008·30	547·06	....
Birrigrin	....	Voided leases	....	....	....	....	....	....	820·68	12,042·93	15,086·09	....
		Sundry claims	....	....	....	....	....	....	179·92	2,487·55	1,238·22	....
Curran's	....	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	....	....	....	....	....	....	443·79	975·75	3,156·49	....
		Voided leases	....	....	....	....	....	....	6,524·37	32,686·50	33,441·16	55·72
		Sundry claims	....	....	....	....	....	4·21	142·89	8,459·10	3,219·53	....
Maninga Marley	....	Voided leases	....	....	....	....	....	....	195·20	60,833·48	48,494·40	22·55
		Sundry claims	....	....	....	....	....	....	158·16	3,079·65	1,768·16	....
Montague	.... 967B, 1100B	North End Leases	....	....	....	*76·40	....	....	....	39,877·95	6,556·80	....
		Voided leases	....	....	....	....	....	....	100·17	39,672·65	16,888·02	....
		Sundry claims	....	....	....	....	....	....	71·09	5,041·35	3,171·19	....

Nungarra	....	Voided leases	....	....	....	....	....	....	25·94	952·34	9,509·00	3,655·49	....
		Sundry claims	....	....	....	....	....	....	50·27	1,458·98	7,636·40	2,953·69	....
Sandstone	959B	Atlas Gold Mines, Ltd.	....	....	....	....	....	....	....	....	986·75	180·56	....
		Prior to transfer	....	....	....	....	....	....	....	136·06	537·75	686·59	....
	(1075B)	Doolette, South	....	....	....	·66	....	....	....	217·54	2,114·00	2,314·11	....
	958B	Lady Mary	....	....	....	....	....	....	....	383·35	7,165·75	7,119·35	2·35
		Voided leases	....	....	....	....	....	....	4·75	4,010·09	692,614·07	444,324·11	11,754·22
		Sundry claims	....	....	....	....	....	....	44·95	1,421·07	15,506·95	6,820·85	....
Youanmi	....	Voided leases	....	....	....	....	....	....	·36	126·92	731,497·55	273,884·97	10,474·10
		Sundry claims	....	....	....	....	....	....	1·07	18·79	6,258·55	1,814·66	....
	From District generally :—												
	Sundry Parcels treated at :—												
	North End Battery Cyanide Plant	....	....	....	....	....	....	....	....	....	....	*4,934·14	....
	State Battery, Sandstone	....	....	....	*545·26	1·49	....	....	290·50	*23,552·64	61·02
	State Battery, Youanmi	....	....	....	....	....	....	....	40·00	*5,461·83	....
	Various Works	....	....	....	....	....	....	....	....	92·50	*6,510·12	....
	Reported by Banks and Gold Dealers	....	....	....	....	....	1,459·55	52·23	....	20·38	....
	Totals	....	....	....	**622·32**	**1·49**	**1,635·11**	**18,521·80**	**1,728,587·97**	**953,070·06**	**22,495·56**

Murchison Goldfield.

CUE DISTRICT.

Big Bell	2050, etc.	Big Bell Mines, Ltd.	....	....	402,906·00	54,142·27	15,973·79	....	....	5,118,502·00	664,208·09	233,324·22
	2050	Little Bell	....	....	....	....	....	....	4·49	579·75	60·95	....
		Voided leases	....	....	....	....	....	....	....	401·00	422·83	....
		Sundry claims	....	....	....	....	....	·39	6·32	382·75	357·46	....
Cuddingwarra	2266	William	....	....	....	....	....	....	....	9·50	·47	
		Voided leases	....	....	....	....	....	10·59	132·46	102,035·16	56,141·91	100·71
		Sundry claims	....	....	72·00	74·09	....	18·46	384·38	9,689·89	5,614·62	9·00
Cue	2262	Table Top	....	....	399·60	268·74	....	....	....	838·10	936·07	....
	2247	Victory	....	....	....	....	....	....	....	226·75	125·38	....
		Voided leases	....	....	....	....	....	202·71	911·60	288,796·44	221,102·80	69·11
		Sundry claims	....	....	24·25	4·65	....	252·92	894·70	44,585·09	20,207·91	....
Eelya	2241	Eaglehawk	....	....	....	....	....	....	....	1,408·75	416·08	....
		Voided leases	....	....	....	....	....	....	8·78	1,069·00	1,811·26	....
		Sundry claims	....	....	222·75	40·34	....	6·20	143·81	2,291·40	1,083·70	....
Mindoolah	....	Voided leases	....	....	....	....	....	3·07	2·54	9,380·28	5,672·31	42·97
		Sundry claims	....	....	....	....	....	....	29·30	3,299·60	2,345·43	....
Reedy	2253	Rand No. 3	....	....	....	....	....	....	....	4,152·25	1,356·56	....
		Voided leases	....	....	....	....	....	1·46	216·72	725,487·43	238,924·59	20,467·28
		Sundry claims	....	....	190·75	15·19	....	170·71	137·16	7,072·00	2,661·56	....

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953.					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 lb.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.).	Fine ozs.	Fine ozs.
MURCHISON GOLDFIELD—continued.												
CUE DISTRICT—*continued.*												
Tuckabianna	2237	Gidgie	....	....	....	....	....	....	79·16	2,671·15	1,803·84	....
	2260	Montorio	....	27·09	....	....	....	....	27·09	221·50	139·33	....
	2244	Winston	....	....	....	....	....	....	634·28	624·00	239·43	2·30
		Voided leases	....	....	....	....	....	649·70	297·68	12,908·48	7,321·43	....
		Sundry claims	....	....	....	....	....	151·38	489·40	4,757·60	2,675·86	....
Tuckanarra	....	Voided leases	....	....	....	....	....	85·37	3,511·10	19,490·00	22,828·99	172·77
		Sundry claims	....	2·76	101·00	12·92	....	115·23	792·07	10,190·80	10,307·86	....
Weld Range	....	Voided leases	....	....	....	....	....	....	23·64	2,169·75	1,137·11	....
		Sundry claims	....	....	....	....	....	....	3·90	1,438·50	1,136·41	....
	From District generally :—											
	Sundry parcels treated at :											
	State Battery, Cue		....	....	....	*170·30	4·67	....	....	76·25	*25,760·28	122·02
	State Battery, Tackanarra		....	....	....	....	....	....	....	518·50	*5,535·57	....
	Lansdown C. W., (L.T.T. 1243H)		....	....	....	*21·39	....	....	....	....	*51·28	....
	Various works		....	....	....	....	....	....	....	7,340·27	*29,430·64	1,147·77
	Reported by Banks and Gold Dealers		2·28	....	....	....	....	3,406·52	107·60	....	22·62	·07
	Totals		**2·28**	**29·85**	**403,916·35**	**54,749·89**	**15,978·46**	**5,074·71**	**8,838·18**	**6,382,613·94**	**1,331,840·63**	**255,458·22**
MEEKATHARRA DISTRICT.												
Abbotts	....	Voided leases	....	....	....	....	....	....	26·45	36,841·35	38,775·28	....
		Sundry claims	....	....	12·00	2·34	....	....	5·29	3,781·27	2,328·66	....
Burnakura	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	2,486·55	1,310·84	1·54
Chesterfield	1942N, 1946N	Margueritta leases	....	....	1,590·00	415·17	....	....	....	1,590·00	415·17	....
	1942N	Margueritta	....	....	....	....	....	....	....	732·00	197·73	7·74
	1946N	Margueritta	....	....	....	....	....	....	....	1,420·00	250·09	10·65
		Voided leases	....	....	....	....	....	29·02	420·32	6,875·26	7,500·57	·80
		Sundry claims	....	....	....	....	....	....	42·19	960·55	740·97	....

Gabanintha	1948N	Fortuna	....	....	506·00	93·83	....	....	....	1,620·00	676·10	....
	1943N	Nance	....	....	39·50	18·47	....	....	....	39·50	18·47	....
	1725N	New Brew	....	....	74·00	67·07	....	....	....	4,779·10	6,268·22	....
		Voided leases	....	....	....	....	....	11·79	38·14	24,864·50	14,929·37	815·57
		Sundry claims	....	....	140·00	38·27	....	16·78	159·05	5,002·75	2,913·20	....
Garden Gully	....	Voided leases	....	....	....	....	....	26·36	74·91	30,272·07	21,864·74	1,102·59
		Sundry claims	....	....	9·25	23·99	....	....	18·74	2,914·69	1,719·14	....
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	....	Voided leases	....	....	....	....	....	....	1,263·53	1,999·80	3,565·40	....
		Sundry claims	....	....	....	....	....	173·02	150·04	440·75	403·14	....
Meeka Pool	....	Voided leases	....	....	....	....	....	....	....	111·58	82·27	....
		Sundry claims	....	....	....	....	....	....	2·84	233·57	205·38	....
Meekatharra	1922N	Albury Heath	....	....	348·50	315·19	....	....	....	1,299·25	1,807·41	....
	1855N	Commodore	....	....	112·50	10·03	....	....	....	1,272·75	396·53	....
	(1952N)	Consols North	....	....	....	....	....	....	....	82·00	38·26	....
	1571N	Coolgardie Brilliant, N.L.	....	....	....	....	....	....	....	2,451·36	541·38	....
	1571N	Prior to transfer to present holders	....	....	....	....	....	....	....	8,107·50	4,907·48	....
	(1893N)	Halcyon	....	....	12·00	10·72	....	....	·78	7,894·10	1,061·20	....
	1559N	Ingliston	....	....	....	....	....	....	498·32	1,846·10	1,691·61	....
	(1950N)	Ingliston South	....	....	....	....	....	....	....	71·25	32·92	....
	(1547N)	Lady Central	....	....	....	....	....	....	19·36	96·00	51·78	....
	(1547N)	(Meekatharra Central Gold, N.L.)	....	....	....	....	....	....	5·29	4,842·25	2,463·30	....
	(1547N)	(Lady Central Leases)	....	....	....	....	....	....	11·06	2,951·42	5,198·33	....
	1577N	Mopoke	....	....	....	....	....	....	12·47	1,361·50	827·50	....
	1923N	Peter Pan	....	....	....	....	....	....	....	337·25	30·92	....
	1529N	Prohibition	....	....	....	29·42	4·21	....	....	3,950·00	1,918·02	4·25
	1529N, etc.	(Prohibition Gold Mining, Co., N.L.)	....	....	....	....	....	....	....	24,844·25	4,978·31	11·83
	1529N	Prior to transfer	....	....	....	....	....	....	....	29,422·00	4,971·30	....
	(1934N)	United	....	....	....	*45·76	....	....	....	117·25	176·06	....
	R.C. 75N	C. J. S. White & W. E. Fisher	173·82	43·80	372·50	130·10	....	173·82	43·80	372·50	130·10	....
		Voided Leases	....	....	....	....	....	3·88	1,483·83	1,679,618·49	910,077·82	2,455·04
		Sundry claims	14·22	159·04	463·55	740·39	....	243·93	787·89	25,439·00	10,537·32	....
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	....

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.	Total Production. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.
MURCHISON GOLDFIELD—continued.												
MEEKATHARRA DISTRICT—*continued.*												
Nannine	1872N	Blue Pedro	....	....	....	....	....	4·06	15·26	9,566·40	2,021·11	....
	1941N	Caledonian Gold Mine	....	....	1,804·00	496·24	....	....	....	2,659·00	795·53	....
		Voided leases	....	....	....	....	....	43·25	828·76	116,140·48	73,408·98	167·45
		Sundry claims	....	....	10·00	3·26	....	120·08	1,248·76	6,119·43	4,661·89	....
Quinns	....	Voided leases	....	....	....	....	....	7·30	1,186·50	33,356·91	13,464·37	90·70
		Sundry claims	....	....	....	....	....	15·07	1,289·65	3,841·67	2,718·33	....
Ruby Well	....	Voided leases	....	....	....	....	....	....	43·46	7,461·00	4,046·70	....
		Sundry claims	....	....	....	....	....	1,015·87	409·39	520·25	629·60	....
Stake Well	....	Voided leases	....	....	....	....	....	....	200·12	21,362·00	9,566·18	....
		Sundry claims	....	....	....	....	....	31·91	34·73	1,003·60	584·54	....
Star of The East	....	Voided leases	....	....	....	....	....	....	....	27,244·00	20,305·40	....
		Sundry claims	....	....	....	....	....	....	....	127·62	94·97	....
Yaloginda	1853N	Blue Bird	....	....	650·00	226·52	....	....	....	7,797·00	2,425·69	....
		Voided leases	....	....	....	....	....	19·03	1,972·23	28,175·54	14,609·36	8·68
		Sundry claims	....	....	100·50	37·01	....	61·89	647·51	10,852·42	4,997·36	....
	From District generally :—											
	Sundry Parcels treated at :											
	State Battery, Meekatharra		....	....	....	*209·95	5·34	....	....	130·00	*27,027·38	24·34
	Speering, E. J. (L.T.T. 1230H)		....	....	....	*8·38	....	....	....	....	*8·38	....
	Rinaldi, L. V., (L.T.T. 1259H)		....	....	....	*137·17	....	....	....	....	*137·17	....
	Various Works		....	....	....	....	....	....	....	172·75	*13,455·64	342·17
	Reported by Banks and Gold Dealers		3·00	....	....	5·76	....	12,178·38	179·70	13·50	54·58	....
	Totals		**191·04**	**202·84**	**6,244·30**	**3,065·04**	**9·55**	**14,510·35**	**17,848·40**	**2,277,403·01**	**1,301,704·92**	**5,070·25**
DAY DAWN DISTRICT.												
Day Dawn	573D, etc.	Mountain View Gold, N.L.	....	....	1,460·00	709·54	27·09	....	....	10,385·85	16,495·06	182·30
	573D	Prior to transfer to present holders	....	....	....	....	....	....	94·05	10,060·78	32,623·97	....
	576D	(New Fingall)	....	....	....	....	....	6·12	6·84	3,230·00	1,226·01	....
		Voided leases	....	....	....	....	....	160·64	826·65	1,922,088·36	1,225,599·75	169,210·44
		Sundry claims	....	2·51	186·50	15·50	....	96·42	523·56	13,452·01	6,635·99	·41

Lake Austin	....	Voided leases	....	....	....	....	....	....	613·00	3,079·62	36,872·20	51,050·49	.. .
		Sundry claims	....	....	....	....	....	....	59·07	965·49	3,252·19	1,278·82	....
Mainland	....	Voided leases	....	....	....	....	....	....	·41	3,296·77	7,575·62	25,026·07	....
		Sundry claims	....	....	....	....	....	....	17·85	771·56	1,337·95	701·31	....
Pinnacles	676D	Eclipse Amalgamated North	....	....	....	....	....	....	....	....	159·00	13·75	....
	670D	Eclipse North	....	....	....	....	....	....	....	....	141·25	11·18	....
		Voided leases	....	....	....	....	....	....	4·90	1,213·68	18,280·00	9,915·31	....
		Sundry claims	....	....	25·25	2·13	....	....	62·93	509·50	4,374·67	1,759·41	....
	From District generally :—												
	Sundry Parcels treated at :												
	Various Works	....	....	....	....	....	....	....	16·61	988·00	1,988·33	....
	Reported by Banks and Gold Dealers	1·36	....	....	....	....	2,213·95	37·30	....	12·57	·01
	Totals	**1·36**	**2·51**	**1,671·75**	**727·17**	**27·09**	**3,235·29**	**11,341·63**	**2,032,197·88**	**1,374,338·42**	**169,393·16**

MOUNT MAGNET DISTRICT.

Jumbulyer	1410M	Gold Bug	....	....	13·50	8·13	....	....	2·20	645·70	215·38	....
		Voided leases	....	....	....	....	....	....	13·37	680·10	361·74	....
		Sundry claims	....	....	....	....	....	20·32	116·27	1,205·70	878·98	....
Lennonville	1308M	Empress	....	....	....	....	....	....	....	460·00	167·30	....
		Voided leases	....	....	....	....	....	....	3,226·91	151,042·55	128,400·98	459·62
		Sundry claims	....	....	....	....	....	23·30	108·82	14,036·57	5,454·91	....
Mt. Magnet	1476M	Cascade	....	....	10·50	7·14	....	....	....	10·50	7·14	....
	1255M, 1415M	Edward Carson Leases	1·82	....	....	10·90	....	1·82	....	17,890·50	12,835·98	7·76
	1455M	Evening Star	....	....	51·25	8·87	....	....	....	382·00	46·08	....
	1287M	Havelock	....	....	....	....	....	....	11·05	4,332·50	840·14	....
	1282M, etc.	Hill 50 Gold Mine, N.L.	....	....	83,865·00	41,798·95	1,178·33	....	....	679,205·90	211,267·33	3,525·06
	1246M	Prior to transfer to present holders	....	....	....	....	....	....	829·41	8,787·65	4,122·61	·21
	1361M	Jupiter	....	....	47·00	20·05	....	....	·83	658·05	261·71	....
	1444M	Late Comer	....	....	58·00	41·23	....	....	2·53	426·50	323·33	....
	1447M	Morning Star	....	....	84·75	30·35	....	....	....	387·65	133·05	....
	1505M	Perseverance	....	....	107·25	11·40	....	....	....	107·25	11·40	....
	1332M	Three Boys	....	....	....	....	....	....	231·11	578·53	682·98	....
		Voided leases	....	....	....	....	....	29·26	9,580·43	833,683·78	312,078·71	851·39
		Sundry claims	....	....	42·75	57·60	....	122·27	2,626·24	60,054·65	29,601·10	4·49
Mt. Magnet East	....	Voided leases	....	....	....	....	....	63·29	764·53	5,522·28	2,811·75	....
		Sundry claims	....	....	....	....	....	....	37·22	418·25	428·29	....
Moyagee	(1355M)	Moyagee	....	....	....	....	....	....	....	2,665·75	*5,192·18	375·25
	(1355M, 1398M)	Moyagee Leases	....	....	....	....	....	....	....	4,641·00	*5,489·13	382·52
		Voided leases	....	....	....	....	....	....	23·59	5,132·35	7,617·85	....
		Sundry claims	....	....	....	....	....	14·44	176·21	1,516·25	1,746·42	....
Paynesville	....	Voided leases	....	....	....	....	....	....	1,613·34	449·77	1,116·15	....
		Sundry claims	....	....	....	....	....	3·36	540·21	882·57	1,372·00	....

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.	Total Production. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.
MURCHISON GOLDFIELD—continued.												
MOUNT MAGNET DISTRICT—*continued.*												
Winjangoo	....	Voided leases	....	....	....	....	....	·99	191·88	72·00	69·98	....
		Sundry claims	....	....	....	....	....	....	223·32	237·53	71·58	....
		From District generally :—										
		Sundry Parcels treated at :										
		State Battery, Boogardie	....	....	....	*58·43	2·67	....	....	125·26	*34,460·61	6·87
		Empress Battery	....	....	....	....	....	....	....	....	*46·30	....
		Various Works	....	....	....	....	....	....	....	56·06	18,902·94	10·04
		Reported by Banks and Gold Dealers	3·20	....	....	....	....	2,286·74	114·28	8·00	113·15	·22
		Totals	**5·02**	....	**84,280·00**	**42,053·05**	**1,181·00**	**2,565·79**	**20,433·75**	**1,796,303·15**	**787,129·18**	**5,623·43**
Yalgoo Goldfield.												
Bilberatha	....	Voided leases	....	....	....	....	....	1·27	90·94	3,384·50	1,845·05	....
		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	1113, 1220	Field's Find Central Leases	....	....	....	1·90	·06	....	....	10·00	10·13	·49
	1113	Field's Find	....	....	....	....	....	....	....	44·00	17·96	·10
	1220	Field's Find Central	....	....	....	....	....	....	....	5·00	3·53	....
	1119	Field's Find Central West	....	....	16·25	2·76	....	....	....	156·75	39·26	·80
	(1114), 1119	Field's Find Central West Leases	....	....	....	....	....	....	....	4,625·00	1,074·53	56·69
	1207	Rose Marie	....	....	....	....	....	....	....	418·67	252·10	1·52
		Voided leases	....	....	....	....	....	....	226·72	45,475·96	32,547·10	....
		Sundry claims	....	....	3·00	1·98	....	5·77	188·67	5,458·85	1,777·91	....
Goodingnow	1063	Ark	....	11·26	164·00	261·82	....	....	12·49	2,270·50	1,927·29	....
	1025	Carnation	....	....	110·00	107·90	....	....	....	18,926·05	13,993·00	....
	1206	Orchid	....	....	....	....	....	....	....	157·50	33·74	....
	1145	Oversight	....	....	....	....	....	....	....	2,338·35	875·92	....
	1208	Oversight South	....	....	....	....	....	....	8·03	2,935·00	1,214·21	....
		Voided leases	....	....	....	....	....	146·70	280·63	56,984·81	50,170·45	....
		Sundry claims	....	....	29·05	10·01	....	152·96	169·70	10,222·30	5,100·59	....

Gullewa	(1189)	King Solomon's Mine	....	....	....	....	....	....	....	....	....	315·00	135·89	5·79
	(1189, etc.)	(King Solomon's Mines, Ltd.)	....	....	....	....	....	....	....	....	....	5,130·10	2,101·25	26·49
		Voided leases	....	....	....	....	....	....	....	19·05	34,468·50	18,729·37	81·42
		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	....	Voided leases	....	....	....	....	....	8·64	349·71	39,836·51	28,564·95	1,083·01
		Sundry claims	....	....	....	....	....	463·12	333·98	1,595·10	588·36	·07
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	·63	....	11·25	4·65	....	1·66	44·72	1,134·60	498·90	1·00
Ninghan	....	Voided leases	....	....	....	....	....	....	....	10·00	1·41	....
		Sundry claims	....	....	....	....	....	....	....	324·75	123·28	....
Noongal	1201	Hard to Find	....	....	....	....	....	....	....	114·00	111·83	....
	1203	Rivival	....	....	....	....	....	....	....	80·00	132·93	4·04
		Voided leases	....	....	....	....	....	7·88	31·96	11,069·75	5,526·90	....
		Sundry claims	....	....	....	....	....	39·32	310·31	8,499·05	3,561·25	....
Nyounda	....	Voided leases	....	....	....	....	....	....	217·63	416·00	183·91	....
		Sundry claims	....	....	....	....	....	....	30·88	829·00	206·46	....
Pinyalling	(1217)	Broken Doll	....	....	....	....	....	....	219·99	7·55	148·38	....
		Trump	....	....	5·00	13·68	....	....	....	15·00	38·31	....
		Voided leases	....	....	....	....	....	....	93·80	2,296·35	959·50	....
		Sundry claims	....	....	....	....	....	3·13	134·09	1,492·50	954·82	....
Retaliation	....	Voided leases	....	....	....	....	....	....	....	5,089·25	1,872·98	....
		Sundry claims	....	....	....	....	....	....	....	778·25	304·71	....
Rothsay	1216	Dollar	....	....	....	....	....	....	....	....	2·14	....
		Voided leases	....	....	....	....	....	....	24·06	40,680·75	10,775·84	....
		Sundry claims	....	....	....	....	....	....	·73	6,469·50	2,562·03	....
Wadgingarra	....	Voided leases	....	....	....	....	....	....	....	691·11	650·63	....
		Sundry claims	....	....	....	....	....	....	....	2,131·30	559·83	....
Warda Warra	....	Voided leases	....	....	....	....	....	....	....	10,760·50	5,862·04	....
		Sundry claims	....	....	....	....	....	....	....	933·75	369·87	....
Warriedar	....	Voided leases	....	....	....	....	....	....	....	13,661·50	4,607·88	7·30
		Sundry claims	....	....	....	....	....	....	2·84	8,782·85	1,892·46	....
Yalgoo	....	Voided leases	....	....	....	....	....	....	3·23	6,314·50	9,965·18	....
		Sundry claims	....	....	....	....	....	....	23·56	2,622·75	1,010·02	....
Yuin	....	Voided leases	....	....	....	....	....	....	127·12	68,139·50	27,908·57	130·13
		Sundry claims	....	....	....	....	....	....	4·70	335·50	67·53	....

