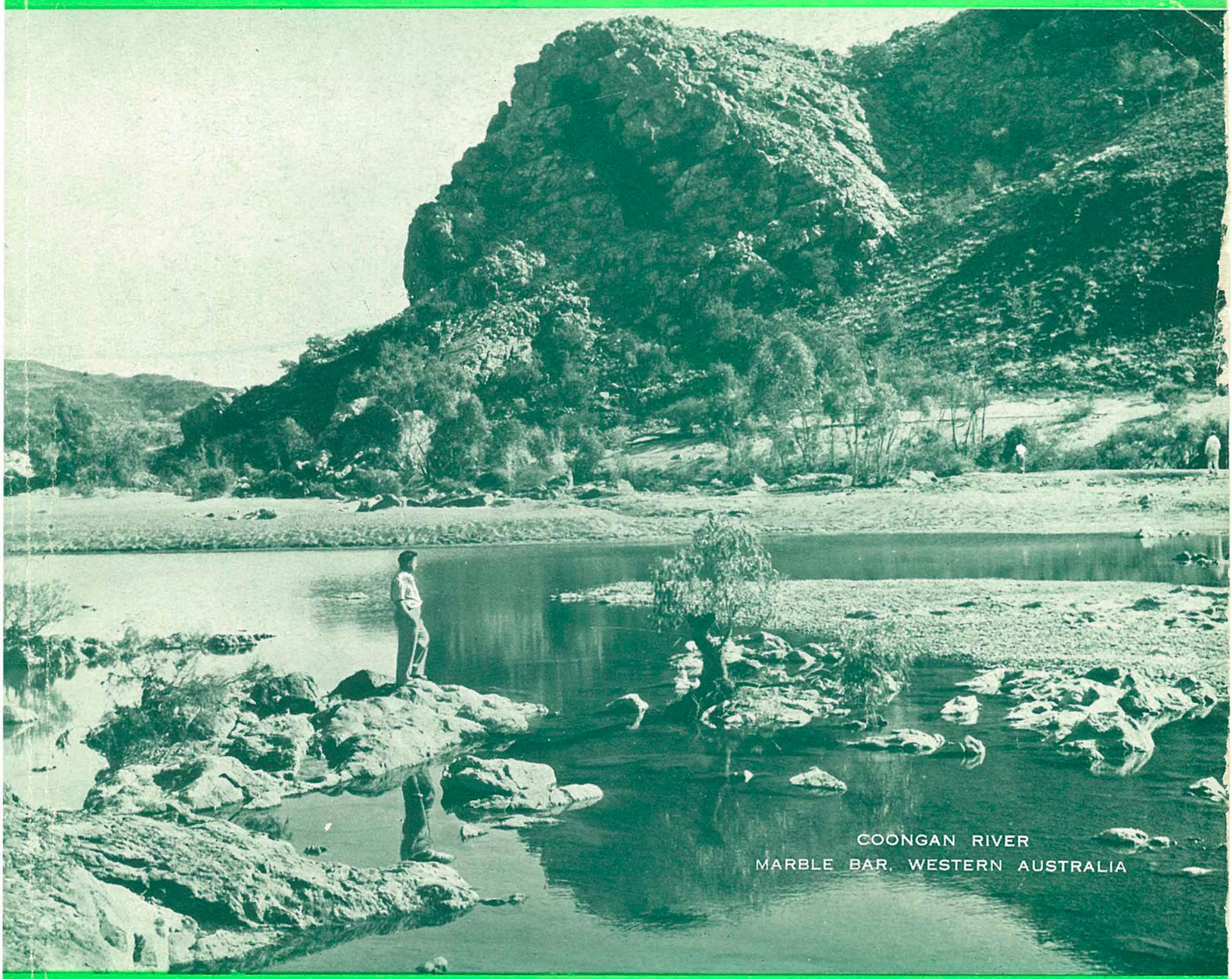
1951



COONGAN RIVER
MARBLE BAR, WESTERN AUSTRALIA

Report of the

DEPARTMENT OF MINES

WESTERN AUSTRALIA

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

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1953

—

WESTERN AUSTRALIA

REPORT

of the

Department of Mines

FOR THE YEAR

1951

PERTH:
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1953.

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ANNUAL REPORT OF THE DEPARTMENT OF MINES, WESTERN AUSTRALIA, 1951.

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ERRATUM SLIP.

To be inserted in the G.S.W.A. Annual Report for the year 1944.

The general report on the Donnelly River Graphite Deposit referred to on page 13 of this report was omitted in error from the 1943 Annual Report of the G.S.W.A. It has now been published in the 1951 Annual Report.