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.	Total Production. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.
YALGOO GOLDFIELD—continued.												
		From Goldfields generally :—										
		Sundry Parcels treated at :										
		State Battery, Payne's Find	....	....	....	....	....	....	....	38·50	*4,532·78	....
		State Battery, Warriedar	....	....	....	*6·11	·37	....	....	....	*6,537·13	·37
		State Battery, Yalgoo	....	....	....	....	....	....	....	....	*1,200·51	....
		Various Works	....	....	....	....	....	9·42	....	664·00	3,325·00	99·84
		Reported by Banks and Gold Dealers	....	....	....	....	....	944·94	58·32	....	48·90	·20
		Totals	**·63**	**11·26**	**338·55**	**410·81**	**·43**	**1,786·09**	**3,212·57**	**441,403·83**	**263,534·74**	**1,502·56**
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	....	....	....	....	....	....	591·62	2,160·30	2,011·78	....
Linden	(553F)	Local Lady	....	....	104·00	74·21	....	....	....	3,200·25	3,091·14	....
	529F	Second Fortune	....	....	26·00	10·70	....	....	....	543·00	292·75	....
		Voided lesaes	....	....	....	....	....	7·53	566·97	69,176·56	62,824·46	·68
		Sundry claims	....	....	29·50	9·78	....	132·11	244·96	19,272·35	13,768·96	....
Mt. Margaret	....	Voided leases	....	....	....	....	....	12·13	1·89	8,900·39	5,291·51	12·55
		Sundry claims	....	....	....	....	....	25·22	111·18	1,779·60	658·99	....
Mt. Morgans	399F, etc.	Morgans Gold Mines, Ltd.	....	....	....	....	....	....	....	4,568·80	*13,789·93	....
	399F	Prior to transfer to present holders	....	....	....	....	....	....	16·66	779,578·43	354,225·86	5,552·63
		Voided leases	....	....	....	....	....	17·95	148·79	61,354·50	34,786·53	77·86
		Sundry claims	....	....	16·50	58·26	....	36·41	398·78	5,084·07	3,387·12	....
Murrin Murrin	....	Voided leases	....	....	....	....	....	10·43	231·35	136,940·22	104,029·97	29·60
		Sundry claims	....	....	30·00	8·53	....	51·15	557·24	6,455·33	4,442·16	....
Red Castle	557F	Trixie	....	6·05	9·75	11·40	....	....	16·10	167·75	50·71	....
		Voided leases	....	....	....	....	....	4·49	436·54	4,107·20	4,043·41	....
		Sundry claims	....	....	50·00	6·42	....	....	113·84	1,183·57	642·45	....

Yundamindera	560F	Queen of the May	....	....	1,245·00	536·33	9·52	....	....	1,245·00	608·23	9·52
		Voided leases	....	....	....	....	....	....	110·93	78,485·85	49,894·35	5·82
		Sundry claims	....	....	....	....	....	3·01	271·93	6,674·35	4,789·46	....
		From District generally :—										
		Sundry Parcels treated at :										
		Anniversary Battery	....	....	....	....	....	....	....	10·00	26·36	....
		State Battery, Linden (B. Dellar)	....	....	....	2·10	....	....	9·16	293·29	*15,490·58	....
		The United Aborigines Mission (M.A. 12)	....	....	....	....	....	113·08	18·87	403·00	135·50	·09
		Various Works	....	....	....	....	....	....	....	1,257·81	*8,561·39	99·97
		Banks and Gold Dealers	24·67	....	....	....	....	3,045·53	141·84	10·30	95·75	·68
		Totals	**24·67**	**6·05**	**1,510·75**	**717·73**	**9·52**	**3,459·04**	**9,359·82**	**1,211,676·96**	**715,723·77**	**5,791·16**

MOUNT MALCOLM DISTRICT.

Cardinia	1795C	Rangoon	....	....	....	....	....	....	6·49	330·00	178·07	....
	1805C	Wanghi	....	....	40·00	3·74	....	....	....	320·00	22·02	....
		Voided leases	....	....	....	....	....	13·87	1,591·66	4,881·74	4,027·89	....
		Sundry claims	....	....	....	....	....	4·25	121·91	1,865·25	575·01	·66
Diorite	....	Voided leases	....	....	....	....	....	....	945·65	38,879·03	35,144·28	33·18
		Sundry claims	....	....	....	....	....	11·21	332·13	4,626·80	4,467·93	....
Dodgers Well	....	Voided leases	....	....	....	....	....	....	57·90	1,373·30	1,936·52	....
		Sundry claims	....	....	....	....	....	·95	28·32	1,440·25	904·23	....
Lake Darlot	1834C	Monte Christo	....	....	452·00	28·72	....	....	....	2,296·00	155·13	....
		Voided leases	....	....	....	....	....	....	4,482·18	70,928·46	52,038·63	7·56
		Sundry claims	....	....	126·00	8·43	....	67·68	557·70	8,172·34	5,317·40	2·60
Leonora	1837C	Great Gwalia	....	....	....	....	....	....	....	200·00	45·75	....
	1829C	Jessie Alma	....	....	....	....	....	....	454·52	619·50	1,823·39	....
	1788C	Little Gwalia	....	....	210·00	120·45	....	....	....	1,576·00	478·34	....
	1579C, etc.	Sons of Gwalia, Ltd.	....	....	100,525·00	26,026·06	2,080·16	....	....	5,743,883·53	2,285,635·42	162,467·78
		Prior to transfer to present holders	....	....	....	....	....	....	....	109,081·00	55,989·21	8·66
		Voided leases	....	....	....	....	....	....	1,866·86	174,799·00	90,621·56	94·57
		Sundry claims	....	3·86	19·00	40·94	....	37·73	361·86	18,338·25	11,705·51	....
Mt. Malcolm	....	Voided leases	....	....	....	....	....	11·65	47·07	62,656·53	47,563·43	....
		Sundry claims	....	....	....	....	....	5·75	33·39	4,572·47	2,711·17	·12
Mertondale	....	Voided leases	....	....	....	....	....	....	....	89,024·75	60,935·32	1,497·58
		Sundry claims	....	....	....	....	....	1·82	85·74	3,216·41	2,295·52	....
Mt. Clifford	....	Voided leases	....	....	....	....	....	....	1,623·35	9,556·96	16,492·17	....
		Sundry claims	....	....	....	....	....	53·98	351·65	5,569·70	3,485·47	....
Pig Well	....	Voided leases	....	....	....	....	....	....	....	13,587·32	14,676·58	63·68
		Sundry claims	....	....	....	....	....	....	34·61	2,896·65	1,225·46	....

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953.					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 lb.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.).	Fine ozs.	Fine ozs.
MOUNT MARGARET GOLDFIELD—continued.												
MOUNT MALCOLM DISTRICT—*continued.*												
Randwick	(1794C)	Mighty Splash	....	....	....	....	....	....	7·27	771·00	82·79	....
		Voided leases	....	....	....	....	....	....	239·49	10,141·65	9,653·78	....
		Sundry claims	....	....	....	....	....	66·57	164·02	2,488·64	1,307·45	....
Webster's Find	....	Voided leases	....	....	....	....	....	30·30	....	22,167·50	14,377·65	....
		Sundry claims	....	....	....	....	....	36·84	695·68	2,356·15	1,530·56	....
Wilsons' Creek	....	Voided leases	....	....	....	....	....	....	....	333·50	168·27	....
		Sundry claims	....	....	....	....	....	·70	4·24	316·00	261·12	....
Wilsons' Patch	....	Voided leases	....	....	....	....	....	....	99·38	28,863·35	13,050·19	1·05
		Sundry claims	....	....	....	....	....	4·68	54·46	1,594·16	1,407·27	....
		From District generally :—										
		Sundry Parcels treated at :										
		State Battery, Darlot (S. K. Millbank)	....	....	....	....	....	....	....	18·00	*786·34	....
		Reefer Cyanide Plant	....	....	....	....	....	....	....	20·00	*3,122·05	22·38
		Various Works	....	....	....	....	....	....	....	789·50	*22,175·93	135·97
		Reported by Banks and Gold Dealers	7·79	....	....	....	....	3,478·57	252·83	21·50	51·57	....
		Totals	**7·79**	**3·86**	**101,372·00**	**26,228·34**	**2,080·16**	**3,826·55**	**14,500·36**	**6,444,572·19**	**2,768,426·38**	**164,335·79**
MOUNT MARGARET DISTRICT.												
Burtville	2446T	Boomerang	....	....	37·75	259·49	24·90	....	....	1,605·15	8,305·28	462·30
	(2516T)	Golden Bell	....	....	11·00	10·56	....	....	....	268·75	336·08	5·87
	(2138T)	Nil Desperandum	....	....	89·85	230·25	....	....	5·30	1,783·22	4,188·53	....
		Voided leases	....	....	....	....	....	4·89	413·80	70,225·58	108,449·75	480·10
		Sundry claims	....	....	....	....	....	2·65	208·27	7,400·16	5,490·71	....
Duketon	....	Voided leases	....	....	....	....	....	5·35	3,216·10	31,889·42	22,542·63	....
		Sundry claims	....	....	....	....	....	....	528·26	2,402·65	2,164·55	29·76
Eagle's Nest	....	Voided leases	....	....	....	....	....	....	145·34	534·50	1,238·22	....
		Sundry claims	....	....	....	....	....	24·07	487·05	1,046·35	360·11	....
Erlistoun	2508T	Morgood	....	....	30·00	81·71	....	....	....	150·25	150·09	....
	2500T	Westralia	....	....	....	....	....	....	....	....	*122·50	....
		Voided leases	....	....	....	....	....	10·07	393·41	156,555·65	101,309·48	4,327·81
		Sundry claims	....	....	107·25	29·58	....	1,181·65	148·23	5,634·09	3,776·42	....

Euro	....	Voided leases	....	....	....	....	....	....	....	65·14	91,821·50	37,678·25	....
		Sundry claims	....	....	....	....	....	4·87	73·04	1,361·50	811·69	....
Laverton	2514T	Gladiator	....	....	1,124·75	122·21	....	....	....	1,450·75	175·04	....
	2245T	Lancefield Leases	....	....	1,771·75	149·92	....	....	....	30,929·25	3,991·93	15·68
	2245T	Lancefield Extended, West	....	....	....	....	....	....	....	881·25	846·77	....
	2489T	Wedge	....	....	....	....	....	....	....	222·00	21·19	....
	2478T	Lancefield, North	....	....	....	....	....	....	....	2,235·25	438·99	....
		Voided leases	....	....	....	....	....	28·59	2,028·85	2,075,638·37	813,222·85	56,923·16
		Sundry claims	....	12·20	121·00	40·42	....	215·58	1,487·55	17,359·25	9,162·52	....
Mt. Barnicoat	....	Voided leases	....	....	....	....	....	....	23·08	2,370·00	2,251·99	....
		Sundry claims	....	....	....	....	....	....	·68	1,309·75	1,087·77	....
Mt. Shenton	....	Voided leases	....	....	....	....	....	....	....	15·00	26·65	....
		Sundry claims	....	....	....	....	....	....	....	279·25	209·67	....
		From District generally :—										
		Sundry Parcels treated at :—										
		State Battery, Laverton	....	....	....	*1,047·55	96·02	....	....	97·50	*15,675·75	378·80
		United Gold Recoveries Pty., Ltd. (T.Ls. 2T, 5T)	....	....	....	*161·32	115·78	....	....	·25	*3,726·91	3,374·06
		Various Works	....	....	....	....	....	....	....	194·50	*19,399·89	·24
		Reported by Banks and Gold Dealers	6·00	....	....	....	....	2,522·93	108·08	....	26·76	....
		Totals	**6·00**	**12·20**	**3,293·35**	**2,133·01**	**236·70**	**4,000·65**	**9,332·18**	**2,505,661·14**	**1,671,188·97**	**65,997·78**

North Coolgardie Goldfield.

MENZIES DISTRICT.

Comet Vale	(5732Z)	Central Coonega	....	....	....	....	....	....	....	92·00	25·50	....
	5766Z	Coonega, Extended	....	....	16·50	15·34	....	....	....	16·50	15·34	....
	5757Z	King of the Hills	....	....	156·75	42·43	....	....	....	156·75	42·43	....
		Voided leases	....	....	....	....	....	....	419·74	267,052·22	193,155·04	5,352·39
		Sundry claims	....	....	13·00	2·35	....	....	40·19	1,908·91	998·31	....
Goongarrie	5740Z	Gull's Blow	....	....	....	....	....	....	....	318·25	132·03	....
	5760Z	Pretty Easy	....	....	....	....	....	....	....	9·25	9·71	....
		Voided leases	....	....	....	....	....	·94	1,385·26	29,838·79	18,085·64	....
		Sundry claims	....	....	11·75	2·54	....	46·46	2,054·17	2,695·02	3,103·80	....
Menzies	5543Z	Black Swan	....	....	....	....	....	....	....	1,000·63	1,633·52	9·08
	5736Z	Bodington	....	41·93	....	....	....	....	59·66	73·00	52·97	....
	5511Z	First Hit	....	....	471·00	461·30	....	....	....	3,236·75	6,461·84	21·25
	5511Z, etc.	First Hit G.M.'s (1934), Ltd.	....	....	....	....	....	....	....	68,473·70	49,060·96	6,676·23
	5542Z	Good Block Leases	....	....	....	....	....	....	7·32	1,589·00	2,523·97	....
	5714Z	Lady Harriet, North	....	....	....	....	....	....	....	21·00	4·01	....
	5549Z	Lady Harriet	....	....	180·00	126·98	....	....	....	728·00	291·44	....
	5520Z	Mignonette	....	....	....	....	....	....	....	538·50	367·23	....
	5749Z	Woolgar	....	....	....	....	....	....	....	553·00	386·91	....
	5752Z	Woolgar, South	....	....	60·00	25·56	....	....	....	60·00	25·56	....
		Voided leases	....	....	....	....	....	45·42	1,125·41	934,445·50	725,962·51	13,586·39
		Sundry claims	....	....	42·00	12·60	....	49·50	597·90	33,027·94	24,949·70	776·49

Table I.—*Production of Gold and Silver from all sources, etc.*—**continued.**

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953.					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 lb.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.).	Fine ozs.	Fine ozs.
NORTH COOLGARDIE GOLDFIELD—continued.												
MENZIES DISTRICT—*continued.*												
Mt. Ida	5701Z, etc.	Moonlight Wiluna G.M.'s, Ltd.	....	40·77	23,105·00	12,998·34	....	....	40·77	81,701·86	41,689·92	787·54
	5701Z, etc.	(Goldfields Australian Development Co., Ltd.)	....	....	....	....	....	....	....	12,682·00	7,208·07	332·63
	5537Z, etc.	(Mt. Ida Gold Mines, Ltd.)	....	....	....	....	....	....	....	17,638·50	8,075·96	558·74
	5537Z, etc.	Prior to transfer	....	....	....	....	....	....	....	1,512·75	737·95	....
		Voided leases	....	....	....	....	....	....	92·21	68,731·17	72,679·14	106·63
		Sundry claims	....	5·81	10·50	15·31	....	48·14	432·65	16,034·41	8,212·32	·12
Twin Hills	....	Voided leases	....	....	....	....	....	....	....	582·30	574·93	....
		Sundry claims	....	....	....	....	....	....	....	97·80	86·69	....
	From District generally :—											
	Sundry Parcels treated at :—											
		Lady Harriet Battery	....	....	....	*293·23	....	....	....	279·50	*19,199·83	30·00
		Mt. Ida State Battery (A. Grey)	....	....	....	*76·05	....	....	....	1,866·25	*7,379·76	·05
		B. W. Sander's Cyanide Plant	....	....	....	*86·50	....	....	....	....	*201·94	46·39
		Yundaga Treatment Works	....	....	....	*177·77	....	....	....	....	*267·95	·03
		Various Works	....	....	....	....	....	....	....	2,528·30	*38,811·38	2,985·69
	Reported by Banks and Gold Dealers		21·23	....	....	....	....	1,467·45	382·80	35·00	8·02	....
		Totals	**21·23**	**88·51**	**24,066·50**	**14,336·30**	....	**1,657·91**	**6,638·08**	**1,549,524·55**	**1,232,422·28**	**31,269·65**
ULARRING DISTRICT.												
Davyhurst	1016U, etc.	New Coolgardie Gold Mines, N.L.	....	....	29,926·00	16,023·45	5,074·35	....	....	65,997·00	35,256·89	8,643·32
	1016U	(New Callion)	....	....	....	....	....	....	....	5,293·30	2,002·37	119·67
		Voided leases	....	....	....	....	....	2·93	152·64	166,783·32	126,011·36	5,408·47
		Sundry claims	....	....	....	....	....	....	208·48	13,653·94	5,690·39	....
Morley's	1101U	Emerald	....	....	514·00	144·74	....	....	26·24	2,072·00	1,880·78	....
	1094U	First Hit	....	....	247·00	264·04	....	....	....	2,064·75	4,897·65	....
	1081U	Mabel Gertrude	....	....	....	....	....	....	....	1,364·00	1,326·43	....
	1089U	Paramount	....	....	256·00	133·72	....	....	1·49	2,692·00	2,470·00	....
		Voided leases	....	....	....	....	....	....	3,854·94	2,956·50	5,944·69	10·54
		Sundry claims	....	....	....	....	....	2·16	932·23	1,585·25	2,401·91	....

Mulline	1107U	Ajax West	....	....	1,048·00	957·20	....	....	1·37	3,869·25	4,216·29	....	
	1070U	Riverina	....	....	....	....	....	....	....	267·00	61·50	....	
	1070U, etc.	(Riverina Gold Mines Pty., Ltd.)	....	....	....	....	....	....	....	32,085·50	11,669·45		·07
	(1154U)	Shirley Patricia	....	....	....	....	....	....	....	7·00	2·23	....	
		Voided leases	....	....	....	....	....	....	274·09	102,630·22	103,358·09		530·75
		Sundry claims	....	....	16·75	16·43	....	10·82	198·67	10,677·64	8,747·38		1·10
Mulwarrie	1153U	Four Mile	....	....	5·50	12·64	....	....	....	48·00	241·84	....	
	1113U	Oakley	....	....	300·00	593·64	....	....	....	2,070·00	3,081·42	....	
		Voided leases	....	....	....	....	....	....	165·29	19,480·68	26,369·21		38·47
		Sundry claims	....	....	....	....	....	·80	282·29	3,106·33	2,722·13	....	
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	....	
	Riverina South Battery	....	....	....	*50·64	....	....	....	....	....	*50·64	....	
	Various Works	....	....	....	....	....	....	....	15·82	268·15	*9,639·15		11·15
	Reported by Banks and Gold Dealers	....	....	....	....	....	....	112·68	63·08	100·00	23·48	....	
	Totals	....	....	**32,313·25**	**18,196·50**	**5,074·35**	**129·39**	**6,739·97**	**450,768·10**	**395,306·57**	**14,763·54**		

NIAGARA DISTRICT.

Desdemona	....	Voided leases	....	....	....	....	....	....	7·12	9,809·00	7,555·81		12·04
		Sundry claims	....	....	....	....	....	....	10·35	2,225·45	892·48	....	
Kookynie	928G	Altona	....	....	405·25	560·38	....	....	....	2,805·50	3,524·66	....	
	911G	Cosmopolitan South	....	....	....	*20·87	....	....	....	2,133·00	1,020·19	....	
	933G	New Gladstone	....	....	....	....	....	....	....	360·00	124·47	....	
		Voided leases	....	....	....	....	....	3·35	347·30	744,917·21	394,601·81		5,375·97
		Sundry claims	....	....	7·50	4·12	....	56·74	106·18	8,868·05	6,566·55		·18
Niagara	....	Voided leases	....	....	....	....	....	....	104·54	85,876·50	52,365·05	....	
		Sundry claims	....	....	....	....	....	28·10	97·22	14,645·16	8,257·78	....	
Tampa	....	Voided leases	....	....	....	....	....	....	41·58	50,477·57	23,287·71		174·24
		Sundry claims	....	....	....	....	....	32·60	283·40	8,041·33	4,113·02	....	
	From District generally :—												
	Sundry Parcels treated at :												
	A. Vickery Treatment Syndicate	....	....	....	*1,303·10	....	....	....	....	*3,508·60		79·81
	Various Works	....	....	....	....	....	....	....	....	1,220·50	*16,406·29		41·17
	Reported by Banks and Gold Dealers	....	....	....	....	....	1,592·34	823·66	....	63·53	....		
	Totals	....	....	**412·75**	**1,888·47**	....	**1,713·13**	**1,821·35**	**931,379·27**	**522,287·95**	**5,683·41**		

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953.					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 lb.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.).	Fine ozs.	Fine ozs.
NORTH COOLGARDIE GOLDFIELD—*continued.*												
YERILLA DISTRICT.												
Edjudina	1011R, etc.	Paget Gold Mines of Ejudina, Ltd.	....	....	....	....	....	....	....	841·50	187·51	....
	1011R, etc.	Prior to transfer to present holders	....	....	....	....	....	....	....	738·75	559·80	....
		Voided leases	....	....	....	....	....	....	18·44	33,943·45	42,627·48	37·79
		Sundry claims	....	....	56·00	18·85	·69	....	28·52	6,948·58	4,827·25	·69
Patricia	....	Voided leases	....	....	....	....	....	....	....	4,158·50	5,396·40	25·40
		Sundry claims	....	....	....	....	....	....	....	47·00	20·78	....
Pingin	....	Voided leases	....	....	....	....	....	....	48·34	17,463·30	10,742·77	....
		Sundry claims	....	....	....	....	....	....	154·86	5,642·59	3,475·75	....
Yarri	1320R	Margaret	....	....	475·00	155·83	....	....	....	2,796·00	974·09	....
	1327R	Nil Desperandum	....	....	14·00	1·56	....	....	....	287·00	70·35	....
	1126R, etc.	Porphyry (1939) Gold Mine, N.L.	....	....	....	....	....	....	....	66,715·00	9,867·95	261·86
		Prior to transfer to present holders	....	....	....	....	....	....	....	30,344·50	5,448·82	507·51
		Voided leases	....	....	....	....	....	6·30	87·08	44,324·75	21,235·42	2·00
		Sundry claims	....	....	123·00	27·33	....	·87	5·93	16,539·05	6,005·44	·04
Yerilla	....	Voided leases	....	....	....	....	....	....	3,107·25	16,481·43	12,925·74	13·93
		Sundry claims	....	19·87	....	·51	....	19·30	74·80	2,742·58	1,568·34	....
Yilgangie	1176R, etc.	Western Mining Corporation	....	....	1,463·00	1,553·41	320·49	....	....	10,095·75	10,194·75	1,167·68
		Prior to transfer to present holders	....	....	....	....	....	....	·85	1,244·75	1,830·28	....
		Voided leases	....	....	....	....	....	....	9·94	2,432·75	1,500·80	....
		Sundry claims	....	....	....	....	....	121·67	98·20	3,302·30	2,020·38	·63
		From District generally :—										
		Sundry Parcels treated at :										
		State Battery, Yarri	....	....	....	*150·65	2·00	....	....	276·50	*9,060·18	11·65
		State Battery, Yerilla	....	....	....	....	....	....	....	....	*43·52	....
		Various Works	....	....	....	....	....	2·17	....	642·25	*6,049·24	....
		Reported by Banks and Gold Dealers	....	....	....	....	....	1,161·60	160·08	....	23·09	....
		Totals	....	**19·87**	**2,131·00**	**1,908·14**	**323·18**	**1,311·91**	**3,794·29**	**268,008·28**	**156,656·13**	**2,029·18**

Broad Arrow Goldfield.

Bardoc	....	Voided leases	....	....	....	....	....	....	....	....	2,335·41	85,370·59	55,699·50	203·60
		Sundry claims	....	....	....	....	54·25	21·51	....	54·95	1,194·11	17,059·53	8,189·92	....
Black Flag	2229W	Bellevue	....	....	....	....	22·97	241·25	360·85	....	202·17	1,115·25	2,310·70	....
		Voided leases	....	....	....	....	....	....	....	27·81	405·90	48,223·79	28,152·20	....
		Sundry claims	....	....	....	....	....	....	....	712·59	251·59	7,935·46	4,808·71	....
Broad Arrow	2039W	Golden Arrow	....	....	....	....	....	....	....	....	....	5,657·50	830·70	....
	2254W	Grace Darling Extended	....	....	....	....	626·75	165·96	....	....	....	2,337·50	977·26	....
	2276W	Johnnie	....	....	....	....	1·09	31·00	11·59	....	1·09	31·00	11·59	....
	1771W....	North Duke	....	....	....	....	....	31·50	13·56	....	1,670·51	333·60	690·37	....
		Voided leases	....	....	....	....	....	....	....	70·32	8,782·21	147,317·09	117,438·60	20·23
		Sundry claims	....	....	....	....	....	180·25	78·25	1,007·72	3,044·75	32,429·14	16,605·56	·11
Cane Grass	....	Voided leases	....	....	....	....	....	....	....	....	27·77	669·82	460·72	....
		Sundry claims	....	....	....	....	....	....	....	....	227·55	717·45	505·06	....
Carnage	....	Voided leases	....	....	....	....	....	....	....	176·04	659·31	2,402·00	2,170·67	....
		Sundry claims	....	....	....	....	....	....	....	....	6·61	1,840·08	874·56	....
Cashman's	....	Voided leases	....	....	....	....	....	....	....	67·51	813·76	8,172·15	7,090·91	....
		Sundry claims	....	....	....	....	....	....	....	....	40·31	1,205·12	361·74	·05
Christmas Reef	2262W....	Gull's Neck	....	....	....	....	....	....	....	....	25·31	3·00	6·58	....
	(2175W)	New Mexico	....	....	....	....	....	....	....	....	....	1,058·35	3,376·21	....
	2253W....	New Mexico South	....	....	....	....	110·25	332·56	....	....	....	329·00	865·18	....
		Voided leases	....	....	....	....	....	....	....	....	29·68	794·77	216·24	....
		Sundry claims	....	....	....	....	27·00	35·26	....	....	441·85	2,914·89	2,670·55	....
Fenbark	2188W....	Golden Penny	....	....	....	....	79·50	9·36	....	....	....	2,873·25	630·89	....
		Voided leases	....	....	....	....	....	....	....	....	4·42	3,897·75	2,080·79	....
		Sundry claims	....	....	....	....	20·00	6·67	....	....	51·96	2,991·02	992·33	....
Grant's Patch	2261W....	Bent Tree	....	....	....	....	64·00	73·69	....	....	....	741·00	241·45	....
	2277W....	Coronation	....	....	....	....	58·00	213·20	....	....	....	58·00	213·20	....
	2242W....	Lady Agnes	....	....	....	....	....	....	....	....	2·11	1,089·50	388·36	....
	(1962W, etc.)	Ora Banda Amalgamated Mines, N.L.	....	....	....	....	....	5·62	....	....	....	168,257·79	62,808·37	175·00
		Prior to transfer to present holders	....	....	....	....	....	....	....	....	....	12,424·50	9,540·07	....
	2208W....	Wentworth	....	....	....	....	1·30	545·00	152·20	....	1·30	3,186·50	956·93	....
	2224W....	Whip-Pole	....	....	....	....	....	....	....	....	12·20	856·60	368·43	....
		Voided leases	....	....	....	....	....	....	....	....	258·52	15,440·10	5,340·79	....
		Sundry claims	....	....	....	....	71·50	39·13	....	....	356·66	6,117·29	3,050·04	....
Ora Banda	T.A. 42W, M.A. 41W	Associated Northern Ora Banda, N.L.	....	....	....	....	....	....	....	....	....	2,783·50	464·53	21·07
		Prior to transfer	....	....	....	....	....	....	....	....	....	315,958·95	123,252·22	1,664·70
	2270W....	Gimlet South	....	....	....	....	505·25	106·52	....	....	....	1,530·50	380·18	....
	2275W....	Squanderbug	....	....	....	....	13·25	5·05	....	....	....	13·25	5·05	....
		Voided leases	....	....	....	....	....	....	....	....	845·72	103,798·07	27,385·59	....
		Sundry claims	....	....	....	....	200·25	46·55	....	....	386·91	13,245·00	4,393·36	....

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.	Total Production. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.
BROAD ARROW GOLDFIELD—continued.												
Paddington	2122W	Pakeha	....	....	451·50	93·09	....	....	....	5,050·15	1,671·62	13·19
		Voided leases	....	....	....	....	....	5,566·30	463·31	189,970·16	84,586·82	18·96
		Sundry leases	....	....	....	....	....	1,714·16	291·43	16,387·73	9,124·63	....
Riche's Find	(2271W)	Merry Dance	....	....	....	....	....	....	....	4·50	98·63	....
	2257W	Yalbalgo	....	6·41	....	....	....	....	6·41	105·00	548·90	....
		Voided leases	....	....	....	....	....	....	7·01	7,471·59	5,363·45	71·36
		Sundry claims	....	....	5·00	1·08	....	....	296·26	1,905·80	1,998·78	·13
Siberia	....	Voided leases	....	....	....	....	....	1·07	2,649·28	28,928·97	31,751·34	....
		Sundry claims	....	....	....	....	....	289·06	1,233·18	20,985·79	12,817·33	....
Smithfield	2264W	King of Kings	....	....	1,150·25	166·46	....	....	....	2,559·00	388·34	....
		Voided leases	....	....	....	....	....	....	....	4,700·71	1,174·69	....
		Sundry claims	....	....	39·50	2·53	....	....	124·29	3,127·59	1,242·40	....
	From District generally :—											
	Sundry parcels treated at :											
	Golden Arrow Battery		....	....	....	*14·13	....	....	....	36·00	*4,045·94	....
	State Battery, Ora Banda		....	....	....	*559·39	2·50	....	....	128·05	*22,675·47	2·50
	Various works		....	....	....	....	....	2,275·66	1·24	16,967·02	*49,481·50	*3,103·45
	Reported by Banks and Gold Dealers		4·22	....	....	....	....	9,989·76	134·97	61·68	90·35	....
	Totals		**4·22**	**31·77**	**4,505·25**	**2,514·21**	**2·50**	**21,953·28**	**27,287·07**	**1321,572·39**	**723,866·30**	**5,294·35**

North-East Coolgardie Goldfield.

KANOWNA DISTRICT.

Gindalbie	(1579X)	Leader's	....	....	40·00	3·72	....	....	....	130·00	14·71	....
	1578X	Walls Reward	....	....	212·50	128·83	....	....	....	579·00	744·37	....
		Voided leases	....	....	....	....	....	....	1,151·99	45,233·78	40,931·71	38·31
		Sundry leases	....	....	232·50	115·89	....	....	716·52	5,335·27	3,123·19	....
Gordon	....	Voided leases	....	....	....	....	....	....	682·54	53,900·58	20,072·51	517·61
		Sundry claims	....	....	....	....	....	....	177·38	2,155·70	1,194·71	....
Kalpini	....	Voided leases	....	....	....	....	....	....	38·73	13,543·50	6,753·78	·07
		Sundry claims	....	....	....	....	....	24·70	269·72	1,492·50	1,026·37	

Kanowna	1572X	Kanowna Red Hill	....	....	44·00	17·67	....	....	....	1,301·00	417·13	....
	1574X	Snowdrop	....	....	....	....	....	....	....	21·75	19·65	....
		Voided leases	....	....	....	....	....	24·94	4,516·76	685,535·35	380,477·71	2,482·24
		Sundry claims	....	....	362·25	108·12	....	118·94	2,163·30	26,359·27	11,720·76	1·50
Mulgarrie	....	Voided leases	....	....	....	....	....	....	1,216·63	6,902·26	4,197·98	....
		Sundry claims	....	....	....	....	....	....	16·78	1,281·75	641·69	....
Six Mile	....	Voided leases	....	....	....	....	....	....	1,603·72	559·00	767·72	....
		Sundry claims	....	....	....	....	....	....	56·51	759·25	229·10	....
	From District Generally :—											
	Sundry parcels treated at :											
	Various works	....	....	....	....	....	330·42	867·52	158,935·05	153,205·89	....
	Reported by Banks and Gold Dealers	6·34	·44	....	3·08	....	106,016·31	37·35	·50	108·04	....
	Totals	**6·34**	**·44**	**891·25**	**377·31**	....	**106,515·31**	**13,515·45**	**1004,025·51**	**625,647·02**	**3,039·73**

KURNALPI DISTRICT.

Jubilee	....	Voided leases	....	....	....	....	....	....	145·13	2,122·50	1,465·16	....
		Sundry claims	....	....	....	....	....	25·57	13·52	1,234·00	520·15	....
Kurnalpi	....	Voided leases	....	....	....	....	....	371·18	3,166·80	4,052·51	3,957·71	6·27
		Sundry claims	....	....	....	....	....	324·12	727·39	4,305·36	2,089·90	....
Mulgabbie	....	Voided leases	....	....	....	....	....	....	1,402·66	226·75	7,845·87	4·95
		Sundry claims	....	....	....	....	....	8·06	2,772·71	1,327·45	2,241·18	....
	From District generally :—											
	Sundry Parcels treated at :											
	Various Works	....	....	....	....	....	....	....	101·50	388·63	....
	Reported by Banks and Gold Dealers	....	....	....	....	....	12,105·10	70·70	....	2·35	1·49
	Totals	....	....	....	....	....	**12,834·03**	**8,298·91**	**13,370·07**	**18,510·95**	**12·71**

East Coolgardie Goldfield.

EAST COOLGARDIE DISTRICT.

Binduli	6025E	Belle of Kalgoorlie	....	....	27·75	3·72	....	....	....	720·00	84·23	....
		Voided leases	....	....	....	....	....	....	....	803·10	385·19	....
		Sundry claims	....	....	84·75	5·08	....	....	13·01	5,091·77	1,673·12	....
Boorara	6310E	Roma	....	....	28·75	2·56	....	....	....	592·00	70·04	....
		Voided leases	....	....	....	....	....	....	459·07	308,606·07	172,779·88	411·37
		Sundry claims	....	....	60·00	17·77	....	·49	145·56	3,328·34	1,484·13	....

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953.					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 lb.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.).	Fine ozs.	Fine ozs.
EAST COOLGARDIE GOLDFIELD—continued.												
EAST COOLGARDIE DISTRICT—*continued.*												
Boulder	6145E	Boomerang	....	....	....	....	....	....	....	77·00	8·00	....
	5690E	Boulder Perseverance, Ltd.	....	....	136,257·09	33,676·87	8,706·17	....	....	2,848,946·63	1,030,154·95	328,366·16
		Prior to transfer to present holders	....	....	....	....	....	....	....	3,306,942·88	1,841,159·00	203,821·43
	5531E	Cassidy's Hill	....	....	75·50	7·77	....	....	....	75·50	7·77	....
	5964E	Croesus Extended	....	....	143·00	14·71	....	....	....	143·00	14·71	....
	6320E	Edith Joy	....	....	113·50	13·46	....	....	....	150·50	21·21	....
	5472E	Golden Key	....	....	....	....	....	18·27	24·33	432·25	165·02	....
	5159E, etc.	Gold Mines of Kalgoorlie (Aust.), Ltd.	....	....	191,292·00	57,183·63	7,553·32	....	....	2,326,755·30	643,774·90	156,643·87
	5466E	(South Star) G.M.K. of Kalgoorlie, Ltd.	....	....	....	....	....	....	233·46	4,237·43	1,494·78	....
	5466E	Prior to transfer to present holders	....	....	....	....	....	....	5·22	1,835·75	748·78	....
	5159E, etc.	(Lake View South) G.M.K. of Kalgoorlie, Ltd.	....	....	....	....	....	....	....	62,278·38	21,536·66	....
	5692E, etc.	Prior to transfer to present holders	....	....	....	....	....	....	545·23	527,790·53	568,643·05	4,844·50
	5853E, etc.	(Paringa Junction North Leases) G.M.K.	....	....	....	....	....	....	7·82	1,686·79	701·11	....
	5853E	(Paringa Junction)	....	....	....	....	....	....	....	123·75	17·77	....
	5854E	(Paringa Junction North)	....	....	....	....	....	....	....	60·50	10·64	....
	5855E	(Paringa Junction South)	....	....	....	....	....	....	....	1,473·25	228·42	....
	5696E, etc.	Great Boulder Pty. Gold Mines, Ltd.	....	....	409,814·00	106,775·40	58,960·28	....	1·53	10,552,586·97	5,414,940·47	1,163,341·38
	5845E	Happy Returns	....	....	549·00	96·58	....	....	....	7,676·50	1,422·23	....
	5345E, etc.	Kalgoorlie Enterprise Mines, Ltd.	....	....	65,220·09	18,119·24	1,390·37	....	....	884,425·23	271,925·93	25,725·03
		Prior to transfer to present holders	....	....	....	....	....	....	....	15,320·68	8,957·01	....
	4476E, etc.	Lake View and Star, Ltd.	....	....	657,621·00	165,691·12	28,075·85	....	....	11,162,647·30	3,463,281·09	365,763·76
		Prior to transfer to present holders	....	....	....	....	....	....	8·49	15,792,500·38	9,149,223·80	1,348,055·82
	6230E	New Look	....	....	....	....	....	....	....	256·75	22·68	....
	5431E, etc.	North Kalgurli (1912), Ltd.	....	....	253,967·20	61,057·45	10,375·59	....	111·55	3,348,549·17	1,025,078·72	248,574·96
	5405E, etc.	North Kalgurli (1912) Ltd. Croesus Pty. Group	....	....	....	....	....	....	51·20	90,159·00	19,261·22	....
	5891E	(New Croesus)	....	....	....	....	....	....	....	193·00	48·74	....
	5700E	Prior to transfer to present holders	....	....	....	....	....	43·99	....	4,018,436·01	2,815,911·21	97,625·03
	5429E	(North Kalgurli United Mines, Ltd.)	....	....	....	....	....	....	....	4,661·51	928·18	232·93
		Prior to transfer to present holders	....	....	....	....	....	....	....	131·74	76·74	....
	6095E	Raymond	....	....	....	....	....	....	....	255·75	49·19	....
	5695E	South Kalgurli Consolidated, Ltd.	....	....	102,449·22	23,672·99	43·07	....	....	3,110,586·40	1,132,987·42	26,389·19
		Prior to transfer to present holders	....	....	....	....	....	....	....	1,344,254·70	531,792·77	17,722·97
	5716E	Two Bs.	....	....	304·25	48·68	....	....	....	464·25	88·66	....
		Voided leases	....	....	....	....	....	110·97	11,999·04	1,813,479·56	760,206·32	24,046·96
		Sundry claims	....	2·07	11·25	4·92	....	24·58	212·32	11,626·99	4,294·71	....

Cutter's Luck	....	Voided leases	....	....	....	....	....	45·87	133·58	74·50	239·19	....
		Sundry claims	....	....	....	....	....	8·11	501·65	922·90	384·71	....
Feysville	....	Voided leases	....	....	....	....	....	....	110·93	863·30	425·16	....
		Sundry claims	....	....	28·75	4·49	....	....	199·00	1,228·85	644·76	....
Hampton Plains....	P.P.L. 1, etc.	Consolidated Gold Areas, N.L.	....	....	....	....	....	....	....	142,389·98	37,226·58	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. 252	Hampton Properties, Ltd., Mount Martin	....	....	....	....	....	....	....	14,953·75	5,574·11	....
	P.P.L. 460	Hampton Xmas Gift	....	....	....	....	....	6·72	37·57	107·00	89·44	....
	P.P.L. 12	Junction Extended	....	....	....	....	....	....	....	3,581·75	527·74	....
	P.P.L. 255	Lees & Nunn	....	....	16·75	3·06	....	....	....	16·75	3·06	....
	P.P.L. 289	Mount Martin	....	....	....	....	....	....	....	529·00	119·26	....
	P.P.L. 277	New Hope	....	....	....	....	....	....	17·23	61,468·55	11,175·94	....
	P.P.L. 299	C. T. Norris	....	....	34·50	4·22	....	....	....	506·50	130·71	....
	P.P.L. 148	O'Reilly & Andrews	....	....	20·00	4·84	....	....	....	20·00	4·84	....
	P.P.L. 227	Pernatty	....	....	1,926·25	204·38	....	....	....	2,406·75	255·56	....
	P.P.L. 175	F. C. Schoppe	....	....	1,087·00	116·81	....	....	....	6,253·00	867·28	....
	P.P.L. 270	R. J. Taylor	....	....	40·25	11·05	....	....	....	40·25	11·05	....
	P.P.L. 297	R. J. Taylor	....	....	82·50	7·45	....	....	....	82·50	7·45	....
	P.P.L. 179	J. E. Trinidad	....	....	64·00	4·91	....	....	....	64·00	4·91	....
	P.P.L. 371	Victory	....	....	....	....	....	....	....	1,901·75	251·63	....
		Voided leases	....	....	....	....	....	4,578·52	203·94	123,650·84	39,168·43	69·83
		Sundry claims	....	....	53·25	15·07	....	2·68	70·85	46,439·41	8,509·67	....
Kalgoorlie	5927E	A.I.F.	....	....	....	....	....	....	....	101·25	18·02	....
	6048E	Auld Acquaintance	....	....	....	....	....	....	....	7·50	2·36	....
	5913E	Devon Consols	....	....	250·25	57·16	....	....	93·19	2,092·96	667·52	....
	5647E	Golden Cross	....	....	109·75	14·60	....	....	....	109·75	14·60	....
	5510E	Golden Dream	....	....	79·00	6·53	....	....	....	79·00	6·53	....
	5737E	Golden Mile Channel	....	....	....	....	....	....	·97	2,677·25	207·65	....
	5739E	Golden Star	....	....	595·25	66·86	....	....	....	595·25	66·86	....
	5878E	Lady May	....	....	922·00	52·86	....	....	62·05	4,718·25	1,175·42	....
	6091E	Lesanben	....	2·62	249·50	47·89	....	....	174·76	346·50	256·16	....
	6485E	Maritana Hill	....	....	1,139·25	170·46	....	....	....	1,139·25	170·46	....
	4547E, etc.	Mount Charlotte (Kalgoorlie) Gold Mines, Ltd.	....	....	1,705·25	168·04	....	....	....	24,935·25	2,870·69	110·15
		Prior to transfer to present holders	....	....	....	....	....	....	5·72	48,292·60	13,930·79	....
	6321E	North End Extended	....	....	108·00	40·41	....	....	....	108·00	40·41	....
	5852E, etc.	Pedestal Leases	....	....	....	....	....	....	....	1,627·75	456·85	....
	5852E	(Pedestal)	....	....	....	....	....	....	....	1,608·75	444·93	....
	6024E	(Trident)	....	....	....	....	....	....	....	58·75	36·67	....
	5468E	Phar Lap	....	....	794·75	218·08	2·50	....	....	1,387·75	599·04	2·50
	5415E, etc.	Return Leases	....	....	....	....	....	....	5·64	3,801·25	654·34	....
	5449E, etc.	The Broken Hill Pty. Co., Ltd.	....	....	....	139·56	113·07	....	3·99	487,068·01	179,438·71	1,956·35
		Prior to transfer to present holders	....	....	....	....	....	....	....	1,558·49	316·58	....
		Voided leases	....	....	....	....	....	242·48	10,567·16	965,930·80	398,542·65	44,017·12
		Sundry claims	....	2·21	296·75	30·26	....	232·41	1,124·38	60,148·88	23,079·09	....
Wombola	6051E	Big Bull	....	....	109·75	46·20	....	....	....	595·50	432·86	....
	5688E, (5967E)	Caledonian Leases	....	....	....	....	....	....	....	970·00	659·67	....
	5688E	(Caledonian)	....	....	....	....	....	....	....	4,275·00	3,632·98	....
	(5967E)	(North Caledonian)	....	....	....	....	....	....	1·27	22·25	8·15	....

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.	Total Production. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.
EAST COOLGARDIE GOLDFIELD—continued.												
EAST COOLGARDIE DISTRICT—*continued.*												
	5497E, 5500E	Daisy Leases	....	....	1,506·00	1,211·52	....	....	....	6,508·15	4,668·76	5·92
	5497E	(Daisy)	....	....	....	....	....	....	....	6,282·25	5,031·93	....
	5500E	(Happy-Go-Lucky)	....	....	....	....	....	....	....	2,075·25	1,675·85	....
	6032E	Dry Mount	....	....	....	....	....	....	....	1,120·50	1,121·40	....
	6325E	Great Hope	....	....	60·00	22·15	....	....	....	60·00	22·15	....
	5689E, etc.	Haoma Leases	....	....	3,827·00	4,636·26	....	....	....	20,377·50	17,528·56	....
	5689E	(Haoma)	....	....	....	....	....	....	....	2,168·00	1,948·36	....
	5525E	(Xmas Flat)	....	....	....	....	....	....	....	330·25	264·74	....
	6312E	Inverness	....	....	368·75	64·93	....	....	....	1,145·50	218·32	....
	6043E	Launa Doone	....	....	225·25	89·82	....	....	....	1,456·00	655·11	....
	6043E, etc.	(Launa Doone Leases)	....	....	....	....	....	....	....	32·50	42·76	....
	5798E	Maranoa	....	....	....	....	....	....	32·17	3,183·50	1,633·27	....
	5493E	New Milano, N.L.	....	....	....	....	....	....	·25	17,390·75	11,622·24	479·00
	5493E	(Milano)	....	....	....	....	....	....	....	4,012·75	11,676·72	....
	5616E	(Leslie)	....	....	....	....	....	....	....	602·00	939·10	....
	6213E	Pauline	....	....	....	....	....	....	....	195·00	196·39	....
	(6313E)	Proprietary	....	....	....	20·72	....	....	....	100·00	61·40	....
	5866E	Rosemary	....	....	....	....	....	....	....	53·50	84·73	....
	6255E	Spinifex	....	....	88·50	31·01	....	....	....	371·25	106·78	....
		Voided leases	....	....	....	....	....	3·80	2,464·78	26,931·84	39,963·89	....
		Sundry claims	....	....	222·25	88·75	....	....	711·10	23,028·18	14,010·37	....
	From District generally :—											
		Sundry Claims	....	....	....	....	....	11,014·57	465·61	5,440·46	2,541·10	....
	Sundry Parcels treated at :											
		Golden Horseshoe (New), Ltd. (T.L. 101, etc.)	....	....	....	*9,245·59	5,877·10	....	....	....	*329,631·40	331,331·40
		Pericles Cyanide Plant	....	....	....	....	....	....	....	....	*3,982·90	....
		State Battery, Kalgoorlie	....	....	....	*1,388·10	6·84	....	....	360·70	*30,632·79	46·24
		Various Works	....	....	....	....	....	384·36	64·70	41,135·02	*266,773·43	14,114·46
		Reported by Banks and Gold Dealers	10·92	·97	....	127·95	....	16,877·69	9,960·15	355·66	6,786·34	....
		Totals	**10·92**	**7·87**	**1,834,028·85**	**484,753·94**	**121,104·16**	**33,595·51**	**40,830·47**	**63,753,153·44**	**30,375,039·87**	**4,409,534·18**
BULONG DISTRICT.												
Balagundi		Voided leases	....	....	....	....	....	....	2,408·98	1,115·93	1,488·91	12·92
		Sundry claims	....	....	15·00	5·83	....	3·51	293·52	806·01	505·93	....