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STATE OF WESTERN AUSTRALIA.

Report of the Department of Mines of the State of Western Australia for the Year 1951.

To the Honourable Minister for Mines.

Sir,

I have the honour to submit the Annual Report of the Department for the year 1951, 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 31/3/1952.

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 1951.

The estimated value of the mineral output of the State for the year was £5,647,519 (calculating gold at £4 4s. 11.45d. per fine ounce), an increase in value of £1,031,362 compared with the preceding twelve months. The estimated value of the premium paid to gold producers amounted to £A7,058,709, bringing the gross value of all minerals to £A12,706,228, an increase of £A1,216,331 compared to the 1950 production.

There were increases in quantites and values of asbestos, bentonite, beryl, bismuth, clays, coal, copper ore, copper fertiliser, diatomaceous earth, felspar, glauconite, glass-sand, gypsum, iron ore (pig), iron ore (export), lead ores and concentrates, ochres, pyrites, scheelite, silver, soapstone, talc, tin, wolfram and zinc fertiliser. Decreases in quantity and value were recorded for barytes, dolomite, magnesite, manganese, tanto-columbite concentrates and vermiculite.

The estimated value of gold received at the Perth Branch of the Royal Mint and exported in gold-bearing material was £A9,725,343 (and equalled 76.54 per cent. of all minerals). (See footnote to Table 1 (a), Part II).

Other minerals realised: Coal, £1,716,788; pyrites, £296,988; lead ores and concentrates, £240,176; asbestos, £225,639; iron ore (pig), £181,136; silver, £79,222; gypsum, £46,726; tin, £39,493; manganese, £33,789; clays, £20,668; cupreous ore (fertiliser), £16,104; glauconite, £15,033; beryl, £11,174; iron ore (export), £10,297; wolfram, £9,585; ochres, £7,891; talc, £7,663; felspar, £7,390; glass sand £4,417; diatomaceous earth, £2,700; tanto- columbite concentrates, £2,350; magnesite, £1,969; bentonite, £1,347; copper ore, £758; dolomite, £599; scheelite, £215; soapstone, £125; bismuth, £84; zinc ore (fertiliser), £50; and barytes, £18.

Dividends paid by the Mining Companies amounted to £1,000,469, a decrease of £195,619 when compared with the previous year (see Table 6, Part II).

To the end of 1951, the total amount distributed by gold mining companies was £47,228,432. To the same date the progressive value of the mineral production amounted to £260,711,037, of which gold accounted for £229,760,598 based on normal values; but premiums on sale of gold during years 1920-1924, plus payments under the Gold Bounty Act, 1930, and further premiums by virtue of enhanced value, increased the total value of gold and mineral productions by £95,224,498, making a gross value of £A355,935,535.

GOLD.

The quantity of gold reported as being received at the Perth Branch of the Royal Mint (622,189.64 fine ounces), together with that contained in gold-bearing materials exported for treatment (5,589.45 fine ounces), totalled 627,779.09 fine ounces, and exceeded that of the previous year by 17,445.68 fine ounces (vide Table 1 (a) of Part II).

Similarly, the total gold yield for the year reported directly to the Department by the producers was 648,244.81 fine ounces, which constituted an increase of 39,611.45 fine ounces in comparison with the previous years' figures (vide Table 3 of Part II).

The apparent inconsistency 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 increased from 20.990 shillings per ton in 1950 to 22.281 shillings per ton in 1951, calculating gold at the old rate of £4 4s. 11.45d. per fine ounce, but the premium rate, which remained unchanged throughout the year (264.70 per cent.), would more than treble this estimate. For East Coolgardie Goldfield (which produced 68.5 per cent. of the State's yield of gold), the calculated average value of the ore treated increased from 20.862 shillings to 22.180 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.M's. N.L.), and Dundas (Central Norseman Gold Corp. N.L.), were 13.258s. (14.100s.); 24.676s. (28.436s.); 46.961s. (37.797s.) and 25.072s. (23.430s.) respectively. Figures for 1950 being shown in parenthesis.

The tonnage of ore reported to have been treated in 1951, viz. 2,471,679 tons, was 8,256 tons more than the previous year and constituted 57.5 per cent. of the State record tonnage established in 1940.

The following tonnage increases were reported from the respective Goldfields—Pilbara 7,259, Yalgoo 1,179, North Coolgardie 22,819, Broad Arrow 2,065, East Coolgardie 40,888, Coolgardie 444, and Phillips River 70; whilst those fields showing a reduction in tonnage were West Pilbara 152, Ashburton 152, Peak Hill 1,263, East Murchison 3,670, Murchison 9,703, Mt. Margaret 14,209, North-East Coolgardie 58, Yilgarn 31,147 and Dundas to 6,103 tons.