Bulong	1311Y	Blue Quartz	....	....	52·50	88·39	....	....	....	1,285·00	529·23	....
	1308Y	Southern Cross	....	....	98·25	11·99	....	....	1·30	3,523·75	555·13	....
		Voided leases	....	....	....	....	....	107·54	8,524·82	104,806·80	85,230·44	....
		Sundry claims	....	3·69	313·00	53·99	....	1,655·86	1,611·58	15,960·48	17,643·00	....
Majestic	....	Voided leases	....	....	....	....	....	19·45	63·91	1,317·94	647·62	....
		Sundry claims	....	....	....	....	....	42·88	154·58	1,926·55	948·06	....
Morelands	....	Sundry claims	....	....	....	....	....	....	·13	308·75	81·84	....
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	33,180·35	11,100·46	....
		Sundry claims	....	....	....	....	....	20·70	8·11	4,814·31	1,211·05	....
Taurus	....	Voided leases	....	....	....	....	....	2·06	3·70	1,765·10	909·84	....
		Sundry claims	....	....	48·25	11·93	....	112·69	51·88	2,656·60	1,049·81	....
Trans Find	P.P.L. 308	Dawn of Hope	....	....	....	....	....	....	2·87	1,145·75	330·33	....
		Voided leases	....	....	....	....	....	....	....	1,098·42	876·22	....
		Sundry claims	....	....	....	....	....	....	5·93	808·25	335·33	....
	From District generally :—											
		Various Works	....	....	....	....	....	....	....	6,102·15	6,675·38	....
		Reported by Banks and Gold Dealers	·28	....	....	....	....	25,223·49	70·15	·01	28·44	....
		Totals	**·28**	**3·69**	**527·00**	**172·13**	....	**27,403·78**	**16,032·89**	**184,439·05**	**131,711·60**	**12·92**

Coolgardie Goldfield.

COOLGARDIE DISTRICT.

Bonnievale	(5923)	Guy Fawkes	....	....	11·25	11·16	....	....	....	11·25	11·16	....
	5622	Lucky Hit	....	....	23·50	19·24	....	....	3·28	945·60	491·59	....
	4600	Melva Maie	....	....	90·00	64·66	....	....	....	2,492·40	3,642·25	2·35
		Prior to transfer to present holders	....	....	....	....	....	....	....	614·50	1,099·21	11·63
	5890	Rayjax	....	....	43·00	99·27	....	....	....	53·50	118·42	....
	5767, 5768	Victory Explorations, N.L.	....	....	77·75	7·19	....	....	....	3,112·00	756·34	....
	5767	(Red Ridge)	....	....	....	....	....	....	....	108·00	53·63	....
		Voided leases	....	....	....	....	....	....	212·48	354,465·72	190,445·76	5·88
		Sundry claims	....	....	132·50	43·73	....	....	163·19	7,435·13	5,131·45	·04
Bulla Bulling	....	Voided leases	....	....	....	....	....	....	....	776·81	668·19	....
		Sundry claims	....	....	193·00	46·86	....	5·21	15·98	1,650·26	656·86	....
Burbanks	5605	Burbanks Deeps	....	....	....	....	....	....	....	103·00	53·46	....
	5685	Lady Robinson	....	....	66·75	11·41	....	....	....	86·50	14·85	....
	5956	Lord Bobs	....	....	34·50	11·98	....	....	....	34·50	11·98	....
	5872	Vice Regal	....	....	45·75	5·99	....	....	....	60·50	10·09	....
		Voided leases	....	....	....	....	....	14·90	374·17	420,153·21	306,332·12	521·06
		Sundry claims	....	2·11	298·25	41·82	....	55·05	489·57	15,658·35	8,825·06	....

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953.					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 lb.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.).	Fine ozs.	Fine ozs.
COOLGARDIE GOLDFIELD—continued.												
COOLGARDIE DISTRICT—*continued.*												
Cave Rocks		Voided leases	....	....	....	....	....	....	....	8,223·16	1,941·42	....
		Sundry claims	....	....	130·50	14·93	....	....	50·00	4,473·65	1,082·79	....
Coolgardie	5679	Ada	....	....	97·20	10·81	....	....	....	1,426·95	143·69	....
	5876	Bayley's West	....	....	6·25	2·22	....	....	....	6·25	2·22	....
	(5875)	Dugans	....	....	16·00	2·09	....	....	....	36·00	3·04	....
	5868	El Dorado	....	....	17·75	4·90	....	....	498·20	104·20	1,022·96	....
	5878	Ellen Jean	....	....	186·00	40·25	·69	....	....	227·50	52·98	·69
	5844	Jack Pot	....	....	934·25	489·87	....	....	....	2,847·25	1,247·53	....
	5643	Lloyd George South	....	....	....	....	....	....	....	....	10·25	....
	5884	Lone Hand	....	·75	212·25	23·47	....	....	·75	212·25	23·47	....
	5907	Lucky Star	....	....	21·50	1·51	....	....	....	21·50	1·51	....
	5881	MacPherson's Reward	....	....	540·00	200·45	....	....	....	547·25	204·36	....
	5743	Moya Jan	....	....	129·00	62·61	....	....	....	2,205·00	908·09	....
	5912	Ruin Ridge	....	....	65·25	4·02	....	....	....	65·25	4·02	....
	5914	Sydenham	....	....	14·25	3·56	....	....	....	14·25	3·56	....
		Voided leases	....	....	....	....	....	1,301·71	4,763·64	1,104,651·04	447,586·98	4,818·90
		Sundry claims	....	2·49	1,213·59	165·86	....	205·49	2,710·75	71,113·64	26,891·07	....
Eundynie	(5867)	Old Dodge	....	....	....	....	....	....	....	17·00	5·28	....
		Voided leases	....	....	....	....	....	3·70	16·09	31,755·98	16,526·06	1·75
		Sundry claims	....	....	....	....	....	....	82·28	694·12	468·01	....
Gibraltar	5723	Lloyd George	....	....	100·00	11·20	....	....	....	670·00	169·18	....
	5684	Winston Churchill	....	....	....	....	....	....	....	60·00	12·96	....
		Voided leases	....	....	....	....	....	....	33·97	38,592·63	20,097·49	....
		Sundry claims	....	....	....	....	....	1·39	50·76	3,270·10	1,390·47	....
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. 462	Bobby Dazzler	....	....	....	....	....	....	28·55	31·37	301·45	....
	P.P.L. 419	Chatanooka	....	....	....	....	....	....	....	1,267·75	295·73	1·10
	P.P.L. 338	Dry Hill	....	....	....	....	....	....	....	43·00	58·42	....
	P.P.L. 21	Eva	....	....	24·25	6·08	....	....	....	24·25	6·08	....
	P.P.L. 454	Golden Dollar	....	....	....	·34	....	....	....	105·50	13·66	....
	P.P.L. 434	Locker & Dempster	....	....	11·75	3·66	....	....	....	11·75	3·66	....
	P.P.L. 319	Lady May	....	....	....	....	....	....	....	1,742·25	981·39	....
	P.P.L. 316, 330	New Coolgardie Gold Mines, N.L.	....	....	39,570·00	17,176·16	6,622·30	....	....	174,978·00	83,205·24	21,565·81

	P.P.L. 316	(Surprise G.M.)	....	....	....	....	....	....	....	....	7,189·00	3,425·59	....
	P.P.L. 330	(Barbara)	....	....	....	....	....	....	....	....	2,157·75	1,655·63	....
	P.P.L. 464	E. Scahill	....	....	15·75	17·56	....	....	....	....	15·75	17·56	....
		Voided leases	....	....	....	....	....	....	451·32	13,877·34	11,085·93	....
		Sundry claims	....	....	33·75	23·37	....	1·63	132·06	1,853·25	838·06	....
Higginsville	5647	Fair Play Gold Mine	....	....	....	....	....	....	....	28,276·00	3,123·82	·02
	5877	Sons of Erin	....	....	20·00	8·44	....	....	....	20·00	8·44	....
	5293	Two Boys	....	....	....	24·00	....	....	....	360·00	*1,260·43	·01
	5293	(Two Boys)	....	....	....	....	....	....	....	6,888·00	3,193·95	....
		Voided leases	....	....	....	....	....	....	373·93	38,141·35	17,438·49	159·50
		Sundry claims	....	....	16·50	8·76	....	....	187·25	3,654·76	1,951·40	....
Larkinville	....	Voided leases	....	....	....	....	....	22·77	54·44	2,335·16	3,256·49	....
		Sundry claims	....	....	....	....	....	....	147·20	448·53	1,029·03	....
Logans	5324, etc.	Spargo's Reward Gold Mine (1935), N.L.	....	....	....	....	....	....	....	105,397·50	26,320·67	....
		Voided leases	....	....	....	....	....	....	....	1,263·31	607·26	....
		Sundry claims	....	....	....	....	....	6·88	128·95	1,958·85	905·45	....
Londonderry	....	Voided leases	....	....	....	....	....	....	95·04	34,155·35	22,238·37	·35
		Sundry claims	....	....	98·50	13·48	....	16·68	38·72	3,499·42	2,503·05	22·42
Mungari	....	Voided leases	....	....	....	....	....	....	17·71	1,872·50	458·43	....
		Sundry claims	....	....	299·75	45·43	....	1·77	153·24	2,787·94	750·54	....
Paris	(5311), 5500	Lister's Gold Mine	....	....	....	....	....	·88	....	5,460·00	3,563·29	75·95
	(5311), 5500, (5530)	(Lister's Gold Mine)	....	....	....	....	....	....	....	8,582·00	4,423·84	....
	5500	(Paris Central)	....	....	....	....	....	....	....	113·00	24·16	....
	5873	Paris West	....	....	19·00	11·03	....	....	....	19·00	11·03	....
		Voided leases	....	....	....	....	....	....	4·30	1,342·00	614·08	3·24
		Sundry claims	....	....	....	....	....	....	....	2,104·25	518·98	....
Red Hill	....	Voided leases	....	....	....	....	....	14·87	1,551·81	40,797·40	31,070·65	....
		Sundry claims	....	....	....	....	....	15·29	90·33	1,403·14	999·97	....
Ryan's Find	....	Voided leases	....	....	....	....	....	....	....	54·16	151·69	....
		Sundry claims	....	....	....	....	....	....	·44	116·44	355·83	....
St. Ives	5628, etc.	Ives Reward Leases	....	....	....	....	....	....	....	1,617·00	450·47	....
		Voided leases	....	....	....	....	....	63·34	146·87	37,701·46	15,756·31	....
		Sundry claims	....	....	....	....	....	211·25	944·85	4,177·56	1,459·39	....
Wannaway	....	Voided leases	....	....	....	....	....	....	28·61	1,831·95	1,465·70	....
		Sundry claims	....	....	....	....	....	....	193·79	1,316·37	1,300·33	....
Widgemooltha	(5794)	Blue Bird	....	....	....	....	....	....	137·76	40·69	121·62	....
	5663	Bobs	....	....	....	....	....	....	....	16·00	4·94	....
	5834	Harpers	....	....	·30	18·45	....	....	9·54	40·00	93·06	....
	5451	Host Group	....	....	....	....	....	....	12·75	1,604·15	565·02	....
		Voided leases	....	....	....	....	....	17·95	1,114·94	22,687·12	11,843·73	·17
		Sundry claims	....	....	24·25	16·57	....	46·49	456·07	16,157·36	6,822·05	·07

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953.					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 lb.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.).	Fine ozs.	Fine ozs.
COOLGARDIE GOLDFIELD—continued.												
COOLGARDIE DISTRICT—*continued.*												
From District generally :—												
Sundry Parcels treated at :—												
State Battery, Coolgardie			....	....	....	*605·18	7·35	....	....	771·01	*37,310·24	17·00
Australian Machinery & Investment Co., Ltd. Cyanide Plant (T.Ls 63, 127)			....	....	....	....	....	....	....	....	*3,044·44	86·31
T. James (T.A. 201)			....	....	70·00	*95·40	....	....	....	337·00	*318·89	....
Lister's Cyanide Plant			....	....	....	....	....	....	....	....	*269·23	....
Paris Central Cyanide Plant			....	....	....	....	....	....	....	....	*77·64	....
J. Seymour			....	....	....	*5·71	....	....	....	....	*5·71	....
Various Works			....	....	....	....	....	7·75	....	3,897·61	*29,382·24	223·06
Reported by Banks and Gold Dealers			25·48	....	....	48·70	·05	14,905·72	718·84	48·25	123·65	·65
Totals			**25·48**	**5·35**	**44,903·84**	**19,529·38**	**6,630·39**	**16,920·72**	**16,703·27**	**2,669,504·60**	**1,379,049·99**	**27,517·96**
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	6,075·13	2,177·23	....
Chadwin	....	Voided leases	....	....	....	....	....	....	....	4,781·55	5,232·25	2·50
		Sundry claims	....	....	....	....	....	14·28	78·02	5,924·05	2,923·42	·25
Dunnsville	....	Voided leases	....	....	....	....	....	....	828·58	17,548·85	8,657·45	....
		Sundry claims	17·65	....	137·50	20·64	....	21·00	1,034·08	2,862·56	2,052·45	....
Jourdie Hills	....	Voided leases	....	....	....	....	....	....	18·00	28,009·74	19,401·09	28·45
		Sundry claims	....	....	....	....	....	1·86	49·81	1,769·00	831·28	1·05
Kintore	1036S	Newhaven	....	....	....	....	....	....	....	1,886·25	453·88	....
		Voided leases	....	....	....	....	....	18·70	169·33	54,829·39	39,579·50	677·88
		Sundry claims	....	....	2·00	2·50	....	111·91	102·70	4,524·78	2,503·91	....
Kunanalling	....	Voided leases	....	....	....	....	....	86·13	1,734·92	130,303·61	100,812·73	40·77
		Sundry claims	....	....	....	....	....	216·53	815·28	14,659·92	9,577·42	....

Kudana	....	Voided leases	....	....	....	....	....	....	....	....	465·00	68·12	....
		Sundry claims	....	....	....	....	....	....	....	....	475·25	60·38	....
	From District generally :—												
	Sundry Parcels treated at :—												
	Goldfields Australian Development Cyanide Plant		....	....	....	....	....	....	....	....	....	*548·07	....
	Various Works		....	....	....	....	....	42·23	....	1,782·26	*5,061·33	....	
	Reported by Banks and Gold Dealers		....	....	....	....	....	866·02	17·93	....	5·85		·49
	Totals		**17·65**	....	**139·50**	**23·14**	....	**1,514·74**	**5,630·59**	**361,825·20**	**252,327·38**	**751·39**	

Yilgarn Goldfield.

Blackbournes	....	Voided leases	....	....	....	....	....	....	....	1,282·50	341·37	....
		Sundry claims	....	....	....	....	....	....	....	392·50	81·15	....
Bullfinch	3350, etc.	Great Western Consolidated, N.L.	....	....	392,508·00	50,192·16	16,767·88	....	....	422,651·00	52,326·60	17,535·20
		Prior to transfer to present holders			....	....	....	....	64·80	78,404·34	24,644·88	....
	4287	Volcano	....	....	....	....	....	....	....	87·00	98·68	....
		Voided leases	....	....	....	....	....	....	10·14	490,361·07	185,489·03	27,958·41
		Sundry claims	....	....	22·00	8·73	....	8·47	37·04	7,464·75	4,056·14	....
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	....
	4180	Deliverance	....	....	....	....	....	....	....	480·00	167·55	....
		Voided leases	....	....	....	....	....	....	23·46	138,241·40	33,293·21	....
		Sundry claims	....	....	....	....	....	....	2·68	1,088·35	640·61	....
Eenuin	4020	Birthday	....	....	....	....	....	....	2·25	45·00	194·94	·01
	(3936)	Newfield Central	....	....	....	....	....	....	....	343·00	526·82	....
	(3936, etc.)	Yellowdine Gold Areas, N.L.	....	....	....	....	....	....	....	7,341·50	7,605·06	....
		Voided leases	....	....	....	....	....	....	179·49	2,308·56	2,131·10	....
		Sundry claims	....	....	24·00	27·39	....	2·50	73·97	2,610·60	1,817·79	....
Evanston	3868, etc.	Evanston Gold, N.L.	....	....	....	....	....	....	....	12,399·20	5,530·12	....
	3868	(Evanston)	....	....	....	....	....	....	....	48,125·30	25,848·30	10·14
	3870	(Evanston, East)	....	....	....	....	....	....	....	34·00	13·59	....
	3888	(Goldies)	....	....	....	....	....	....	....	200·00	43·15	....
	3895	(Blue Peter)....	....	....	....	....	....	....	....	1,288·00	285·84	....
		Voided leases	....	....	....	....	....	....	79·27	2,486·56	1,470·88	....
		Sundry claims	....	....	....	....	....	4·98	....	638·35	159·55	....
Forrestonia	....	Voided leases	....	....	....	....	....	....	....	1,185·00	298·15	....
		Sundry claims	....	....	....	....	....	....	....	372·00	141·78	....
Golden Valley	4173	Inspiration	....	....	23·00	32·54	....	....	....	206·00	310·47	....
	4247	Lilly of the Valley	....	....	148·00	40·94	....	....	....	518·00	120·32	....
	4220	Manxman South	....	....	19·00	4·42	....	....	....	19·00	4·42	....
	2994, etc.	Radio Leases	....	....	840·00	780·09	....	....	2·70	27,035·80	48,119·85	667·86
		Voided leases	....	....	....	....	....	....	36·34	36,545·92	28,509·40	10·99
		Sundry claims	....	....	....	....	....	4·58	237·85	6,631·27	4,908·99	1·02

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953.					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 lb.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.).	Fine ozs.	Fine ozs.
YILGARN GOLDFIELDS—continued.												
Greenmount	72P.P.	Black and White	....	....	....	....	....	....	....	105·00	10·36	....
		Voided leases	....	....	....	....	....	45·99	21·62	125,022·64	31,575·09	944·50
		Sundry claims	....	....	16·00	2·66	....	·46	4·27	3,072·58	813·96	....
Holleton	37P.P.	Brattania	....	....	190·00	121·47	....	....	....	1,716·00	1,552·70	....
	(4317)	Felstead's Reward	....	....	80·00	6·30	....	....	....	80·00	6·30	....
	(4169)	Holleton East	....	....	....	24·14	2·01	....	....	223·00	104·06	2·16
		Voided leases	....	....	....	....	....	....	9·33	44,700·25	13,037·52	34·53
		Sundry claims	....	....	....	....	....	....	3·75	3,464·05	923·78	·20
Hope's Hill	3414	Pilot	....	....	....	....	....	....	....	19,446·12	2,948·68	....
		Voided leases	....	....	....	....	....	....	74·78	132,660·55	36,462·02	1·00
		Sundry claims			....	....	....	18·67	44·35	4,600·52	1,417·83	....
Kennyville	3875	Victoria	....	....	....	....	....	....	....	5,084·00	1,126·96	·63
		Voided leases	....	....	....	....	....	....	18·76	55,876·63	21,625·66	·59
		Sundry claims	....	....	....	....	....	....	5·06	8,598·50	2,302·77	....
Koolyanobbing	....	Voided leases	....	....	....	....	....	....	·99	1,768·05	972·77	....
		Sundry lcaims	....	....	....	....	....	·26	17·33	656·10	329·20	....
Marvel Loch	4243	Christmas Gift	....	....	....	....	....	....	32·56	23·00	39·21	....
	13P.P.	Cricket	....	....	....	....	....	....	....	1,655·00	929·17	....
	4039	Cromwell	....	....	....	....	....	....	....	633·00	98·46	....
	3942, etc.	Edward's Reward Leases	....	....	6,612·00	2,702·98	....	....	....	55,493·50	24,738·74	....
	3942	(Edward's Reward)	....	....	....	....	....	....	....	2,080·00	2,016·32	....
	3943	(Sunshine)	....	....	....	....	....	....	....	3,866·00	2,384·79	....
	4034	Firelight	....	....	....	....	....	....	2·68	6,653·75	940·03	....
	3724	Francis Firness	....	....	725·00	396·11	....	....	....	12,597·75	5,754·40	....
	(4254)	Golden Cube	....	....	....	....	....	....	....	79·00	17·16	....
	(4336)	Jacolleti	....	....	....	....	....	....	....	43·00	4·36	....
	3718	Kurrajong	....	....	....	....	....	....	....	9,221·00	3,271·73	....
	3914	May	....	....	....	....	....	....	....	145·00	45·86	....
	4230	May Queen	....	....	....	....	....	....	....	286·00	43·42	....
	3970	Mountain Queen	....	....	....	....	....	....	....	1,201·00	451·85	....
	3390, etc.	N.G.M., Ltd.	....	....	....	....	....	....	....	4,369·22	409·06	2·00
		Prior to transfer to present holders	....	....	....	....	....	....	....	2,675·00	459·60	....
	(4068)	Try Again	....	....	....	....	....	....	9·49	1,960·00	570·85	....
	4035	Undaunted	....	....	....	....	....	....	....	865·00	113·59	....