East Coolgardie Goldfield recorded a net gain of only 40,800 ore tons, despite the fact that six of the nine principal companies on the Golden Mile showed an aggregate improvement of nearly 145,000 tons, mainly due to the increases effected by the Lake View & Star Ltd. (88,000) and Boulder Perserverance Ltd. (21,000 tons). The Paringa Mining and Exploration Co. Ltd. and the Broken Hill Pty. Ltd. were the principal companies in regression by 88,200 and 29,800 tons respectively. In the Coolgardie Goldfield the New Coolgardie G.M's. N.L. (Hampton Plains), reported a higher output which more than countered the decline shown in the rest of that field.

Credit for the brighter showing of the North Coolgardie Goldfield went to the Western Mining Corporation (New Callion Leases) under the management of the New Coolgardie Gold Mines N.L., and the Moonlight Wiluna G.M's. Ltd. (Timoni Leases).

Lower tonnages by the Sons of Gwalia Ltd. (Mt. Margaret), Burbidge Gold Mine N.L. (Yilgarn), and Central Norseman Gold Corporation (Dundas), were mainly responsible for the decline in their respective Goldfields, whilst in the Murchison Goldfield the small gain by the Big Bell Gold Mines was outweighed by the breakdown loss sustained by the Hill 50 Gold Mine N.L. early in the year.

The sound policy of the principal producers has always been to operate the mines on a basis which will ensure reasonable profits over the longest possible life.

The impact of rising costs is, therefore, reflected in the grade of ore mined. It is interesting in this regard to compare the position in the first six months of 1949 when the industry was also going through a critical period, with that for the latter half of 1951.

	dwts. per ton.
1949 (first half)	5.3842
1950 (first half)	4.7756
1951 (last half)	5.4208

This comparison, added to the fact that two companies of long standing ceased operations during the year, would tend to indicate that practically all benefits derived from the increased Australian price of gold from September, 1949, had now been absorbed, and that the further relief resulting from the decision to allow the sale of gold on the open dollar market was needed and warranted.

The year 1951 was notable for the passing of legislation by the Commonwealth Government permitting the sale of gold on the open dollar market. A Gold Producers' Association was subsequently formed with headquarters at Kalgoorlie, and gold produced from November, 1951 excepting that required for Australian use, approximately seven per cent. has been so disposed of at a premium.

While this additional revenue must of course be of great assistance to producers in helping to meet the greatly increased costs of production, I am of opinion that it will not overcome all the difficulties of the lower grade producers. A higher gold price and one less variable would be more satisfactory.

In order to help cope with changing conditions today gold producers should give consideration to the possibility of utilisation of bye-products. For instance, many of our large producers are operating on sulphide ore-bodies. The possibilities of production of profitable by-products suitable for superphosphate manufacture should be given the closest attention. Australia today, like all other countries must try to become self-supporting in regard to essential minerals. The world is now so industrialised that major deposits of essential minerals which once appeared inexhaustible are showing signs of depletion. The owner nations are naturally now not so anxious to export such minerals, and importing countries must take stock to see if deposits or alternatives exist within their own shores.

Labour is still an uncertain factor on the Goldfields and particularly in the outback mines is there a big annual turnover. Immigration has to some slight extent improved the position, but I am afraid that scarcity of labour will remain one of the major mining problems for some time.

Possibly because of the well-paid jobs offering on the larger mines, prospecting activity in regard to gold is at a low ebb, although some good prospectors' finds were recorded during the year, particularly in the Coolgardie field.

Good progress was made in the development of the two major additions to the gold industry, the Bullfinch and Horseshoe projects, and these should soon provide substantial additions to the State's gold yield.

MINERALS.

The world demand for minerals has been steadily maintained, and the mineral industry in Western Australia is active and expanding.

The State is itself entering upon an industrial era, and this is creating an internal market for many of our minerals.

PART II.—MINERALS.

TABLE 1.—*Quantity and Value of Minerals, other than Gold and Silver, produced and/or exported during Years* 1950 *and* 1951.

Description of Minerals.	1950.		1951.		Increase or Decrease for year, compared with 1950.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons.	£A.	Tons.	£A.	Tons.	£A.
Alunite (Crude Potash)	84·45	1,822	*Nil*	*Nil*	— 84·45	— 1,822
Antimony Ore and Concentrates	92·19	3,514	*Nil*	*Nil*	— 92·19	— 3,514
Asbestos (Chrysotile)	210·14	9,157	**726·55**	**29,301**	+ 515·81	+ 20,144
Asbestos (Crocidolite)	1,018·41	143,496	**1,392·61**	**196,338**	+ 374·20	+ 52,842
Asbestos (Tremolite)	1·00	25	*Nil*	*Nil*	— 1·00	— 25
Barytes	16·00	56	**5·00**	**18**	— 11·00	— 38
Bentonite	213·00	599	**449·00**	**1,347**	+ 236·00	+ 748
Beryl Ore	16·93	1,431	**90·77**	**11,174**	+ 73·84	+ 9,743
			lb.		lb.	
Bismuth	*Nil*	*Nil*	**187·00**	**84**	+ 187·00	+ 84
			Tons.		Tons.	
Calcite	5·00	25	*Nil*	*Nil*	— 5·00	— 25
Clays	6,439·00	4,936	**47,547·00**	**20,668**	+ 41,108·00	+ 15,732
Coal	814,351·53	1,287,749	**848,474·86**	**1,716,788**	+ 34,123·33	+ 429,039
Copper Ore, etc.	2·50	183	**43·13**	**758**	+ 40·63	+ 575
Cupreous Ore (Fertiliser)	969·85	8,867	**1,337·05**	**16,104**	+ 367·20	+ 7,237
Diatomaceous Earth	*Nil*	*Nil*	**198·00**	**2,700**	+ 198·00	+ 2,700
Dolomite	319·85	1,268	**124·25**	**599**	— 195·60	— 669
Felspar	1,421·00	5,329	**1,806·50**	**7,390**	+ 385·50	+ 2,061
Glass Sand	5,132·25	3,566	**6,172·59**	**4,417**	+ 1,040·34	+ 851
Glauconite	323·50	8,735	**506·00**	**15,033**	+ 182·50	+ 6,298
Gypsum	30,835·40	21,942	**77,923·00**	**46,726**	+ 47,087·60	+ 24,784
Ilmenite Rutile Zircon Sand	84·00	521	*Nil*	*Nil*	— 84·00	— 521
Iron Ore (for Pig)	14,895·23	82,682	**19,122·27**	**181,136**	+ 4,227·04	+ 98,454
Iron Ore (Exported)	*Nil*	*Nil*	**10,384·00**	**10,297**	+ 10,384·00	+ 10,297
Kaolin	*Nil*	*Nil*	**12·00**	**19**	+ 12·00	+ 19
Lead / Silver-Lead / Silver-Lead-Zinc — Ore and Concentrates	1,865·79	*111,648	**2,538·67**	***240,176**	+ 672·88	+ 128,528
Magnesite	1,828·70	3,825	**762·25**	**1,969**	— 1,066·45	— 1,856
Manganese Ore	11,961·64	65,459	**5,256·52**	**33,789**	— 6,705·12	— 31,670
Ochre (Red)	186·00	1,860	**627·70**	**7,051**	+ 441·70	+ 5,191
Ochre (Yellow)	*Nil*	*Nil*	**60·00**	**840**	+ 60·00	+ 840
Pyrites Ore and Concentrates	35,213·00	163,514	**46,615·00**	**296,988**	+ 11,402·00	+ 133,474
Soapstone	*Nil*	*Nil*	**38·40**	**125**	+ 38·40	+ 125
Talc	256·00	2,700	**651·17**	**7,663**	+ 395·17	+ 4,963
Tantalo/Columbite Ore and Concentrates	6·69	2,858	**2·06**	**2,350**	— 4·63	— 508
Tin	51·41	25,496	**61·10**	**39,493**	+ 9·69	+ 13,997
	lb.		lb.		lb.	
Tungsten Ore and Concentrates (Scheelite)	*Nil*	*Nil*	**317·00**	**215**	+ 317·00	+ 215
Tungsten Ore and Concentrates (Wolfram)	*Nil*	*Nil*	**11,038·00**	**9,585**	+ 11,038·00	+ 9,585
	Tons.		Tons.		Tons.	
Vermiculite	120·00	720	**54·50**	**491**	— 65·50	— 229
Zinc Ore (Fertiliser)	*Nil*	*Nil*	**10·70**	**50**	+ 10·70	+ 50
Total	....	1,963,983	....	**2,901,682**	....	+ 937,699

TABLE 1 (a).—*Quantity and Value of Gold and Silver exported and minted during Years* 1950 *and* 1951.