	4251	Union Jack	....	....	....	....	....	....	....	2,175·00	182·17	....
		Voided leases	....	....	....	....	....	....	1,494·77	848,586·26	205,208·01	2,472·95
		Sundry claims	....	....	100·00	10·25	....	11·35	230·20	35,171·61	13,173·98	·02
Mt. Jackson	....	Voided leases	....	....	....	....	....	....	180·85	55,166·78	39,927·52	2,313·77
		Sundry claims	....	....	....	....	....	6·44	52·87	10,936·95	4,879·54	70·74
Mt. Palmer	M.L. 4	Yellowdine Gold Dev., Pty., Ltd., (in Liq.)	....	....	14·00	50·20	....	....	....	93·00	136·46	....
		Voided leases	....	....	....	....	....	....	....	306,408·40	158,486·81	....
		Sundry claims	....	....	....	....	....	1,643·48	18·19	450·25	387·14	....
Mt. Rankin	76P.P.	Majorie Glen Reward	....	....	450·00	764·96	....	....	....	488·00	849·02	....
	3555	No Trumps	....	....	....	....	....	....	....	5,562·37	853·06	....
		Voided leases	....	....	....	....	....	3·84	5·20	496·00	122·17	....
		Sundry claims	....	....	....	....	....	....	....	606·00	221·86	....
Parker's Range	4348	Centepede	....	....	132·00	69·69	....	....	....	132·00	69·69	....
	(4333)	Snowdrop	....	....	....	....	....	....	3·73	10·50	10·23	....
		Voided leases	....	....	....	....	....	·42	266·75	62,737·85	32,399·58	26·46
		Sundry claims	....	....	94·00	52·17	....	6·59	303·93	11,808·30	5,205·13	·08
Southern Cross	4082	Day Dawn	....	....	....	....	....	....	....	86·00	9·16	....
	4018	Fraser's	....	....	....	....	....	....	....	1,376·50	164·49	....
	3944	Nil Desperandum	....	....	....	....	....	....	....	1,533·00	216·77	....
	3444, etc.	Western Mining Corporation	....	....	....	....	....	....	....	568·00	92·63	....
	3444, etc.	(Three Boys Gold Mines, Ltd.)	....	....	....	....	....	....	....	10,157·00	1,392·95	1·26
	3444	(Three Boys)	....	....	....	....	....	....	....	4,180·00	727·75	....
	3934	(Three Boys North)	....	....	....	....	....	....	....	106·00	14·66	....
	3981	(Three Kings)	....	....	....	....	....	....	....	104·00	10·01	....
	3444, etc.	(Yellowdine Options, N.L.)	....	....	....	....	....	....	....	8,074·25	2,000·29	....
		Voided leases	....	....	....	....	....	4·89	261·35	454,906·68	215,351·50	364·41
		Sundry Claims	....	....	10·00	2·21	....	95·90	648·49	8,183·66	2,626·86	....
Westonia	4326	Consols	....	....	49·00	20·09	....	....	....	718·00	453·47	....
	(4252)	Corio	....	....	....	....	....	....	....	320·00	148·40	9·80
		Voided leases	....	....	....	....	....	....	4·06	595,704·64	380,726·05	5,094·27
		Sundry claims	....	....	41·00	47·77	....	9·51	64·96	4,200·76	2,963·73	·72
	From District generally :—											
	Sundry Parcels treated at :—											
	Butcher Bird Battery (M.A. 43)	....	....	....	....	....	....	....	....	....	*170·06	....
	Holleton Cyanide Plant	....	....	....	....	....	....	....	....	....	*880·71	48·05
	Kurrajong Battery	....	....	....	....	....	....	....	....	....	*409·57	....
	Mt. Palmer Cyanide Plant	....	....	....	*222·65	....	....	....	....	....	*236·57	....
	Pilot Cyanide Plant	....	....	....	....	....	....	....	....	30·00	*3,753·59	....
	State Battery, Marvel Loch	....	....	....	*3·74	....	....	....	....	29·00	*526·38	....
	Three Boys Cyanide Plant	....	....	....	45·23	....	....	....	....	7·00	*3,457·32	....
	Various Works	....	....	....	....	....	....	....	....	341·48	*97,552·15	57·35
	Reported by Banks and Gold Dealers	1·22	....	....	....	....	318·99	71·73	·60	116·72	....
	Totals	**1·22**	....	**402,097·00**	**55,628·89**	**16,769·89**	**2,187·32**	**4,602·04**	**4,247,577·60**	**1,768,840·19**	**57,629·12**

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1953. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons. (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.	Total Production. Alluvial. Fine ozs.	Dollied and Specimens. Fine ozs.	Ore treated. Tons. (2,240 lb.).	Gold therefrom. Fine ozs.	Silver. Fine ozs.
Dundas Goldfield.												
Buldania	....	Voided leases	....	....	....	....	....	....	3·02	846·05	708·99	....
		Sundry claims	....	....	....	....	....	....	39·25	1,324·27	861·36	·72
Dundas	1860	Coronation	....	....	31·50	6·65	....	....	....	31·50	6·65	....
		Voided leases	....	....	....	....	....	1·88	28·02	6,103·48	2,545·38	155·02
		Sundry claims	....	....	....	....	....	·76	413·85	2,086·75	1,101·23	18·32
Norseman	1596	Abbotshall	....	....	....	....	....	....	....	2,511·45	1,096·71	754·37
	1468	Bronzewing	....	....	....	....	....	....	33·89	4,168·75	2,532·36	154·78
	1422, 1468	(Onkaparinga Leases)	....	....	....	....	....	....	....	698·00	831·67	3·62
	1617	Caesar	....	....	....	....	....	....	....	54·00	42·72	....
	1288, etc.	Central Norseman Gold Corp., N.L.	....	....	155,451·00	73,869·43	55,863·05	....	....	1,845,724·20	676,375·97	572,536·80
		Prior to transfer to present holders	....	....	....	....	....	....	1,663·32	69,819·83	47,892·08	16,508·85
	(1421)	Dundas Gold Mines, N.L.	....	....	....	....	....	....	....	6,544·25	3,557·41	885·72
	(1421)	(Empress Gold Mines, N.L.)	....	....	....	....	....	....	....	567·50	516·08	54·61
	(1718)	Iron Duke	....	....	....	....	....	....	....	493·50	167·27	....
	1859	Mt. Barker	....	....	14·50	2·94	·19	....	....	14·50	2·94	·19
	1315, etc.	Norseman Gold Mines, N.L.	....	....	....	....	....	....	....	964,099·00	240,900·95	353,206·54
		Prior to transfer to present holders	....	....	....	....	....	....	....	20,657·00	3,909·60	4,981·00
	1823	Sun	....	....	660·00	290·28	6·05	....	....	1,817·75	827·70	24·90
	1624	Valhalla	....	....	....	....	....	....	....	626·00	405·90	21·77
		Voided leases	....	....	....	....	....	14·27	10,567·26	898,178·97	591,772·71	37,101·27
		Sundry claims	....	....	171·75	46·53	·69	1,052·09	3,402·99	47,179·20	22,194·93	200·64
Peninsula	....	Voided leases	....	....	....	....	....	....	24·29	9,603·39	6,102·61	12·20
		Sundry claims	....	....	....	....	....	....	....	217·25	119·32	·97
	From District generally :—											
	Sundry Parcels treated at :—											
	State Battery, Norseman	....	....	....	....	....	....	....	....	417·89	*25,351·51	1,051·13
	Various Works	....	....	....	....	....	....	....	54·52	760·64	15,104·14	2,588·35
	Reported by Banks and Gold Dealers	....	....	....	....	....	1,181·77	48·76	47·50	18·62	·70
	Totals	....	....	**156,328·75**	**74,134·83**	**55,869·98**	**2,250·77**	**16,279·17**	**3,884,592·62**	**1,644,946·81**	**990,262·47**

Phillips River Goldfield.

Hatter's Hill	(274)	Beulah	....	....	....	....	....	....	....	65·00	4·10	....
	(269)	Jimmy Bob	....	....	....	....	....	....	....	35·00	35·87	....
		Voided leases	....	....	....	....	....	....	4·38	1,499·55	1,182·75	....
		Sundry claims	....	....	....	....	....	74·91	24·26	5,225·60	2,720·90	26·09
Kundip	263	Hillsborough	....	....	....	6·66	·74	....	....	258·00	65·75	19·33
		Voided leases	....	....	....	....	....	113·28	556·17	84,866·58	60,584·54	4,008·81
		Sundry claims	....	....	....	....	....	90·27	73·02	6,434·68	1,951·87	54·65
Mt. Desmond	....	Voided leases	....	....	....	....	....	....	1·40	9·00	*3,905·46	6,891·59
		Sundry claims	....	....	....	....	....	....	....	80·00	41·96	51·01
Ravensthorpe	....	Voided leases	....	....	....	....	....	....	141·80	24,723·55	26,070·94	4,384·07
		Sundry claims	....	....	....	....	....	163·96	7·68	7,261·57	3,195·67	41·12
West River	....	Voided leases	....	....	....	....	....	....	....	....	10·34	31·06
		Sundry claims	....	....	....	....	....	....	....	....	6·60	3·44
	From District generally :—											
	Sundry Parcels treated at :—											
	Cordingup Copper Smelter	....	....	....	....	....	....	....	....	....	*46·08	8·89
	Floater Cyanide Works	....	....	....	....	....	....	....	....	12·00	*245·95	....
	Hatter's Hill Cyanide Plant	....	....	....	....	....	....	....	....	....	*361·37	....
	F. E. Daw	....	....	....	*55·40	....	....	....	....	....	*55·40	....
	Ravensthorpe Sands Pty., Ltd.	....	....	....	*417·18	....	....	....	....	....	*603·65	5·72
	Various Works	....	....	....	....	....	....	....	....	15·00	2,857·28	500·82
	Reported by Banks and Gold Dealers	....	....	....	....	....	164·69	12·14	....	4·76	....
	Totals	....	....	....	**479·24**	**·74**	**607·11**	**820·85**	**130,485·53**	**103,951·24**	**16,026·60**

OUTSIDE PROCLAIMED GOLDFIELD.

Burracoppin	....	Voided leases	....	....	....	....	....	....	....	710·85	706·38	....
		Sundry claims	....	....	....	....	....	....	·98	372·75	213·97	....
Donnybrook	....	Voided leases	....	....	....	....	....	23·24	....	1,613·30	816·23	....
		Sundry claims	....	....	....	....	....	44·01	43·03	119·50	15·71	15·18
Jimperding	1PP Avon	Hillsdale	....	....	....	....	....	....	....	1,261·75	308·00	....
Northampton	....	Sundry lead claims	....	....	....	....	†146·71	....	....	....	....	†1,648·08
Ongerup	....	Sundry claims	....	....	....	....	....	....	1·58	·33	1·74	....
	From State generally :—											
	Miscellaneous Voided Leases and Sundry Claims	....	....	....	....	....	245·83	3·07	210·35	45·19	....
	Sundry Specimens	....	....	....	....	....	4·24	56·85	....	....	....
	Various Works	....	....	....	....	....	....	....	27·00	*9,009·75	31,521·73
	Reported by Banks and Gold Dealers	2·66	19·69	....	16·46	....	1,103·99	911·42	....	316·21	404·26
	Totals	**2·66**	**19·69**	....	**16·46**	**146·71**	**1,421·31**	**1,016·93**	**4,315·83**	**11,433·18**	**33,589·25**

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 1953.

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 lb.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.).	Fine ozs.	Fine ozs.	Fine ozs.
Kimberley	....	....	....	....	....	....	....	151·74	60·51	52·50	26·27	238·52	....
West Kimberley	....	....	....	....	....	....	....	....	....	....	....	....	3,820·29
Pilbara	Marble Bar	53·52	51·68	5,896·00	3,082·74	3,187·94	5,871·05	74·28	266·16	8,973·15	7,633·16	7,973·60	6,211·18
	Nullagine	20·76	214·48	3,077·15	4,550·42	4,785·66	340·13						
West Pilbara	....	....	....	....	....	....	....	....	3·80	....		3·80	28·25
Ashburton	....	....	....	....	....	....	....	·62	....	43·00	83·17	83·79	5,237·67
Gascoyne	....	....	....	....	....	....	....	....	....	....	....	....	....
Peak Hill	....	....	....	....	....	....	....	1·00	....	55,488·50	9,012·57	9,013·57	624·36
East Murchison	Lawlers	....	....	259·00	136·36	136·36	....						
	Wiluna	....	6·74	87·00	433·83	440·57	1·00	....	6·74	346·00	1,192·51	1,199·25	2·49
	Black Range	....	....	....	622·32	622·32	1·49						
Murchison	Cue	2·28	29·85	403,916·35	54,749·89	54,782·02	15,978·46						
	Meekatharra	191·04	202·84	6,244·30	3,065·04	3,458·92	9·55						
	Day Dawn	1·36	2·51	1,671·75	727·17	731·04	27·09	199·70	235·20	496,112·40	100,595·15	101,030·05	17,196·10
	Mt. Magnet	5·02	....	84,280·00	42,053·05	42,058·07	1,181·00						
Yalgoo	....	....	....	....	....	....	....	·63	11·26	338·55	410·81	422·70	·43
Mt. Margaret	Mt. Morgans	24·67	6·05	1,510·75	717·73	748·45	9·52						
	Mt. Malcolm	7·79	3·86	101,372·00	26,228·34	26,239·99	2,080·16	38·46	22·11	106,176·10	29,079·08	29,139·65	2,326·38
	Mt. Margaret	6·00	12·20	3,293·35	2,133·01	2,151·21	236·70						
North Coolgardie	Menzies	21·23	88·51	24,066·50	14,336·30	14,446·04	....						
	Ularring	....	....	32,313·25	18,196·50	18,196·50	5,074·35	21·23	108·38	58,923·50	36,329·41	36,459·02	5,397·53
	Niagara	....	....	412·75	1,888·47	1,888·47	....						
	Yerilla	....	19·87	2,131·00	1,908·14	1,928·01	323·18						
Broad Arrow	....	....	....	....	....	....	....	4·22	31·77	4,505·25	2,514·21	2,550·20	2·50
N.E. Coolgardie	Kanowna	6·34	·44	891·25	377·31	384·09	....	6·34	·44	891·25	377·31	384·09	....
	Kurnalpi	....	....	....	....	....	....						
East Coolgardie	East Coolgardie	10·92	7·87	1,834,028·85	484,753·94	484,772·73	121,104·16	11·20	11·56	1,834,555·85	484,926·07	484,948·83	121,104·16
	Bulong	·28	3·69	527·00	172·13	176·10	....						
Coolgardie	Coolgardie	25·48	5·35	44,903·84	19,529·38	19,560·21	6,630·39	43·13	5·35	45,043·34	19,552·52	19,601·00	6,630·39
	Kunanalling	17·65	....	139·50	23·14	40·79	....						
Yilgarn	....	....	....	....	....	....	....	1·22	....	402,097·00	55,628·89	55,630·11	16,769·89
Dundas	....	....	....	....	....	....	....	....	....	156,328·75	74,134·83	74,134·83	55,869·98
Phillips River	....	....	....	....	....	....	....	....	....	....	479·24	479·24	·74
Outside Proclaimed Goldfields	....	....	....	....	....	....	....	2·66	19·69	....	16·46	38·81	146·71
		....	....	....	....	....	....	556·43	782·97	3,169,875·14	821,991·66	823,331·06	241,369·05

61988—(12)

TABLE III.

Return showing total production reported to the Mines Department, and respective Districts and Goldfields from whence derived, to 31st December, 1953.

Goldfield.	District.	District. Alluvial.	District. Dollied and Specimens.	District. Ore treated.	District. Gold therefrom.	District. Total Gold.	District. Silver.	Goldfield. Alluvial.	Goldfield. Dollied and Specimens.	Goldfield. Ore treated.	Goldfield. Gold therefrom.	Goldfield. Total Gold.	Goldfield. Silver.
		Fine ozs.	Fine ozs.	Tons (2,240 lb.).	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.).	Fine ozs.	Fine ozs.	Fine ozs.
Kimberley	....	....	....	....	....	....	....	8,882·46	2,498·93	22,641·90	17,145·82	28,527·21	128·76
West Kimberley	....	....	....	....	....	....	....	1·30	24·68	1·00	2·49	28·47	11,456·85
Pilbara	Marble Bar	15,145·99	4,530·94	326,098·67	321,585·65	341,262·58	19,490·14	25,387·04	6,947·49	449,967·98	444,353·57	476,688·10	19,987·54
	Nullagine	10,241·05	2,416·55	123,869·31	122,767·92	135,425·52	497·40						
West Pilbara	....	....	....	....	....	....	....	6,313·31	374·67	24,680·96	24,200·90	30,888·88	1,880·49
Ashburton	....	....	....	....	....	....	....	9,262·77	479·40	6,728·10	2,810·44	12,552·61	36,351·14
Gascoyne	....	....	....	....	....	....	....	693·44	41·57	387·00	517·29	1,252·30	....
Peak Hill	....	....	....	....	....	....	....	3,376·86	5,300·33	714,743·93	311,370·52	320,047·71	3,400·96
East Murchison	Lawlers	6,904·30	2,343·19	2,011,033·92	822,630·68	831,878·17	26,290·77	8,764·26	22,119·10	12,612,979·83	3,647,388·12	3,678,271·48	59,068·71
	Wiluna	224·85	1,254·11	8,873,357·94	1,871,687·38	1,873,166·34	10,282·38						
	Black Range	1,635·11	18,521·80	1,728,587·97	953,070·06	973,226·97	22,495·56						
Murchison	Cue	5,074·71	8,838·18	6,382,613·94	1,331,840·63	1,345,753·52	255,458·22	25,386·14	58,461·96	12,488,517·98	4,795,013·15	4,878,861·25	435,545·06
	Meekatharra	14,510·35	17,848·40	2,277,403·01	1,301,704·92	1,334,063·67	5,070·25						
	Day Dawn	3,235·29	11,341·63	2,032,197·88	1,374,338·42	1,388,915·34	169,393·16						
	Mt. Magnet	2,565·79	20,433·75	1,796,303·15	787,129·18	810,128·72	5,623·43						
Yalgoo	....	....	....	....	....	....	....	1,786·09	3,212·57	441,403·83	263,534·74	268,533·40	1,502·56
Mt. Margaret	Mt. Morgans	3,459·04	9,359·82	1,211,676·96	715,723·77	728,542·63	5,791·16	11,286·24	33,192·36	10,161,910·29	4,651,339·12	4,695,817·72	236,124·73
	Mt. Malcolm	3,826·55	14,500·36	6,444,572·19	2,768,426·38	2,786,753·29	164,335·79						
	Mt. Margaret	4,000·65	9,332·18	2,505,661·14	1,167,188·97	1,180,521·80	65,997·78						
North Coolgardie	Menzies	1,657·91	6,638·08	1,549,524·55	1,232,422·28	1,240,718·27	31,269·65	4,812·34	18,993·69	3,199,680·20	2,306,672·93	2,330,478·96	53,745·78
	Warring	129·39	6,739·97	450,768·10	395,306·57	402,175·93	14,763·54						
	Niagara	1,713·13	1,821·35	931,379·27	522,287·95	525,822·43	5,683·41						
	Yerilla	1,311·91	3,794·29	268,008·28	156,656·13	161,762·33	2,029·18						
Broad Arrow	....	....	....	....	....	....	....	21,953·28	27,287·07	1,321,572·39	723,866·30	773,106·65	5,294·35
N.E. Coolgardie	Kanowna	106,515·31	13,515·45	1,004,025·51	625,647·02	745,677·78	3,039·73	119,349·34	21,814·36	1,017,395·58	644,157·97	785,321·67	3,052·44
	Kurnalpi	12,834·03	8,298·91	13,370·07	18,510·95	39,643·89	12·71						
East Coolgardie	East Coolgardie	33,595·51	40,830·47	63,753,153·44	30,375,039·87	30,449,465·85	4,409,534·18	60,999·29	56,863·36	63,937,592·49	30,506,751·47	30,624,614·12	4,409,547·10
	Bulong	27,403·78	16,032·89	184,439·05	131,711·60	175,148·27	12·92						
Coolgardie	Coolgardie	16,920·72	16,703·27	2,669,504·60	1,379,049·99	1,412,673·98	27,517·96	18,435·46	22,333·86	3,031,329·80	1,631,377·37	1,672,146·69	28,269·35
	Kunanalling	1,514·74	5,630·59	361,825·20	252,327·38	259,472·71	751·39						
Yilgarn	....	....	....	....	....	....	....	2,187·32	4,602·04	4,247,577·60	1,768,840·19	1,775,629·55	57,629·12
Dundas	....	....	....	....	....	....	....	2,250·77	16,279·17	3,884,592·62	1,644,946·81	1,663,476·75	990,262·47
Phillips River	....	....	....	....	....	....	....	607·11	820·85	130,485·53	103,951·24	105,379·20	16,026·60
Outside Proclaimed Goldfields		....	....	....	....	....	....	1,421·31	1,016·93	4,315·83	11,433·18	13,871·42	33,589·25
		....	....	....	....	....	....	333,156·13	302,664·39	117698504·74	53,499,673·62	54,135,494·14	6,402,863·26

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, 1953; 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 1950	22,422·06	14,848·65	37,270·71	156,794·89	360,366·51	517,161·40
1950	....	1,135·94	1,135·94	1,107·45	4,341·93	5,449·38
1951	....	104·35	104·35	2,093·93	5,634·59	7,728·52
1952	....	327·57	327·57	6,790·64	8,291·93	15,082·57
1953	....	186·46	186·46	4,105·56	4,694·22	8,799·78
Total	22,422·06	16,602·97	39,025·03	170,892·47	383,329·18	554,221·65
	(a) West Pilbara.			**Ashburton.**		
Prior to 1950	4,351·11	26,760·61	31,111·72	4,104·96	6,191·52	10,296·48
1950	....	108·72	108·72	....	56·19	56·19
1951	....	13·12	13·12	....	5·75	5·75
1952	....	13·96	13·96	....	....	....
1953	....	....	....	....	68·85	68·85
Total	4,351·11	26,896·41	31,247·52	4,104·96	6,322·31	10,427·27
	(b) Gascoyne.			**(c) Peak Hill.**		
Prior to 1950	304·55	1,068·17	1,372·72	41,102·76	206,607·44	247,710·20
1950	....	....	....	....	398·30	398·30
1951	....	....	....	....	144·89	144·89
1952	....	....	....	....	5,296·37	5,296·37
1953	....	....	....	....	8,465·73	8,465·73
Total	304·55	1,068·17	1,372·72	41,102·76	220,912·73	262,015·49
	East Murchison.			**Murchison.**		
Prior to 1950	259,070·94	3,018,584·17	3,277,655·11	1,575,182·03	3,264,184·56	4,839,366·59
1950	110·76	2,783·23	2,893·99	432·27	70,800·19	71,232·46
1951	9·13	644·67	653·80	721·62	65,210·07	65,931·69
1952	84·50	1,160·39	1,244·89	572·80	83,400·62	83,973·42
1953	83·33	1,162·39	1,245·72	304·86	98,202·21	98,507·07
Total	259,358·66	3,024,334·85	3,283,693·51	1,577,213·58	3,581,797·65	5,159,011·23
	(d) Yalgoo.			**(e) Mt. Margaret.**		
Prior to 1950	13,635·97	194,565·72	208,201·69	694,339·90	3,738,794·25	4,433,134·15
1950	14·59	695·23	709·82	88·86	29,535·88	29,624·74
1951	....	1,175·09	1,175·09	114·35	22,475·34	22,589·69
1952	....	505·95	505·95	101·76	24,620·40	24,722·16
1953	....	283·12	283·12	....	25,725·48	25,725·48
Total	13,650·56	197,225·11	210,875·67	694,644·87	3,841,151·35	4,535,796·22
	(f) North Coolgardie.			**(g) Broad Arrow.**		
Prior to 1950	263,409·98	2,007,333·70	2,270,743·68	122,618·69	429,937·55	552,556·24
1950	7·21	5,274·48	5,281·69	7·26	3,384·17	3,391·43
1951	22·05	11,198·65	11,220·70	1·02	3,241·41	3,242·43
1952	50·26	18,510·84	18,561·10	166·14	3,451·59	3,617·73
1953	22·27	18,816·46	18,838·73	6·43	1,734·52	1,740·95
Total	263,511·77	2,061,134·13	2,324,645·90	122,799·54	441,749·24	564,548·78
	(f) North-East Coolgardie.			**(f) East Coolgardie.**		
Prior to 1950	235,893·69	458,592·73	694,486·42	7,026,233·04	23,386,206·61	30,412,439·65
1950	....	138·50	138·50	1,729·80	422,738·26	424,468·06
1951	....	162·05	162·05	2,230·79	436,962·54	439,193·33
1952	....	453·56	453·56	1,577·43	455,615·32	457,192·75
1953	....	120·57	120·57	777·13	493,055·30	493,832·43
Total	235,893·69	459,467·41	695,361·10	7,032,548·19	25,194,578·03	32,227,126·22
	(h) Coolgardie.			**Yilgarn.**		
Prior to 1950	663,150·44	1,219,453·94	1,882,604·38	220,078·94	1,533,944·20	1,754,023·14
1950	44·24	18,024·30	18,068·54	59·14	6,724·00	6,783·14
1951	105·46	25,991·88	26,097·34	178·96	4,482·78	4,661·74
1952	177·31	42,139·84	42,317·15	87·78	7,732·55	7,820·33
1953	49·20	40,262·26	40,311·46	47·52	57,387·44	57,434·96
Total	663,526·65	1,345,872·22	2,009,398·87	220,452·34	1,610,270·97	1,830,723·31
	(i) Dundas.			**(j) Phillips River.**		
Prior to 1950	170,313·19	1,345,907·67	1,516,220·86	40,610·12	62,741·16	103,351·28
1950	410·04	39,171·22	39,581·26	37·59	51·85	89·44
1951	64·16	44,067·81	44,131·97	3·11	18·41	21·52
1952	....	68,103·96	68,103·96	....	222·45	222·45
1953	....	66,780·03	66,780·03	....	898·98	898·98
Total	170,787·39	1,564,030·69	1,734,818·08	40,650·82	63,932·85	104,583·67
	(k) Donnybrook.			**Outside Proclaimed Goldfields.**		
Prior to 1950	282·21	557·53	839·74	22,611·93	38,950·81	61,562·74
1950	....	....	....	112·32	809·49	921·81
1951	....	....	....	44·87	656·24	701·11
1952	....	....	....	....	519·14	519·14
1953	....	....	....	....	671·63	671·63
Total	282·21	557·53	839·74	22,769·12	41,607·31	64,376·43