	Fine ozs.	£A.	Fine ozs.	£A.	Fine ozs.	£A.
Gold	610,333·41	‡9,466,270	**627,779·09**	**9,725,343**	+ 17,445·68	+ 259,073
Silver	205,103·90	59,644	**196,743·32**	**79,222**	— 8,360·58	+ 19,578
Total	....	9,525,914	....	**9,804,565**	....	+ 278,651
Grand Total	....	11,489,897	....	**12,706,247**	....	1,216,350

* Excluding Silver value. ‡Included in the value of Gold shown are the following estimated premiums :— 1950, £A6,873,740 ; 1951, £A7,058,709.

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	109,310,163	7,479,601	6·84
Total since 1902	1,004,202,362	253,324,432	25·22

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. only of gold bullion production 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 1951

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

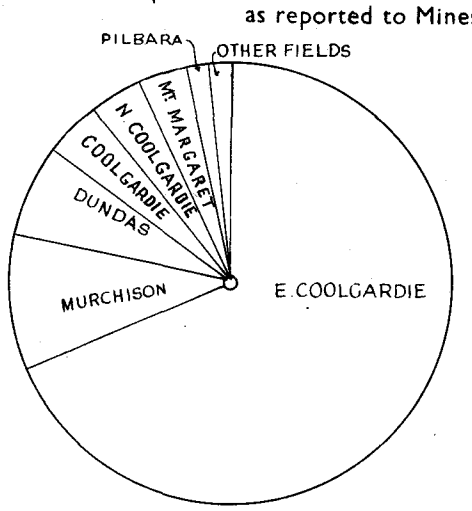


Fig. 2 Gold produced from various Goldfields as given by the Export and Mint Returns

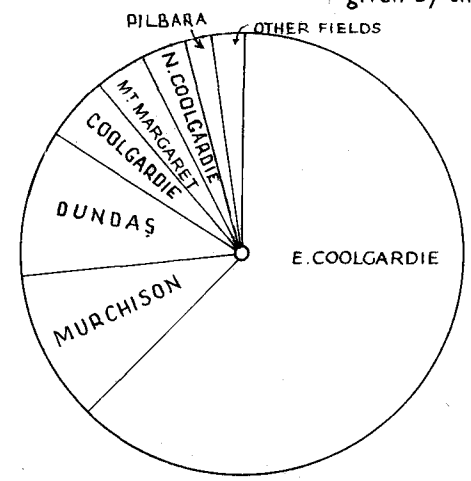


Fig. 3 Value of Gold and other Minerals

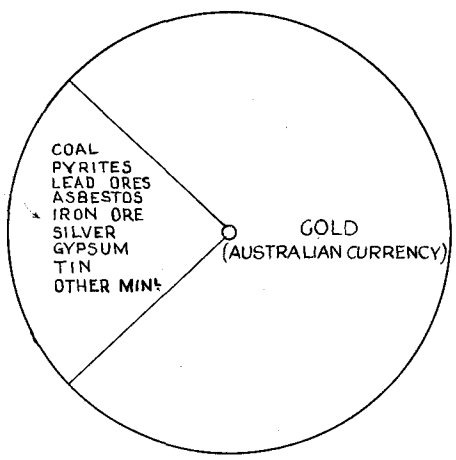


Fig. 4 Value of Minerals other than Gold

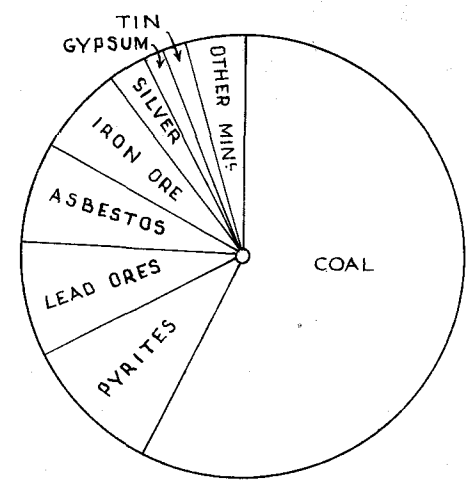


Fig. 5 Areas of land leased for Goldmining on various Goldfields

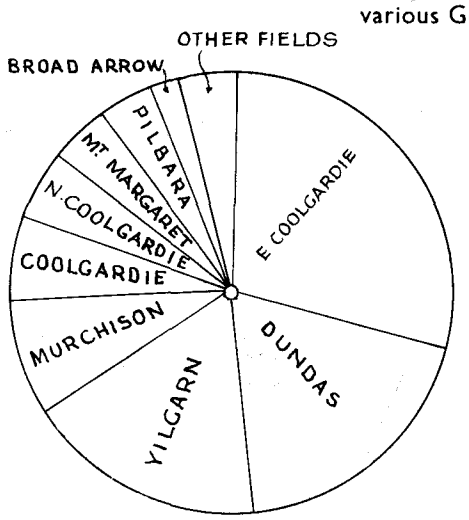


Fig. 6 Output of Gold in the States of Australia and the Dominion of New Zealand

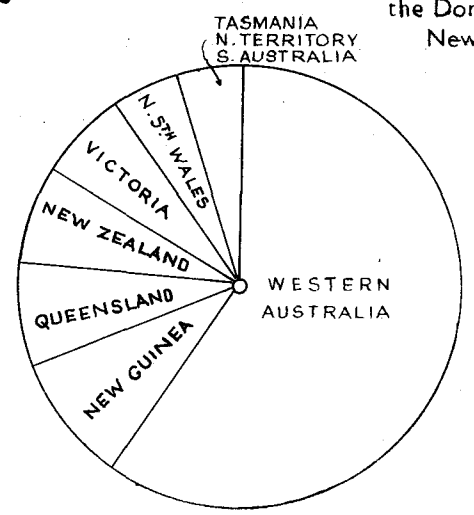
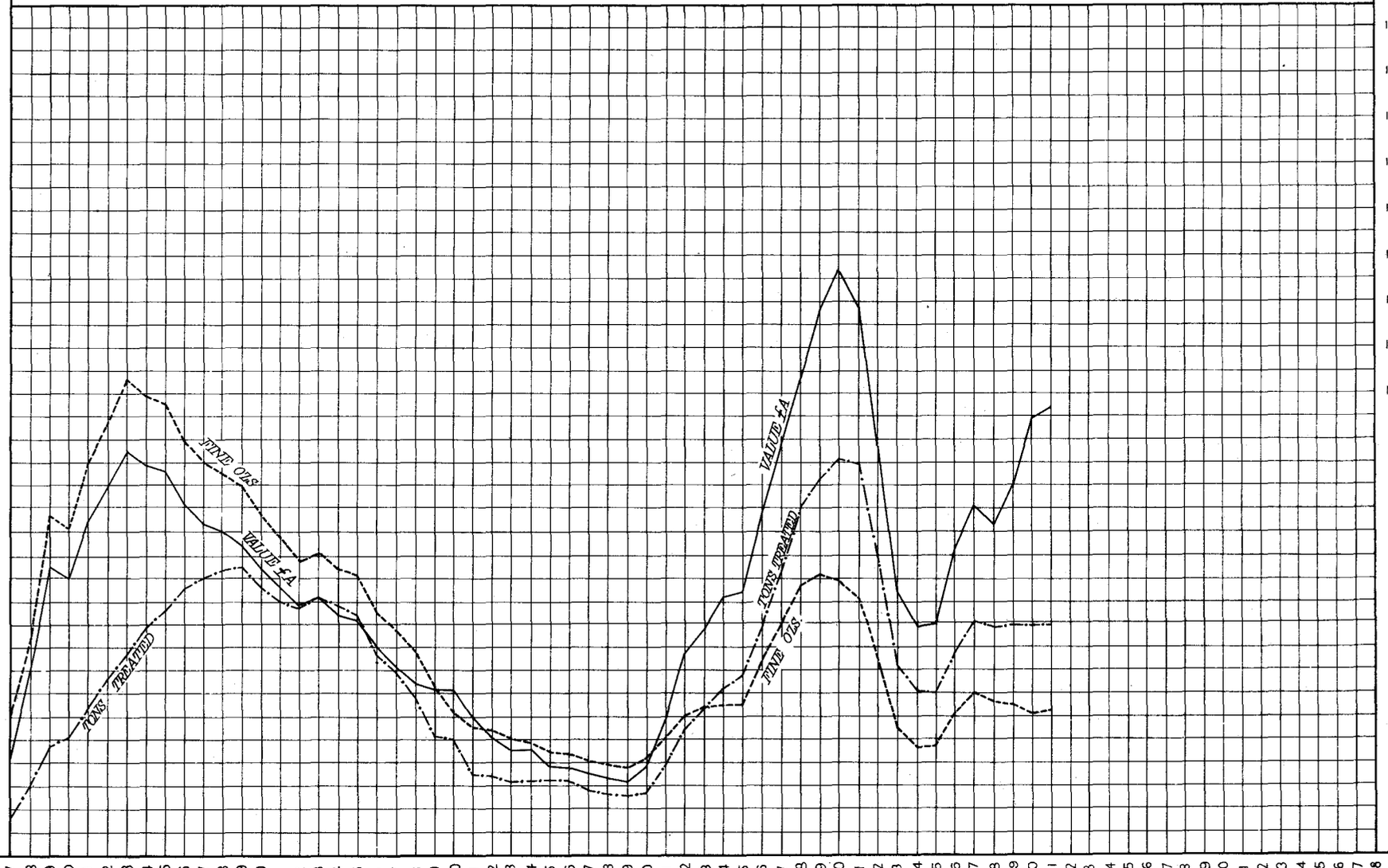