(*a*) Prior to 1st May, 1898, included with Pilbara, and from 12th July, 1929 to 15th September, 1949, included in Outside Proclaimed Goldfields. (*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. (*k*) 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	923,698·96	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	655,098·88	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	5,621·13	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	661,338·35	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	540,057·08	546,475·42	5,710,669
1944	1,824·99	464,439·76	466,264·75	4,899,997
1945	5,029·38	463,521·34	468,550·72	5,010,541
1946	6,090·14	610,873·52	616,963·66	6,640,069
1947	5,220·09	698,666·29	703,886·38	7,575,574
1948	4,653·72	660,332·07	664,985·79	7,156,909
1949	4,173·14	644,252·48	648,425·62	7,962,808
1950	4,161·53	606,171·88	610,333·41	9,466,270
1951	5,589·45	622,189·64	627,779·09	9,725,343
1952	9,608·62	720,366·44	729,975·06	11,847,917
1953	5,396·30	818,515·65	823,911·95	13,299,092
Total	11,561,267·30	44,082,841·11	55,644,108·41	349,970,657

	1952. £A.	1953. £A.
Estimated total par value of above production	232,861,333	236,361,085
Overseas Gold Sales Premium distributed by Gold Producers Association, 1920–1924	2,589,602	2,589,602
Overseas Gold Sales Premium distributed by Gold Producers Association during, 1952–53	539,358	1,074,688
Exchange Premium paid by Mint above par value 1930–1953 (Approximate)	100,681,272	109,945,282
Estimated Total	£A336,671,565	£A349,970,657
Bonus paid by Commonwealth Government under the Commonwealth Bounty Act, 1930	161,448	161,448
Gross estimated value of gold won	£A336,833,013	£A350,132,105

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 1953, and previous years.

Period.	Abrasive Silica Stone.		Alunite (Crude Potash).		Arsenic.*		Antimony.†		
	Murchison Goldfield. (Mt. Magnet District).		Yilgarn Goldfield.		(East Murchison Goldfield. Wiluna District).		East Murchison Goldfield.		
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Conc.	Metal.	Value.
	tons.	£	tons.	£	tons.	£	tons.	tons.	£
Prior to 1950	1·50	9	8,988·60	214,043	‡38,674·08	747,205	7,883·66	3,870·93	157,298
1950	....	....	84·45	1,822	....	....	....	....	....
1951	....	....	....	....	....	....	....	....	....
1952	....	....	....	....	....	....	....	....	....
1953	....	....	....	....	....	....	....	....	....
Total	**1·50**	**9**	**9,073·05**	**215,865**	**38,674·08**	**747,205**	**7,883·66**	**3,870·93**	**157,298**

* By-product by Wiluna G.Ms., Ltd. † By-product of Gold Mining. ‡ Includes 1·13 tons Arsenic valed at £24 from Yilgarn Goldfield.

Period.	Antimony—*continued.**						Asbestos.	
	Pilbara Goldfield.			Total.			Ashburton Goldfield.	
	Conc.	Metal.	Value.	Conc.	Metal.	Value.	Quantity.	Value.
	tons.	tons.	£	tons.	tons.	£	tons.	£
Prior to 1950	876·84	356·11	24,993	†8,786·73	4,240·60	182,891	10·10	959
1950	92·19	40·25	3,514	92·19	40·25	3,514	....	....
1951	....	....	....	....	....	....	....	....
1952	264·58	129·69	43,397	264·58	129·69	43,397	....	....
1953	358·43	164·23	10,313	358·43	164·23	10,313	....	....
Total	**1,592·04**	**690·28**	**82,217**	**9,501·93**	**4,574·77**	**240,115**	**10·10**	**959**

* By-product of Gold Mining. † Includes 26·23 tons conc. containing 13·56 tons metal valued at £600 from West Pilbara.

Period.	Asbestos—*continued.*							
	Pilbara Goldfield.		West Pilbara Goldfield.		Outside Proclaimed Goldfield.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	1,227·41	56,013	6,656·21	331,103	501·10	6,732	8,403·07	394,849
1950	....	....	1,230·15	152,677	....	....	1,230·15	152,677
1951	109·50	1,861	2,009·66	223,778	....	....	2,119·16	225,639
1952	192·72	3,084	3,399·72	592,032	....	....	3,592·44	595,116
1953	341·69	7,087	4,059·29	700,277	....	....	4,400·98	707,364
Total	**1,871·32**	**68,045**	**17,355·03**	**1,999,867**	**501·10**	**6,732**	**19,745·80**	**2,075,645**

Period.	Barytes.							
	Murchison Goldfield.		North-East Coolgardie Goldfield.		Outside Proclaimed Goldfield.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	....	....	10·00	50	....	....	10·00	50
1950	....	....	....	....	16·00	56	16·00	56
1951	....	....	....	....	5·00	18	5·00	18
1952	9·00	50	....	....	....	....	9·00	50
1953	....	....	42·22	380	169·65	1,410	211·87	1,790
Total	**9·00**	**50**	**52·22**	**430**	**190·65**	**1,484**	**251·87**	**1,964**

Period.	Bentonite.		Beryl Ore.					
	Outside Proclaimed Goldfield.		Pilbara Goldfield.		Yalgoo Goldfield.		Coolgardie Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	1,173·13	3,142	848·47	26,125	....	....	81·47	2,744
1950	213·00	599	4·74	442	....	....	....	....
1951	449·00	1,347	65·18	7,078	....	....	16·14	2,291
1952	586·00	2,036	69·69	11,[illegible]	....	....	14·03	2,737
1953	217·70	741	104·49	18,049	8·00	1,390	10·06	1,782
Total	**2,638·83**	**7,865**	**1,092·57**	**64,730**	**8·00**	**1,390**	**121·70**	**9,554**

Table VI.—*Minerals other than Gold*—continued.

Period.	Beryl Ore—*continued.*				Bismuth.		Calcite.	
	Outside Proclaimed Goldfield.		Total.		Outside Proclaimed Goldfield.		Mt. Margaret Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	lbs.	£	tons.	£
Prior to 1950	103·22	3,745	*1,061·29	33,839	5,506·40	1,800	....	....
1950	12·19	989	16·93	1,431	....	....	5·00	25
1951	9·45	910	90·77	11,174	127·91	84	....	....
1952	1·57	284	85·29	14,562	....	....	....	....
1953	2·07	402	124·62	22,223	....	....	....	....
Total	**128·60**	**6,330**	**1,378·90**	**83,229**	**5,634·31**	**1,884**	**5·00**	**25**

* Includes 3·50 tons valued at £297 from West Kimberley Goldfield, and 24·53 tons valued at £928 from Murchison Goldfield.

Period.	Chromite.		Clays (Cement, Fire and White Clays).					
	Peak Hill Goldfield.		Murchison Goldfield.		Outside Proclaimed Goldfield.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	....	....	....	....	36,868·23	32,184	*37,919·03	32,922
1950	....	....	....	....	6,439·00	4,936	6,439·00	4,936
1951	....	....	....	....	47,559·00	20,687	47,559·00	20,687
1952	773·00	11,100	41·75	207	25,924·10	19,280	25,965·85	19,487
1953	1,968·00	29,717	....	....	22,915·85	15,881	22,915·85	15,881
Total	**2,741·00**	**40,817**	**41·75**	**207**	**139,706·18**	**92,968**	**140,798·73**	**93,913**

* Includes 1,050·80 tons valued ay £738 from Collie Mineral Field.

Period.	Coal.		Copper Ore.					
	Collie Coalfield.		Pilbara Goldfield.		West Pilbara Goldfield.		Ashburton Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	20601560·37	15,789.345	46·87	866	82,745·45	748,482	354·37	6,444
1950	814,351·53	1,287,749	....	....	....	....	....	....
1951	848,474·86	1,716,788	13·30	77	....	....	23·70	493
1952	830,461·20	2,457,296	15·51	1,094	....	....	....	....
1953	886,182·20	3,073,073	32·93	2.424	13·32	674	....	....
Total	**23981030·16**	**24,324,251**	**108·61**	**4,461**	**82,758·77**	**749,156**	**378·07**	**6,937**

Period.	Copper Ore—*continued.*							
	Mt. Margaret Goldfield.		Phillips River Goldfield.		Outside Proclaimed Goldfield.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	47,860·52	230,846	95,871·64	589,159	5·11	56	‡253,724·29	1,749,738
1950	....	*107	48·00	76	....	....	48·00	183
1951	1·30	50	4·83	138	....	....	43·13	758
1952	....	....	....	†94	....	....	15·51	1,188
1953	....	....	....	....	4·04	101	50·29	3,199
Total	**47,861·82**	**231,003**	**95,924·47**	**589,467**	**9·15**	**157**	**253,881·22**	**1,755,066**

* Value of Copper separated from 2·54 tons of Copper matte.
† Value of Copper separated from 1·31 tons Copper precipitates.
‡ Including 109·52 tons valued at £1,709 from West Kimberley Goldfield ; 284·31 tons valued at £5,052 from East Murchison Goldfield : 1,042·02 tons valued at £11,290 from Murchison Goldfield ; 82·35 tons valued at £811 from Yalgoo Goldfield ; 6·12 tons valued at £51 from North Coolgardie Goldfield ; 50·67 tons valued at £379 from East Coolgardie Goldfield ; 16·00 tons valued at £77 from Yilgarn Goldfield ; 1,051·54 tons valued at £33,130 from Peak Hill Goldfield ; 24,026·25 tons valued at £119,497 from Northampton Mineral Field ; 171·55 tons valued at £1,889 from Yandanooka Mineral Field.

Period.	Corundum.		Cupreous Ore (Fertiliser).			
	East Murchison Goldfield.		West Pilbara Goldfield.		Ashburton Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£
Prior to 1950	....	....	133·98	1,844	....	....
1950	....	....	821·40	6,160	....	....
1951	....	....	898·21	10,471	39·66	494
1952	54·00	380	1,001·90	7,571	1·75	31
1953	....	....	672·22	6,851	9·79	114
Total	**54·00**	**380**	**3,527·71**	**32,897**	**51·20**	**639**

Table VI.—*Minerals other than Gold*—continued.

Period.	Cupreous Ore (Fertiliser)—*continued.*							
	Peak Hill Goldfield.		East Murchison Goldfield.		Murchison Goldfield.		Yalgoo Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	1,288·65	9,204	....	....	....	....	7·00	48
1950	93·90	2,304	....	....	....	....	....	....
1951	22·00	660	268·93	3,079	....	....	40·00	240
1952	229·04	7,080	340·05	5,496	....	....	....	....
1953	163·30	1,140	892·10	10.043	25·54	461	....	....
Total	**1,796·89**	**20,388**	**1,501·08**	**18,618**	**25·54**	**461**	**47·00**	**288**

Period.	Cupreous Ore (Fertiliser)—*continued.*							
	Mt. Margaret Goldfield.		Broad Arrow Goldfield.		East Coolgardie Goldfield.		Yilgarn Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	....	....	....	....	....	....	....	....
1950	9·21	64	....	....	....	....	38·37	133
1951	12·55	125	....	....	....	....	....	....
1952	6·85	95	....	....	....	....	....	....
1953	9·50	73	22·00	368	29·00	100	....	....
Total	**38·11**	**357**	**22·00**	**368**	**29·00**	**100**	**38·37**	**133**

Period.	Cupreous Ore (Fertiliser)—*continued.*							
	Dundas Goldfield.		Phillips River Goldfield.		Outside Proclaimed Goldfield.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	....	....	....	....	....	....	1,429·63	11,096
1950	....	....	6·97	206	....	....	969·85	8,867
1951	....	....	55·70	1,035	....	....	1,337·05	16,104
1952	....	....	64·00	1,322	....	....	1,643·59	21,595
1953	12·69	117	72·00	1,406	39·94	331	1,948·08	21,004
Total	**12·69**	**117**	**198·67**	**3,969**	**39·94**	**331**	**7,328·20**	**78,666**

Period.	Diamonds.		Diatomaceous Earth.		Dolomite.		Emerald.	
	Pilbara Goldfield.		Outside Proclaimed Goldfield.		Murchison Goldfield.		Murchison Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	carats.	£	tons.	£	tons.	£	carats (cut and rough).	£
Prior to 1950	....	24	630·00	1,810	575·55	2,856	18,373·00	1,609
1950	....	....	....	....	319·85	1,268	....	....
1951	....	....	198·00	2,700	124·25	599	....	....
1952	....	....	....	....	555·25	2.423	....	....
1953	....	....	....	....	....	....	....	....
Total	....	**24**	**828·00**	**4,510**	**1,574·90**	**7,146**	**18,373·00**	**1,609**

Period.	Emery.		Felspar.					
	Outside Proclaimed Goldfield.		Coolgardie Goldfield.		Outside Proclaimed Goldfield.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	13·00	130	38,584·30	99,134	528·00	1,050	39,112·30	100,184
1950	....	....	1,421·00	5,329	....	....	1,421·00	5,329
1951	....	....	1,806·50	7,389	....	....	1,806·50	7,389
1952	....	....	2,503·50	10,452	....	....	2,503·50	10,452
1953	....	....	2,079·50	8,682	47·50	178	2,127·00	8.860
Total	**13·00**	**130**	**46,394·80**	**130,986**	**575·50**	**1,228**	**46,970·30**	**132,214**

Table VI.—*Minerals other than Gold*—continued.

Period.	Fergusonite.		Fuller's Earth.		Gadolinite.		Glass Sand.	
	Pilbara Goldfield.		Outside Proclaimed Goldfield.		Pilbara Goldfield.		Outside Proclaimed Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	....	....	*30·00	86	1·00	112	2,883·50	3,288
1950	....	....	....	....	....	....	5,132·25	3,566
1951	....	....	....	....	....	....	6,172·59	4,417
1952	0·17	165	25·00	125	....	....	7,669·12	5,629
1953	....	....	15·75	79	....	....	6,905·74	4.690
Total	**0·17**	**165**	**70·75**	**290**	**1·00**	**112**	**28,763·20**	**21,590**

* From Broad Arrow Goldfield.

Period.	Glauconite.		Graphite.		Gypsum.			
	Outside Proclaimed Goldfield.		Outside Proclaimed Goldfield.		Yilgarn Goldfield.		Dundas Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	4,069·00	65,907	18·10	97	56,171·50	66,048	1,999·00	1,238
1950	323·50	8,735	....	....	20,446·00	14,372	....	....
1951	506·00	15,033	....	....	63,816·00	36,571	7·00	19
1952	230·00	7,305	....	....	34,054·00	21,692	21·00	53
1953	319·50	11,182	20·00	180	25,216·00	19,041	12·00	6
Total	**5,448·00**	**108,162**	**38·10**	**277**	**199,730·50**	**157,724**	**2,039·00**	**1,316**

Period.	Gypsum—*continued.*				Ilmenite Sand.		Iron Ore (for Pig Iron).	
	Outside Proclaimed Goldfield.		Total.		Outside Proclaimed Goldfield.		Yilgarn Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	156,530·45	184,994	214,700·95	252,280	71·95	255	84·35	128
1950	10,389·40	7,570	30,835·40	21,942	84·00	521	3,069·98	19,922
1951	14,100·00	10,136	77,923·00	46,726	....	....	13,629·08	139,215
1952	16,256·56	11,512	50,331·56	33,257	....	....	12,994·90	179,405
1953	15,019·11	11,131	40,247·11	30,178	....	....	13,175·88	185,670
Total	**212,295·52**	**225,343**	**414,038·02**	**384,383**	**155·95**	**776**	**42,954·19**	**524,340**

Period.	Iron Ore (for Pig Iron)—*continued.*				Iron Ore (Exported).		Jarosite.	
	Outside Proclaimed Goldfield.		Total.		West Kimberley Goldfield.		Phillips River Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	*77,726·33	129,381	77,810·68	129,509	....	....	9·54	37
1950	11,825·25	62,760	14,895·23	82,682	....	....	....	....
1951	5,493·19	41,921	19,122·27	181,136	10,384·00	10,297	....	....
1952	4,708·55	47,439	17,703·45	226,844	204,945·00	203,238	....	....
1953	3,675·89	35,336	16,851·77	221,006	687,895·00	682,162	....	....
Total	**103,429·21**	**316,837**	**146,383·40**	**841,177**	**903,224·00**	**895,697**	**9·54**	**37**

* Includes 450 tons valued at £247 from East Coolgardie and 100 tons valued at £300 from West Pilbara Goldfield.

Period.	Kyanite.		Lead Ore and Concentrates.					
	Outside Proclaimed Goldfield.		Northampton Mineral Field.		Outside Proclaimed Goldfield.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	4,215·69	21,781	421,175·48	1,476,079	12·19	13	421,187·67	1,476,092
1950	....	....	1,035·05	66,389	....	....	1,035·05	66,389
1951	....	....	1,521·62	148,068	....	....	1,521·62	148,068
1952	....	....	5,699·39	783,186	....	....	5,699·39	783,186
1953	....	....	4,776·11	284,524	....	....	4,776·11	284,524
Total	**4,215·69**	**21,781**	**434,207·65**	**2,758,246**	**12·19**	**13**	**434,219·84**	**2,758,259**

Table VI.—*Minerals other than Gold*—continued.

Period.	Magnesite.							
	East Coolgardie Goldfield.		Coolgardie Goldfield.		Outside Proclaimed Goldfield.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	1,034·96	1,314	779·40	2,090	2,481·12	6,068	4,295·48	9,472
1950	....	....	40·00	175	1,788·70	3,650	1,828·70	3,825
1951	418·00	1,099	344·25	870	....	....	762·25	1,969
1952	....	....	1,054·67	2,843	....	....	1,054·67	2,843
1953	....	....	19·60	73	....	....	19·60	73
Total	**1,452·96**	**2,413**	**2,237·92**	**6,051**	**4,269·82**	**9,718**	**7,960·70**	**18,182**

Period.	Manganese.		Mica.		Ochre.			
	Peak Hill Goldfield.		Outside Proclaimed Goldfield.		Kimberley Goldfield.		West Pilbara Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	lb.	£	tons.	£	tons.	£
Prior to 1950	*11,141·90	67,167	†32,930·00	3,984	....	....	3,743·25	46,780
1950	11,961·64	65,459	....	....	....	....	....	....
1951	5,256·52	33,789	....	....	....	....	15·60	234
1952	5,044·80	35,634	....	....	....	....	....	....
1953	16,324·00	150,991	....	....	20·61	330	....	....
Total	**49,728·86**	**353,040**	**32,930·00**	**3,984**	**20·61**	**330**	**3,758·85**	**47,014**

* Includes 20 tons valued at £180 from Mt. Margaret Goldfield and 24·85 tons valued at £112 from Outside Proclaimed Goldfield.
† Includes 7,868 lb. Crude Mica. Also includes 31·25 lb. Mica valued at £5 from West Kimberley Goldfield.

Period.	Ochre—*continued.*						Petalite.	
	Murchison Goldfield.		East Coolgardie Goldfield.		Total.		Coolgardie Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	1,842·17	17,551	45·35	163	*5,690·27	64,766	5·19	52
1950	186·00	1,860	....	....	186·00	1,860	....	....
1951	672·10	7,657	....	....	687·70	7,891	....	....
1952	296·55	3,252	....	....	296·55	3,252	....	....
1953	266·06	2,412	20·50	145	307·17	2,887	....	....
Total	**3,262·88**	**32,732**	**65·85**	**308**	**7,167·69**	**80,656**	**5·19**	**52**

* Includes 2·10 tons valued at £15 from Pilbara Goldfield, 11 tons valued at £66 from Yalgoo Goldfield, 10·40 tons valued at £83 from North-East Coolgardie Goldfield and 36 tons valued at £108 from Outside Proclaimed Goldfield.

Period.	Phosphatic Guano.		Pyrites.		Sillimanite.		Silver/Lead Ore and Concentrates.	
	Outside Proclaimed Goldfield.		Dundas Goldfield.		Outside Proclaimed Goldfield.		Kimberley Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	10,799·73	59,174	*293,132·56	820,505	2·00	13	6·53	357
1950	....	....	35,213·00	163,514	....	....	....	....
1951	....	....	46,615·00	296,988	....	....	....	....
1952	....	....	53,577·00	422,029	....	....	2·73	291
1953	....	....	59,248·00	489,985	....	....	....	....
Total	**10,799·73**	**59,174**	**487,785·56**	**2,193,021**	**2·00**	**13**	**9·26**	**648**

* Includes 74,047·56 tons valued at £45,496 from Mt. Margaret Goldfield.

Period.	Silver/Lead Ore and Concentrates.							
	Pilbara Goldfield.		West Pilbara Goldfield.		Ashburton Goldfield.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	446·97	15,387	123·96	2,044	3,820·46	80,800	*4,403·42	98,873
1950	445·22	21,859	2·24	75	345·62	21,743	793·08	43,677
1951	301·72	25,692	18·14	2,289	648·16	61,559	968·02	89,540
1952	420·30	36,827	30·79	3,176	979·20	96,977	1,433·02	137,271
1953	393·77	20,975	3·29	28	713·28	40,195	1,110·34	61,198
Total	**2,007·98**	**120,740**	**178·42**	**7,612**	**6,506·72**	**301,274**	**8,707·88**	**430,559**

* Includes 5·50 tons valued at £285 from Peak Hill Goldfield.

Table VI.—*Minerals other than Gold*—continued.

Period.	Silver/Lead/Zinc Ore and Concentrates.							
	West Kimberley Goldfield.		Pilbara Goldfield.		Northampton Mineral Field.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	746·84	15,054	....	....	75·53	2,607	822·37	17,661
1950	7·83	205	....	....	29·83	1,376	37·66	1,581
1951	49·03	2,568	....	....	....	....	49·03	2,568
1952	316·57	14,743	....	....	....	....	316·57	14,743
1953	444·61	7,118	94·42	5,488	....	....	539·03	12,606
Total	**1,564·88**	**39,688**	**94·42**	**5,488**	**105·36**	**3,983**	**1,764·66**	**49,159**

Period.	Soapstone.						Talc.	
	Greenbushes Mineral Field.		Outside Proclaimed Goldfield.		Total.		East Coolgardie Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	517·00	1,778	10·00	25	527·00	1,803	784·96	3,271
1950	....	....	....	....	....	....	56·00	210
1951	....	....	38·40	125	38·40	125	54·70	232
1952	....	....	....	....	....	....	68·25	273
1953	....	....	....	....	....	....	108·70	487
Total	**517·00**	**1,778**	**48·40**	**150**	**565·40**	**1,928**	**1,072·61**	**4,473**

Period.	Talc—*continued.*				Tantalite.			
	Outside Proclaimed Goldfield.		Total.		Pilbara Goldfield.		Greenbushes Mineral Field.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	181·00	2,375	965·96	5,646	265·07	130,672	15·29	10,052
1950	200·00	2,490	256·00	2,700	....	....	....	....
1951	597·47	7,431	651·17	7,663	....	....	....	....
1952	1,155·36	14,410	1,223·61	14,683	....	....	....	....
1953	2,119·37	30,445	2,228·07	30,932	....	....	....	....
Total	**4,252·20**	**57,151**	**5,324·81**	**61,624**	**265·07**	**130,672**	**15·29**	**10,052**

Period.	Tantalite—*continued.*		Tantalo/Columbite Ore and Concentrates.					
	Total.		Greenbushes Mineral Field.		Pilbara Goldfield.		Coolgardie Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	*283·17	143,233	1·16	286	0·53	166	....	....
1950	....	....	4·41	2,109	2·29	749	....	....
1951	....	....	2·06	2,350	....	....	....	....
1952	....	....	3·63	6,056	1·37	1,555	2·02	2,399
1953	....	....	3·09	7,252	2·89	8,560	1·09	2,960
Total	**283·17**	**143,233**	**14·35**	**18,053**	**7·08**	**11,030**	**3·11**	**5,359**

* Includes 2·81 tons valued at £2,509 from Coolgardie Goldfield.

Period.	Tantalo/Columbite Ore and Concentrates—*continued.*						Tin.	
	Phillips River Goldfield.		Outside Proclaimed Goldfield.		Total.		Greenbushes Mineral Field.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	....	....	....	....	1·69	452	11,382·91	1,008,737
1950	....	....	....	....	6·70	2,858	30·34	17,019
1951	....	....	....	....	2·06	2,350	22·44	17,854
1952	....	....	....	....	7·02	10,010	35·88	23,962
1953	*0·22	390	0·80	1,038	8·09	20,200	41·41	23,311
Total	**0·22**	**390**	**0·80**	**1,038**	**25·56**	**35,870**	**11,512·98**	**1,090,883**

* Microlite.

Table VI.—*Minerals other than Gold*—continued.

Period.	Tin—*continued.*							
	Kimberley Goldfield.		West Kimberley Goldfield.		Pilbara Goldfield.		West Pilbara Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	0·60	143	....	....	6,034·33	585,322	....	....
1950	....	....	....	....	21·07	8,477	....	....
1951	0·17	117	0·15	115	38·31	21,389	0·03	18
1952	0·06	42	0·15	120	59·85	43,305	1·86	1,287
1953	....	....	....	....	70·97	39,386	0·59	310
Total	**0·83**	**302**	**0·30**	**235**	**6,224·53**	**697,879**	**2·48**	**1,615**

Period.	Tin—*continued.*				Tungsten (Scheelite).			
	East Murchison Goldfield.		Total.		East Murchison Goldfield.		Yalgoo Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Conc.	Value.	Conc.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	0·39	103	*17,423·70	1,594,726	....	....	2·99	1,050
1950	....	....	51·41	25,496	....	....	....	....
1951	....	....	61·10	39,493	....	....	....	....
1952	....	....	97·80	68,716	0·06	52	....	....
1953	0·30	122	113·27	63,129	....	....	0·03	43
Total	**0·69**	**225**	**17,747·28**	**1,791,560**	**0·06**	**52**	**3·02**	**1,093**

* Includes 4·72 tons valued at £360, 0·15 tons valued at £15, and 0·60 tons valued at £46 from Murchison, Coolgardie and Yilgarn Goldfields respectively.

Period.	Tungsten (Scheelite).							
	Mt. Margaret Goldfield.		North Coolgardie Goldfield.		Coolgardie Goldfield.		Yilgarn Goldfield.	
	Conc.	Value.	Conc.	Value.	Conc.	Value.	Conc.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	....	....	6·45	1,030	21·33	5,238	106·74	39,087
1950	....	....	....	....	....	....	....	....
1951	0·04	51	....	....	0·10	164	....	....
1952	1·29	2,255	....	....	0·93	1,384	....	....
1953	0·78	842	1·31	1.571	0·74	867	0·05	38
Total	**2·11**	**3,148**	**7·76**	**2,601**	**23·10**	**7,653**	**106·79**	**39,125**

Period.	Tungsten (Scheelite)—*continued.*		Tungsten (Wolfram).					
	Total.		Pilbara Goldfield.		Murchison Goldfield.		Yalgoo Goldfield.	
	Conc.	Value.	Ore and Conc.	Value.	Ore and Conc.	Value.	Ore and Conc.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1950	*138·75	46,658	....	....	238·64	1,148	0·72	115
1950	....	....	....	....	....	....	....	....
1951	0·14	215	3·69	7,392	1·24	2,193	....	....
1952	2·28	3,691	20·92	37,686	5·94	7,538	0·57	795
1953	2·91	3,361	....	....	3·00	3,861	0·45	612
Total	**144·08**	**53,925**	**24·61**	**45,078**	**248·82**	**14,740**	**1·74**	**1.522**

* Includes 0·16 tons valued at £59 from Murchison Goldfield, 1·01 tons valued at £175 from Broad Arrow Goldfield and 0·08 tons valued at £19 from Dundas Goldfield.

Period.	Tungsten (Wolfram)—*continued.*		Vermiculite.		Zinc Ore (Fertiliser).	
	Total.		Outside Proclaimed Goldfield.		Pilbara Goldfield.	
	Ore and Conc.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£
Prior to 1950	*268·12	1,682	†1,566·42	9,519	....	....
1950	....	....	120·00	720	....	....
1951	4·03	9,585	54·50	491	10·70	50
1952	27·43	46,019	62·00	744	....	....
1953	3·45	4,473	29·00	348	10·00	50
Total	**303·93**	**61,759**	**1,831·92**	**11,822**	**20·70**	**100**

* Includes 28·48 tons valued at £331 from West Kimberley Goldfield and 0·28 tons valued at £88 from Broad Arrow Goldfield.
† Includes 126·12 tons valued at £872 from East Coolgardie Goldfield and 20 tons valued at £60 from Yilgarn Goldfield.

Table VI.—*Minerals other than Gold*—continued.

Period.	Zinc.*					
	West Kimberley Goldfield.		Pilbara Goldfield.		Total.	
	Metallic content.	Value.	Metallic content.	Value.	Metallic content.	Value.
	tons.	£	tons.	£	tons.	£
Prior to 1950	....	....	....	....	....	....
1950	....	....	....	....	....	....
1951	....	....	....	....	....	....
1952	46·01	365	....	....	46·01	365
1953	63·77	1,011	†4·38	....	68·15	1,011
Total	**109·78**	**1,376**	**4·38**	....	**114·16**	**1,376**

* By-product from Silver/Lead/Zinc Mining. † Unpayable assayed zinc content of Silver/Lead/Zinc Ore and Concentrates.

TABLE VII.

Quantity and Value of Minerals, other than Gold, reported during year 1953.

Number of Lease, Claim, Or Area.	Goldfield or Mineral Field.	Registered Name of Producer.	Quantity.	Metallic Content.	Value.
		ANTIMONY (*f*) (*g*) (*s*).			
			tons.	tons.	£A.
G.M.L's. 231L, etc.	Pilbara	Blue Spec Mining Co., N.L.	358·43	164·23	(*b*) 10,313·00
		ASBESTOS (Chrysotile).			
Temporary Reserve, 1305H	Pilbara	Hancock, L. G.	341·69	....	7,087·40
M.Cs. 48, 68	West Pilbara	Hancock, L. G.	262·83	....	58,417·60
M.C. 67	West Pilbara	Hancock, L. G.	1·06	....	264·00
		ASBESTOS (Crocidolite).			
M.Cs. 54, etc.	West Pilbara	Australian Blue Asbestos Ltd.	3,795·40	....	641,595·04
			4,400·98	....	(*b*)707364·04
		BARYTES.			
M.C. 2K	N.E. Coolgardie	Jones, R. L.	42·22	....	380·10
P.A. 487H, (Cranbrook)	O.P.G.	Ferrari, A.	169·65	....	1,410·00
			211·87	....	(*a*) 1,790·10
		BENTONITE.			
M.C's. 282H, 397H, (Marchagee)	O.P.G.	Fennel, W. G.	42·50	....	212·50
M.L's. 437H, etc., (Marchagee)	O.P.G.	Noonan, E. J.	175·20	....	528·00
			217·70	....	(*a*) 740·50
		BERYL (*f*) (*g*).			
				BeO Units.	
M.C. 234	Pilbara	Otway, R. H.	3·78	50·34	755·15
M.C. 286	Pilbara	Thompson, Coffin & Ball	11·03	117·31	1,759·60
M.C's. 294, 306	Pilbara	Rare Metals Ltd.	1·72	19·26	275·00
M.C's. 297, 301	Pilbara	Millar & Trembath	13·61	158·26	2,374·05
M.C. 313	Pilbara	Richardson Bros.	7·61	85·18	1,277·70
P.A. 2437	Pilbara	Wilson, G. T. R.	·83	9·99	149·90
P.A. 2416	Pilbara	McGregor, D. M.	7·41	88·47	1,372·05
P.A. 2410	Pilbara	Bell Bros., & Watkins	·75	·966	138·90
P.A. 2411	Pilbara	Thompson, Coffin & Ball	10·36	118·70	1,669·35
Crown Lands	Pilbara	Otway, R. H.	3·23	42·30	634·50
		Watkins, D.	8·63	103·29	1,549·35
		Parker, J.	2·19	28·51	427·60
		Watkins, D.	8·91	113·92	1,707·00
		Mitchell, J.	2·84	29·89	448·80
		Warren, J.	·30	3·44	51·65
		Coffin & Lockyer	·88	11·20	167·95
		Mitchell, J.	1·17	14·29	214·35
		Todd Bros.	·89	12·08	181·15
		Mitchell, J.	3·10	38·93	584·05
		Ball, J.	·56	7·16	107·40
		Vallance, J. H.	·31	3·79	51·25
		Pitt, R. E.	9·19	122·28	1,833·00
		Stein, L. C.	·55	7·33	103·00
		Todd Bros.	3·29	41·22	618·25
		Thompson & Ball	·65	8·44	126·65
		Thompson, D.	·70	7·76	116·45
P.A. 2495	Yalgoo	Phillips, D. M.	1·08	13·66	204·85
P.A. 2496	Yalgoo	Drew, O. D.	6·92	84·05	1,185·10
M.C. 9	Coolgardie	Culley, D.	·18	2·38	35·70
M.C. 12	Coolgardie	Giles & Morris	9·88	116·46	1,746·85
M.C. 444H, (Yinnietharra)	O.P.G.	Brazzale, P. J.	·28	3·38	47·65
Crown Lands(Yinnietharra)	O.P.G.	Giles, K. G.	1·79	23·64	354·00
			124·62	1,496·57	(*b*) 22,223·25

Table VII.—*Minerals other than Gold*—continued.

Quantity and Value of Minerals, other than Gold, reported during year 1953.

Number of Lease, Claim, or Area.	Goldfield or Mineral Field.	Registered Name of Producer.	Quantity.	Metallic Content.	Value.
		CHROMITE.	tons.	Av. Assay. % Cr_2O_3	£A.
M.C's. 39P, etc.	Peak Hill	Ives, L.	1,968·00	43·75	(*b*) 29,717·00
		CLAY (Cement Clay).	tons.		£A.
Freehold Land (Maida Vale)	O.P.G.	D. Rhodes, Pty., Ltd.	13,619·90	....	(*c*) 5,266·40
		CLAY (Fireclay).			
Greenmount Loc. 84 (Glen Forrest)	O.P.G.	Darling Range Firebrick Co.	1,424·95	....	1,358·40
M.C's. 304H, etc., (Clackline)	O.P.G.	Clackline Refractories Ltd.	7,393·00	....	7,393·00
			8,817·95	...	(*c*) 8,751·40
		CLAY (White Clay).			
M.C. 247H, (Mt. Kokeby)	O.P.G.	Linton, J. B.	20·00	....	100·00
M.C. 109H, (Goomalling)	O.P.G.	Brisbane & Wunderlich, Ltd.	458·00	....	1,763·00
			478·00	....	(*c*) 1,863·00
		COAL.			
M.L. 250, etc.	Collie	Amalgamated Collieries of W.A., Ltd. :—			
		Co-operative Mine	59,792·45	....	201,987·58
		Proprietary Mine	50,097·15	....	172,642·63
		Cardiff Mine	66,513·10	....	233,943·23
		Stockton Mine....	62,844·36	....	214,121·26
		Westralia Mine	9,883·00	....	32,939·56
		Black Diamond Mine	3,445·00	....	12,880·69
		Ewington	3,850·00	....	12,666·22
		Stockton Open Cut Mine	138,831·90	....	472,311·84
		Black Diamond Open Cut	6,917·07	....	22,672·39
		Ewington Open Cut	210,353·70	....	717,553·25
M.L's., 314, etc.	Collie	Griffin Coal Mining Co., Ltd. :—			
		Griffin Mine	52,985·20	....	190,723·65
		Wyvern Mine	63,357·00	....	229,586·35
		Phoenix Mine	28,004·00	....	100,640·10
		Centaur Mine	33,735·90	....	121,523·50
		Muja Open Cut	5,708·30	....	19,979·20
		Western Collieries, Ltd. :—			
M.L. 418	....	Western Collieries No. 1 Mine	42.107·46	....	149,463·60
M.L. 437	....	Western Collieries No. 2 Mine	16,420·61	....	57,801·12
M.L's. 432, etc.	....	Western Collieries No. 3 Open Cut	70·00	....	245·00
			886,182·20	....	(*e*) 3073,073·17

COPPER ORE & CONCENTRATES (*f*) (*g*).

				Copper tons.	Silver Fine Ozs.	
M.C's. 34L, 35L	Pilbara	Stubbs & Baker	32·93	10·80	269·46	2,423·92
M.L's. 243, 245	West Pilbara	Dunnet, Burges & Mills	13·32	3·41	....	673·54
(Pindar)	O.P.G.	Richards, H. R.	4·04	0·82	....	101·05
			50·29	15·03	269·46(*b*)	3,198·51

(Silver—Quantity and Value transferred to Silver Item.)

Table VII.—*Minerals other than Gold*—continued.

Quantity and Value of Minerals, other than Gold, reported during year 1953.

Number of Lease, Claim, Or Area.	Goldfield or Mineral Field.	Registered Name of Producer.	Quantity.	Metallic Content.	Value.
CUPREOUS ORE & CONCENTRATES (for Fertilisers).					
			tons.	Av. Assay. Cu %	£A.
M.L. 243, etc.	West Pilbara	Dunnet, C. G.	5·87	23·75	315·00
M.L. 259	West Pilbara	Leet, T.	115·94	14·23	2,344·97
M.L. 260	West Pilbara	Pianta, A. H.	103·92	15·16	2,214·76
Freehold Property	West Pilbara	Walters, I.	446·49	6·65	1,975·85
M.L. 148	Ashburton	Brindal & Party	2·00	11·25	22·50
M.L's. 154, etc.	Ashburton	Northern Transport Co.	7·79	8·85	91·80
M.L. 66P	Peak Hill	Walsh, E.	163·30	6·84	1,140·00
M.C. 5	East Murchison	Poletti, A.	207·31	6·88	1,615·80
M.C. 10	East Murchison	Alac, M.	570·57	8·97	7,134·53
P.A. 1446	East Murchison	Crombie, K. B.	5·35	13·60	109·14
P.A. 1457	East Murchison	Jasper, M.	108·87	8·69	1,184·00
P.A. 3277N	Murchison	Ball, R. A.	25·54	11·87	461·00
M.L. 24F	Mt. Margaret	Philiphoff, M.	9·50	6·90	72·50
P.A. 4779W	Broad Arrow	Elliot & Allen	22·00	12·20	368·48
P.A. 4940E	East Coolgardie	McKain, J. R.	29·00	3·50	100·00
P.A. 2253	Dundas	Weston, B. T.	12·69	8·36	116·74
M.L. 411	Phillips River....	Wehr & O'Dea	62·00	8·78	1,216·22
P.A. 785	Phillips River....	Wehr & O'Dea	10·00	8·21	189·97
Private Property Block No. 342 (Arrino)	O.P.G.	Dower, H. J.	32·00	8·06	215·00
(Pindar)	O.P.G.	Richards, H. R.	7·94	9·75	116·10
			1,948·08	8·67	(*a*) (*b*) 21,001·36
FELSPAR.					
M.L. 80, etc.	Coolgardie	Australian Glass Manufactures, Co., Pty., Ltd.	2,079·50	....	8,681·93
M.C. 111H, (Balingup)	O.P.G.	Oma, V. C.	47·50	....	178·13
			2,127·00	....	(*a*) 8,860·06
FULLER'S EARTH.					
M.C. 452H, (Marchagee)	O.P.G.	Read, D. J. & T. I.	15·75	....	(*a*) 78·75
GLASS SAND.					
M.C. 417H, etc., (Lake Gnangara)	O.P.G.	Australian Glass Manufacturers, Co., Pty., Ltd.	6,674·79	....	4,338·68
M.C. 365H, (Lake Gnangara)	O.P.G.	Leach, R. J.	147·95	....	221·90
M.C's. 161H, etc., (Lake Gnangara)	O.P.G.	Leach, W. M.	83·00	....	129·00
			6,905·74	....	(*c*) 4,689·58
GLAUCONITE.					
			Greensand. Treated.	Glauconite. Recovered. tons.	
Private Property (Gin Gin)	O.P.G.	Brook, G. E.	1,917·00	319·50	(*b*) (*d*) 11,182·50
GRAPHITE.					
			tons.	Assay % Carbon	£A.
M.C. 451H. (Munglinup)	O.P.G.	Drummond, F. R.	20·00	11·00	(*a*) 180·00

Table VII.—*Minerals other than Gold*—continued.

Quantity and Value of Minerals, other than Gold, reported during year 1953.

Number of Lease, Claim, or Area.	Goldfield or Mineral Field.	Registered Name of Producer.	Quantity.	Metallic Content.	Value.
		GYPSUM.			
			tons.		£A.
M.C's. 30, etc.	Yilgarn	Ajax Plaster Co., Pty., Ltd.....	7,597·00	....	6,267·44
M.C's. 9, etc.	Yilgarn	Perth Modelling Works, Ltd.	17,619·00	....	12,773·40
M.C. 12	Dundas	McDonald & Whitfield	12·00	....	6·00
M.C's. 280H, etc., (Lake Brown)	O.P.G.	H. B. Brady & Co., Ltd.	8,935·00	....	6,701·25
M.C's. 126H, etc., (Baandee)	O.P.G.	Perth Modelling Works, Ltd.	2,618·00	....	1,846·60
M.C's. 402H, etc., (Hines Hill)	O.P.G.	Kay, C. J.	3,023·00	....	2,249·50
M.C's. 293H, etc., (Woolundra)	O.P.G.	Ripper, P.	443·11	....	333·40
			40,247·11	....	(*a*) (*c*) 30,177·59

Plaster of Paris reported as manufactured during the year being 25,700·00 tons from 35,950·00 tons of Gypsum by three factories.

			IRON ORE (for Pig Iron).		
			Ore Treated.	Pig Iron Recovered. Tons.	
Temporary Reserve 1258H	Yilgarn	The Charcoal Iron & Steel Industry	13,175·88	8,439·54	185,669·89
Crown Lands (Wundowie)	O.P.G.	The Charcoal Iron & Steel Industry	3,675·89	1,606·18	35,335·96
			16,851·77	10,045·72	(*c*) (*d*) 221,005·85

Average Assay Ore Used—Koolyanobbing 62·11 % Fe, Wundowie 42·55 % Fe.

			IRON ORE (*g*).		
			Ore Exported.	Av. Assayed Iron Content	(*h*)
M.L's. 10. etc	West Kimber'ey	Australian Iron & Steel, Ltd.	687,895·00	63·39%	682,161·69

No. of Lease Claim or Area.	Goldfield or Mineral Field.	Registered Name of Producer.	Ore and Conc.	Lead.		Silver.		Zinc.	
			tons.	tons.	Value £A.	fine oz.	Value £A	tons.	Value £A.
			LEAD ORE AND CONCENTRATES (*f*) (*g*)						
Imp. Grant on Loc. 833	Northampton	Anglo-Westralian Mining Pty., Ltd.	2,567·36	1,990·54	(*b*) 162,984·62	....	....	....	....
M.L. 257	Northampton	Cotic, A. J.	55·38	42·48	2,349·38	23·92	....	....	....
P.A. 71pp.	Northampton	Elphick & Monk	2·78	2·22	163·83	1·08	....	....	....
M.Ls. 205, etc.	Northampton	Galena Lead Mine	25·69	18·18	1,280·30	....	....	....	....
M.L. 222	Northampton	" Geraldine North "	27·06	18·59	1,788·16	....	....	....	....
M.L. 256	Northampton	" Ghurka " Syndicate	53·97	41·32	2,320·51	7·34	....	....	....
Vic. Loc. 832	Northampton	Isseka Mining Pty., Ltd.	53·30	33·66	2,153·77	3·49	....	....	....
M.L. 250	Northampton	" Kirton " Mine	4·35	3·37	201·32	....	....	....	....
M.L. 234	Northampton	Mary Springs Syndicate	9·84	7·09	364·54	1·58	....	....	....
M.Ls 31pp., etc.	Northampton	Northampton M. & D. Co. Ltd.	250·04	196·41	11,752·12	32·49	....	....	....
Vic. Loc. 436	Northampton	Paringa Wheal Fortune	1,370·82	1,041·62	68,610·51	....	....	....	....
P.A. 73pp.	Northampton	Simpson & Hyde	40·94	30·13	1,710·55	20·47	....	....	....
M.L. 252	Northampton	" Three Sisters North "	23·68	19·02	1,495·00	10·78	....	....	....
Vic. Loc. 436	Northampton	Wheal of Fortune Extended	290·90	223·32	27,349·53	36·56	....	....	....
			4,776·11	3,667·95	284,524·14	137·71	*nil*	*nil*	*nil*

(Silver—Quantity transferred to Silver Item.)