DIAGRAM OF GOLD OUTPUT

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.).	
	1950.	1951.	1950.	1951.	1950.	1951.
	Fine ozs.	Fine ozs.	%	%	Shillings.	Shillings.
1. Kimberley	1,241	119	·204	·018	....	....
2. West Kimberley	....	....	....	....	....	....
3. Pilbara	5,408	9,154	·889	1·412	47·194	45·759
4. West Pilbara	115	21	·019	·003	55·196	71·864
5. Ashburton	54	6	·009	·001	30·181	....
6. Gascoyne	....	....	....	....	....	....
7. Peak Hill	565	271	·093	·042	27·842	49·970
8. East Murchison	3,067	890	·504	·137	57·940	91·495
9. Murchison	69,058	63,419	11·346	9·783	14·100	13·258
10. Yalgoo	733	1,657	·120	·256	55·899	63·009
11. Mt. Margaret	32,675	24,228	5·369	3·737	28·436	24·676
12. North Coolgardie	11,889	24,265	1·953	3·743	54·154	49·707
13. Broad Arrow	3,376	3,471	·555	·536	79·846	52·098
14. North East Coolgardie	406	345	·067	·053	35·485	32·133
15. East Coolgardie	408,169	444,629	67·063	68·590	20·862	22·180
16. Coolgardie	20,913	26,229	3·436	4·046	37·797	46·961
17. Yilgarn	7,220	5,180	1·186	·799	14·728	41·905
18. Dundas	43,654	44,274	7·172	6·830	23·430	25·072
19. Phillips River	65	63	·011	·010	(a)	53·894
20. Outside Proclaimed Goldfields	25	24	·004	·004	(a)	....
Totals and Averages	608,633	648,245	100·000	100·000	22·357	22·281

(a) Mainly Dollied and Alluvial.

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

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

TABLE 4.

Average Quantities of Gold Ore raised and treated, and Gold produced therefrom, per man employed on the several Goldfields of the State, during 1950 *and* 1951.

Goldfield.	1950.				1951.			
	Tons of Gold Ore raised and treated.		Fine ounces of Gold produced therefrom.		Tons of Gold Ore raised and treated.		Fine ounces of Gold produced therefrom.	
	Per man employed under ground.	Per man employed above and under ground.	Per man employed under ground.	Per man employed above and under ground.	Per man employed under ground.	Per man employed above and under ground.	Per man employed under ground.	Per man employed above and under ground.
	Tons.	Tons.	Fine ozs.	Fine ozs.	Tons.	Tons.	Fine ozs.	Fine ozs.
1. Kimberley	....	....	620·50	155·12	....	....	11·09	2·77
2. West Kimberley	....	....	....	....	....	....	....	....
3. Pilbara	139·07	66·22	77·26	36·79	236·03	106·21	127·13	57·21
4. West Pilbara	88·50	25·29	57·50	16·43	12·50	4·17	10·58	3·52
5. Ashburton	76·00	38·00	27·00	13·50	....	....	....	3·26
6. Gascoyne	....	....	....	....	....	....	....	....
7. Peak Hill	172·40	61·57	56·50	20·18	38·33	8·21	22·55	4·83
8. East Murchison	132·26	44·09	90·21	30·07	59·00	14·00	63·54	15·08
9. Murchison	1,045·39	511·14	173·51	84·84	1,188·19	563·61	185·43	87·96
10. Yalgoo	79·57	34·81	52·36	22·91	208·51	69·50	150·63	50·21
11. Mt. Margaret	428·16	215·97	143·31	72·29	443·67	204·44	128·87	59·38
12. North Coolgardie	126·02	58·10	80·33	35·92	246·85	118·83	144·43	69·53
13. Broad Arrow	35·92	18·91	33·76	17·40	62·17	30·42	38·15	18·66
14. North-East Coolgardie	54·00	24·92	22·56	9·23	65·23	27·67	24·67	10·47
15. East Coolgardie	808·44	438·56	198·52	107·33	903·95	475·84	236·00	124·23
16. Coolgardie	216·61	122·41	96·37	54·46	232·59	130·71	128·57	72·53
17. Yilgarn	378·62	156·57	65·64	27·14	75·01	29·09	37·00	14·29
18. Dundas	601·84	350·19	165·98	96·58	634·09	377·62	184·47	109·86
19. Phillips River	7·50	2·50	16·25	5·42	25·00	6·67	15·86	4·23
20. Outside Proclaimed Goldfields	....	....	....	....	....	....	....	....
Total Averages	670·14	349·52	165·57	85·97	729·54	366·61	191·33	96·15

TABLE 5.