Table VII.—*Minerals other than Gold*—continued.

Quantity and Value of Minerals, other than Gold, reported during year 1953.

No. of Lease, Claim or Area.	Goldfield. or Mineral Field.	Registered Name of Producer.	Ore and Conc.	Lead.		Silver.		Zinc.	
			tons.	tons.	Value £A.	fine oz.	Value £A	tons.	Value £A.
		SILVER/LEAD ORE AND CONCENTRATES (*f*) (*g*)							
M.Cs 5, 6	Ashburton	Aerial Mines Pty., Ltd.	10·37	6·36	(*b*) 429·87	42·51	11·88	....	....
M.L. 116, etc.	Ashburton	Ashburton Mng. & Min. Pty., Ltd.	23·61	16·82	1,315·63	20·79	1·25	....	....
P.A. 297	Ashburton	Ballard, Shankor & Howie	2·16	1·60	96·61	11·02	2·48	....	....
M.L. 140	Ashburton	" Beadon " Lead Mine	47·36	31·06	3,367·99	203·55	63·53	....	....
M.L. 118	Ashburton	" Bilrose " Lead Mine....	110·77	75·63	5,437·58	1164·11	391·97	....	....
P.A. 282	Ashburton	Coombes & Furvey	1·13	0·61	84·52	5·54	1·55	....	....
M.L. 143	Ashburton	"Dingo Lead Mine"	35·75	23·59	1,574·31	246·41	81·33	....	....
—	Ashburton	Eldridge, M.	1·37	0·94	87·70	....	....	....	....
M.L. 122	Ashburton	" Gift " Lead Mine	145·65	108·65	8,312·84	931·55	290·51	....	....
—	Ashburton	Holland, Cumming & Scurrah	0·87	0·46	38·30	3·04	0·81	....	....
M.C. 2	Ashburton	Ibbotson, G. R.	30·38	17·87	1,393·95	558·80	180·74	....	....
M.L. 156	Ashburton	James, A.	12·32	9·23	658·34	102·49	33·40	....	....
P.A. 283	Ashburton	Jensen & Jacobsen	5·21	3·41	210·92	22·03	4·46	....	....
M.L. 135	Ashburton	" June Audrey " Lead Mine	157·84	112·98	9,954·94	1223·62	375·81	....	....
M.L. 120	Ashburton	" Kooline Queen " Lead Mine	25·11	19·39	1,658·50	56·83	14·82	....	....
M.L. 123	Ashburton	" Phar Lap " Lead Mine	9·22	5·94	379·30	84·43	27·79	....	....
M.L. 138	Ashburton	" Rainbow " Lead Mine	5·13	3·76	246·54	37·81	12·49	....	....
M.L. 155	Ashburton	" Ridge " Lead Mine	70·07	53·22	3,853·65	489·02	157·53	....	....
M.L. 144	Ashburton	Rooney & Healey	17·46	11·23	1,013·68	27·81	5·75	....	....
M.L. 121	Ashburton	" South Kooline " Mine	1·50	0·98	80·29	6·31	1·10	....	....
P.A. 2399	Pilbara	Bennet, J.	2·57	1·50	107·34	15·92	4·84	....	....
M.C. 227	Pilbara	Challenger, C. W.	8·30	5·83	672·63	41·86	11·96	....	....
M.C. 184	Pilbara	Collins & Chamberlain	12·90	8·24	673·05	95·82	29·07	....	....
M.C. 255	Pilbara	Engstrom, O.	7·66	4·87	379·28	21·75	5·09	....	....
M.C. 189	Pilbara	Moore, R. O.	360·99	250·40	19,055·30	3,556·36	1,193·35	....	....
—	Pilbara	Lazar, O.	1·35	0·95	87·68	....	....	....	....
P.A. 229	West Pilbara	Tyrer, G.	3·29	1·28	27·63	28·25	6·41	....	....
			1,110·34	776·78	61,198·37	8997·63	2909·92	*nil*	*nil*
		(Silver—Quantity and Value transferred to Silver Item.)							
		SILVER/LEAD/ZINC ORE AND CONCENTRATES (*f*) (*g*)							
M.C. 29	West Kimberley	Devonian. Pty., Ltd.	444·61	184·17	(*b*)7,117·53	3820·30	1283·77	63·77	1011·5
M.C. 189	Pilbara	Moore, R. O.	94·42	70·69	5,488·19	1372·90	486·27	4·38	....
			539·03	254·86	12,605·72	5193·20	1770·04	68·15	1011·5
		(Silver and Zinc—Quantities and Values transferred to Silver and Zinc Items, respectively.)							

Number of Lease, Claim, Or Area.	Goldfield or Mineral Field.	Registered Name of Producer.	Quantity.	Metallic. Content.	Value.
		MAGNESITE.			
			tons.		£A.
M.L. 87, etc.	Coolgardie	Seahill & Gibbons	19·60	....	(*a*) 73·00
		MANGANESE (*g*).			
				Av. Assay % Mn	
M.C's. 24P, etc.	Peak Hill	Westralian Ores Pty., Ltd.	16,324·00	43·02	(*b*)150,990·57
		OCHRE (Red).			
—	Kimberley	Long, J.	20·61	....	329·79
M.C. 27	Murchison	Cassidy, J. E.	217·06	....	1,922·50
M.C's. 26, etc.	Murchison	Murchison Minerals (1951)	49·00	....	490·00
		OCHRE (Yellow).			
P.A. 5002E	East Coolgardie	Austin, A. J.....	20·50	....	145·00
			307·17	....	(*a*) 2,887·29

Table VII.—*Minerals other than Gold*—continued.

Quantity and Value of Minerals, other than Gold, reported during year 1953.

Number of Lease, Claim, or Area.	Goldfield or Mineral Field.	Registered Name of Producer.	Quantity.	Metallic Content.	Value.
PYRITES ORE AND CONCENTRATES.					
			tons.	Sulphur Recovered Tons.	£A.
G.M.L's. 1460, etc.	Dundas	Norseman G.M., N.L.	15,475·00	5,340·74	81,225·00
			(*h*) 43,773·00	20,229·78	408,760·00
			59,248·00	25,570·52	(*a*)489,985·00
SILVER.					
			Fine Ozs.		
	By-product from Gold Mining		214,766·39	....	84,618·20
	By-product from Lead Mining		137·71	....	....
	By-product from Silver/Lead Mining		8,997·63	....	2,909·92
	By-product from Silver/Lead/Zinc Mining		5,193·20	....	1,770·04
	By-product from Copper Mining		269·46	....	103·13
			229,364·39	....	89,401·29
TALC.					
M.C's. 14E, 15E	East Coolgardie	Bean, H.	108·70	....	487·00
Private Property Location 839 (Three Springs)	O.P.G.	Universal Milling Co., Ltd.	2,119·37	....	30,445·06
			2,228·07	....	(*a*) (*e*) 30,932·06
TANTALO/COLUMBITE ORE AND CONCENTRATES (*f*) (*g*).					
			lbs.	Combined Ta Nb_2O_5 lbs.	
M.C's. 58, etc.	Greenbushes	Amalgamated Tin, Ltd.	(*i*) 6,411·00	4,530·00	6,874·00
D.C. 111	Greenbushes	South Greenbushes Tin Dredging Syndicate	(*j*) 506·00	313·00	378·00
P.A. 2413	Pilbara	Stein, L. C. & Party	2,815·00	2,150·00	3,580·65
M.C. 313	Pilbara	Richardson, E. A.	3,654·00	2,705·00	4,980·00
P.A. 6688	Coolgardie	Culley, D.	1,143·00	847·00	1,416·30
M.C. 9	Coolgardie	Culley, D.	1,311·00	985·00	1,543·40
M.C. 458H, (Yinniethara)	O.P.G.	New Metals (Aust.), Ltd.	1,797·00	1,468·00	1,038·00
TANTALO/COLUMBITE ORE AND CONCENTRATES (Microlite) (*f*) (*g*).					
P.A. 764	Phillips River....	Johnson, F. B.	487·00	306·00	390·05
			18,124·00	13,304·00	(*b*)20,200·40
TIN (*f*) (*g*).					
			Tons.	Tons.	
M.C's. 58, etc.	Greenbushes	Amalgamated Tin Ltd.	(*i*) 27·71	17·23	15,321·00
D.C. 111	Greenbushes	South Greenbushes Tin Dredging Syndicate	(*j*) ·69	·48	516·08
D.C. 111	Greenbushes	Tin & Strategic Min. Syndicate	(*k*) 11·47	8·52	6,669·65
L.T.T. 1273H	Greenbushes	Chapman, E. S.	·34	·21	125·24
Crown Lands	Greenbushes	Sundry Persons	1·20	·77	679·06
M.C's. 25, etc.	Pilbara	J. A. Johnston & Sons	63·92	43·71	35,046·74
D.C's. 49, 50	Pilbara	Thompson & Stutz	2·46	1·75	1,305·65
Crown Lands	Pilbara	Sundry Persons	4·59	3·17	2,970·75
Crown Lands	West Pilbara	Sundry Persons	·59	·29	310·00
P.A. 1460	East Murchison	Hinde, W. A.	·30	·19	121·90
			113·27	76·32	(*b*) 63,128·98
TUNGSTEN (Scheelite) (*f*) (*g*).					
			lbs.	WO_3 content lbs.	
G.M.L. 1063	Yalgoo	Taylor, A. E.	65·00	45·00	42·55
P.A. 2570T	Mt. Margaret	Hutchinson, J.	1,358·00	921·00	822·00
G.M.L. 2516T	Mt. Margaret	Tarabini & Party	400·00	95·00	20·00
G.M.L. 5757Z	North Coolgardie	Evans & White	2,931·00	1,556·00	1,571·45
P.P.L. 463	Coolgardie	R. K. McRae & Party	1,665·00	1,055·55	867·00
P.A. 6678	Yilgarn	Grace & White	101·00	55·00	38·25
			6,520·00	3,727·55	(*b*) 3,361·25

(13)—88619.

Table VII.—*Minerals other than Gold*—continued.

Quantity and Value of Minerals, other than Gold, reported during year 1953.

Number of Lease, Claim, Or Area.	Goldfield or Mineral Field.	Registered Name of Producer.	Quantity.	Metallic Content.	Value.
		TUNGSTEN (Wolfram) (*f*) (*g*).			
			lbs.	WO_3 content lbs.	£A.
M.C. 49	Murchison	Poletti & Gregory	963·00	334·00	313·00
M.C's. 37, etc.	Murchison	Western Minerals Syndicate	5.585·00	3,319·00	3,423·70
M.C. 46	Murchison	Watkins & Sons	183·00	120·00	124·20
P.A. 2470	Yalgoo	Carter, King, Triat & Pavey	640·00	369·00	392·00
P.A. 2491	Yalgoo	Triat & Pavey	362·00	208·00	220·00
			7,733·00	4,350·00	(*b*) 4,472·90
		VERMICULITE.			
			tons.		
M.C. 187H, (Young River)	O.P.G.	Perth Modelling Works, Pty., Ltd.	29·00	....	(*c*) 348·00

ANNUAL DISPOSALS.

Local exfoliation 57·25 tons producing 48·50 tons of " Gold Flake." Crushed and sized ore exported from State was 5·00 tons.

		ZINC (*f*) (*g*).			
				tons.	
	West Kimberley	By-product from Silver/Lead/Zinc Mining	....	(*m*) 46·01	364·71
				(*n*) 63·77	1,011·56
	Pilbara	By-product from Silver/Lead/Zinc Mining	....	(*p*) 4·38	nil
				114·16	1,376·27
		ZINC ORE (Fertiliser).			
				Assay % Zn	
M.C. 232	Pilbara	Rogers, D. C.	10·00	9·60	(*b*) 50·00

TIN/TANTALO/COLUMBITE DISPOSALS REPORTED TO THE DEPARTMENT DURING 1953. PARTICULARS OF THE SEPARATED PRODUCTS BEING INCLUDED IN THE RESPECTIVE MINERALS LISTED THROUGHOUT TABLE VII.

Producer.	Goldfield or Mineral Field.	Mineral Disposed.						Separation Obtained.				
		N.D.W.	Material.	Estimated Assays %				Tantalo/Columbite Ore and Concentrates.			Tin Concentrates.	
				$Sn O_2$	$Ta_2 O_5$	$Nb_2 O_5$	Combined. $TaNb_2O_5$	lbs.	Combined $TaNb_2O_5$	Value.	lbs.	Value.
		lbs.		(Tons)			(Tons)		lbs.	£A.		£A.
Amalgamated Tin Ltd.	Greenbushes	68,840	T/T/C Conc.	56·05	....	....	6·58	6,411	6,530	6,874·00	62,072	15,321·0
South Greenbushes Tin Dredging Syndicate	Greenbushes	5,622	T/T/C Conc.	56·90	....	....	5·60	506	313	378·00	5,084	1,543·75
		74,462		56·10			6·50	6,917	4,843	7,252·00	67,156	16,864·75

T/T/C indicates Tin/Tantalo/Columbite.

References—O.P.G. denotes Outside Proclaimed Goldfield. (*a*) Value F.O.R. (*b*) Value F.O.B. (*c*) Value at Works. (*d*) Value of Mineral Recovered. (*e*) Value at Pit Head. (*f*) Only results from shipments finalised during period under review. (*g*) Metallic content calculated on Assay basis. (*h*) Concentrates. (*i*) Separated from 32·73 tons (68,840 lbs.) of Tin/Tant./Col. concentrates. (*j*) Separated from 2·51 tons (5,622 lbs.) of Tin/Tant./Col. concentrates. (*k*) Separated from 13·94 tons (31,226 lbs.) of Tin/Tant./Col. concentrates. of which only tin portion has been finalised. (*m*) From 316·57 tons silver, lead, zinc ore and concentrates realised in 1952. (*n*) From 444·61 tons silver/lead/zinc ore and concentrates realised in 1953 and including 8·10 tons of unpayable assayed zinc content. (*p*) Unpayable assayed zinc content of 94·42 tons silver/lead/zinc ore and concentrates realised during 1953 from Pilbara Goldfield. (*r*) Estimated assay. (*s*) By-product from Gold Mining.

TABLE VIII.—SHOWING AVERAGE NUMBER OF MEN EMPLOYED ABOVE AND UNDER GROUND IN THE LARGER GOLDMINING COMPANIES OPERATING IN WESTERN AUSTRALIA DURING THE YEARS FROM 1944 to 1953 INCLUSIVE.

COMPANY.	1944.			1945.			1946.			1947.			1948.			1949.			1950.			1951.			1952.			1953.		
	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.
Anglo-Westralian Mng. Pty.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	47	4	51	37	5	42
Boulder Perseverance, Ltd.	116	101	217	127	115	242	178	148	326	195	159	354	185	148	333	171	135	306	173	138	311	115	119	274	151	115	266	155	112	267
Broken Hill Pty. Co., Ltd.	4	....	4	11	2	13	33	82	115	38	95	133	38	84	122	36	73	109	34	68	102	13	12	25	6	....	6	4	....	4
Blue Spec Gold Mines, Ltd.	28	7	35	32	12	44	38	17	55	36	24	60	17	12	29	1	....	1	20	6	26	33	21	54	36	21	57	33	15	48
Big Bell Mines, Ltd.	14	1	15	29	16	45	171	143	314	186	198	384	188	193	381	197	210	407	219	246	465	230	240	470	203	205	408	200	215	415
Burbidge Gold Mines, N.L.	....	....	....	....	....	....	18	....	18	15	4	19	14	4	18	18	4	22	16	4	20	2	....	2	1	....	1	....	....	....
Consolidated Gold Area, N.L.	1	....	1	1	....	1	2	....	2	2	....	2	2	....	2	1	....	1	1	....	1	3	1	4	1	....	1	1	1	2
Comet Gold Mines, Ltd.	47	30	77	42	33	75	43	32	75	17	7	24	7	10	17	9	13	22	11	12	23	13	11	24	10	8	18	10	6	16
Consolidated Gold Mines of Coolgardie, Ltd.	20	23	43	8	1	9	2	....	2	1	....	1	1	....	1	1	....	1	1	....	1	1	....	1	1	....	1	....	....	....
Central Norseman Gold Corporation, N.L.	72	115	187	77	135	212	103	201	304	111	251	362	117	268	385	133	246	379	163	236	399	148	226	374	151	212	363	155	228	383
Coolgardie Gold Mines, Ltd.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	2	3	1	....	1	....	....	....
Dundas Gold Mines, N.L.	....	....	....	1	1	2	4	13	17	9	22	31	7	17	24	11	15	26	3	9	12	....	....	....	....	....	....	....	....	....
Emu Gold Mines, Ltd.	29	28	57	34	38	72	38	40	78	36	35	71	9	6	15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Edna May Amalgamated, N.L.	35	36	71	33	34	67	29	42	71	28	33	61	11	9	20	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Evanston Gold, N.L.	....	....	....	....	....	....	28	32	60	37	26	63	2	....	2	2	....	2	1	....	1	....	....	....	....	....	....	....	....	....
First Hit Gold Mine	21	14	35	20	15	35	7	7	14	4	5	9	2	1	3	1	1	2	1	1	2	....	....	....	....	....	....	....	....	....
Firelight Syndicate	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	2	....	....	....	42	....	42
Golden Horseshoe (New), Ltd.	38	....	38	39	....	39	45	....	45	46	....	46	45	....	45	43	....	43	41	....	41	39	....	39	38	....	38	42	....	42
Gold Mines of Kalgoorlie, Ltd.	90	98	188	103	114	217	144	171	315	169	158	327	166	173	339	175	179	354	187	180	367	181	191	372	185	182	367	184	182	366
Great Boulder Pty., Ltd.	226	305	531	237	344	581	310	469	779	325	496	821	316	418	734	312	392	704	327	404	731	311	354	665	344	339	683	349	359	708
Great Western Consolidated	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	125	72	197	148	60	208	186	113	299
Hill 50 Gold Mine, N.L.	32	41	73	41	45	86	55	48	103	49	55	104	55	67	122	68	78	146	74	66	140	62	41	103	59	48	107	68	63	131
Kalgoorlie Enterprise, Ltd.	....	53	53	....	74	74	....	99	99	....	118	118	1	105	106	7	103	110	7	95	102	8	85	93	8	93	101	8	98	106
Kalgurli Ore Treatment Co., Ltd.	67	....	67	68	....	68	73	....	73	69	....	69	69	....	69	74	....	74	74	....	74	77	....	77	81	....	81	77	....	77
Lake View and Star, Ltd.	225	214	439	246	242	488	337	422	759	366	468	834	414	465	879	454	441	895	471	476	947	492	517	1,009	486	529	1,015	494	519	1,013
Moonlight Wiluna Gold Mines, Ltd.	16	44	60	4	5	9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Marvel Loch Gold Mines, Syndicate	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1	....	....	....	....	....	....
Moonlight Wiluna Gold Mines, Ltd. (Timoni)	4	2	6	2	....	2	13	11	24	18	20	38	13	20	33	18	18	36	33	32	65	42	42	84	42	41	83	39	37	76
Mountain View Gold, N.L.	....	....	....	....	....	....	....	....	....	7	9	16	11	8	19	10	14	24	11	11	22	13	7	20	5	3	8	4	6	10
Mt. Charlotte (Kalgoorlie) Gold Mines, N.L.	....	....	....	....	....	....	....	....	....	2	1	3	18	18	36	24	28	52	10	8	18	2	....	2	2	3	5	3	6	9
North Kalgurli (1912), Ltd.	42	107	149	52	131	183	62	173	235	66	213	279	76	265	341	79	304	383	90	316	406	133	348	481	112	293	405	76	207	283
New Milano, N.L.	1	....	1	2	....	2	2	1	3	2	2	4	2	1	3	1	....	1	1	....	1	....	....	....	....	....	....	....	....	....
*Norseman Gold Mines, N.L.	87	72	159	98	56	154	105	79	184	12	19	31	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
New Coolgardie Gold Mines, N.L. (Barbara Leases)	....	....	....	....	....	....	....	....	....	....	....	....	12	9	21	78	64	142	73	125	198	73	120	193	65	109	174	68	108	176
New Coolgardie Gold Mines, N.L. (Callion Leases)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	21	27	6	29	35	7	34	41
Ora Banda Amalgamated, Ltd.	7	5	12	4	....	4	11	20	31	23	44	67	5	4	9	3	1	4	2	....	2	1	....	1	1	....	1	3	2	5
Paringa Mining and Exploration Co., Ltd.	78	82	160	69	103	172	76	113	189	83	117	200	87	134	221	79	134	213	92	138	230	47	46	93	10	6	16	2	2	4
Phoenix Gold Mines, Ltd.	40	38	78	48	33	81	50	30	80	50	30	80	33	22	55	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Porphyry (1939) Gold Mines, Ltd.	....	....	....	....	....	....	....	....	....	2	1	3	18	18	36	24	28	52	10	8	18	6	1	7	1	....	1	3	3	6
Radio Gold Mines	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	3	8	4	4	8	5	5	10
South Kalgurli Consolidated	43	74	117	51	80	131	80	91	171	103	105	208	107	111	218	110	105	215	120	107	227	124	110	234	67	102	169	67	107	174
Sons of Gwalia, Ltd.	101	115	216	104	106	210	122	160	282	108	128	236	98	109	207	92	143	235	104	151	255	121	129	250	121	118	239	102	157	259
Sunshine Reward Amalgamated Leases	5	5	10	4	3	7	5	7	12	8	9	17	9	10	19	9	14	23	10	9	19	10	7	17	9	7	16	8	7	15
Triton Gold Mine	8	15	23	11	23	34	41	66	107	83	178	261	64	95	159	7	....	7	....	....	....	....	....	....	....	....	....	....	....	....
Wiluna Gold Mines, Ltd.	237	244	481	214	196	410	168	96	264	117	5	122	69	....	69	49	....	49	29	....	29	20	....	20	13	....	13	2	1	3
Yellowdine Gold Development, Ltd.	13	9	22	2	....	2	4	....	4	2	....	2	2	....	2	2	....	2	1	....	1	....	....	....	....	....	....	....	....	....
All other Operators	511	437	948	599	388	987	1,002	674	1,676	1,174	993	2,167	1,127	972	2,099	965	825	1,790	985	837	1,822	879	661	1,540	850	598	1,448	846	523	1,369
State Average (incl. Diggers)	2,266	2,348	4,614	2,424	2,394	4,818	3,416	3,545	6,961	3,612	4,037	7,649	3,416	3,762	7,178	3,260	3,540	6,800	3,404	3,676	7,080	3,378	3,388	6,766	3,265	3,129	6,394	3,238	3,121	6,359
*Also additional men engaged exclusively on Pyrites Production	7	33	40	5	49	54	4	53	57	78	56	134	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

* Converted solely to Pyrites production after 1947.

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