Output of Gold from the several States of Australia, the Northern Territory, Papua, the Mandated Territory of New Guinea, and the Dominion of New Zealand, during 1951.

State.	Output of Gold.	Value.*	Percentage of Total.	
			Output of Commonwealth.	Output of Australasia.
	Fine ozs.	£	%	%
1. Western Australia	627,779	2,666,639	64·727	60·074
2. Victoria	66,063	280,617	6·811	6·322
3. New South Wales	49,288	209,361	5·082	4·716
4. Queensland	78,580	333,786	8·102	7·519
5. Tasmania	14,446	61,362	1·489	1·382
6. South Australia	362	1,537	·037	·035
7. Papua	333	1,414	·034	·032
8. Northern Territory	38,945	165,427	4·015	3·727
9. Mandated Territory of New Guinea	94,105	399,732	9·703	9·005
10. New Zealand	75,115	319,068	....	7·188
	1,045,016	4,438,943	100·000	100·000

* At £4 14s. 11·45d. per fine ounce.

TABLE 6.

Dividends, etc., paid by Western Australian Mining Companies during 1951, *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.	
		1951.	Grand Total to end of 1951.
		£	£
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.	....	268,751
	Various Companies	....	2.764,945
Mt. Margaret	Sons of Gwalia, Ltd.	40,625	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) 2,635,578
	Golden Horseshoe (New), Ltd.	11,459	(b) 4,078,754
	Gold Mines of Kalgoorlie, Ltd.	153,688	875,056
	Great Boulder Proprietary G.M's., Ltd.	93,750	7,371,900
	Kalgoorlie Enterprise Mines Ltd.	5,500	287,375
	Lake View & Star, Ltd.	437,500	(c) 5,649,500
	North Kalgurli (1912), Ltd.	137,500	1,557,186
	Paringa Mining & Exploration Co., Ltd.	....	347,040
	South Kalgurli Consolidated, Ltd.	27,345	1,206,754
	Various Companies	....	10,754,854
Coolgardie	do. do.	....	388,770
Yilgarn	do. do.	....	(d) 1,205,556
Dundas	Central Norseman Gold Corporation, N.L.	65,000	942,500
	Various Companies	....	786,162
	Totals	1,000,469	47,228,432

(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 1951.

Goldfield, District or Mineral Field.	1951.		Increase or Decrease as compared with 1950.	
	Quantity.	Value.	Quantity.	Value.
	Tons.	£A	Tons.	£A.
ALUNITE (Crude Potash)—				
Yilgarn	....	....	— 84·45	— 1,822
ANTIMONY ORE AND CONCENTRATES—				
Pilbara (Nullagine)	....	....	— 92·19	— 3,514
ASBESTOS (Chrysolite)—				
Pilbara	109·50	1,861	+ 109·50	+ 1,861
West Pilbara	617·05	2,7440	+ 406·31	+ 18,283
ASBESTOS (Crocidolite)—				
West Pilbara	1,392·61	196,338	+ 374·20	+ 52,842
ASBESTOS (Tremolite)—				
West Pilbara	....	....	— 1·00	— 25
BARYTES—				
Outside Proclaimed Goldfield	5·00	18	— 11·00	— 38
BENTONITE—				
Outside Proclaimed Goldfield	449·00	1,347	+ 236·00	+ 748
BERYL—				
Pilbara	65·18	7,973	+ 60·44	+ 7,531
Coolgardie	16·14	2,291	+ 16·14	+ 2,291
Outside Proclaimed Goldfield	9·45	910	— 2·74	— 79
	lb.		lb.	
BISMUTH—				
Outside Proclaimed Goldfield	187·00	84	+ 187·00	84
	Tons.		Tons.	
CALCITE—				
Mt. Margaret (Mt. Morgans)	....	....	— 5·00	— 25
CLAYS—				
Outside Proclaimed Goldfield	47,547·00	20,668	+ 41,108·00	+ 15,732
COAL—				
Collie	848,474·86	1,716,788	+ 34,123·33	+ 531,750
COPPER ORE, etc.—				
Ashburton	23·70	493	+ 23·70	+ 493
Pilbara	13·30	77	+ 13·30	+ 77
Mt. Margaret (Mt. Morgans)	1·30	50	+ 1·30	— 57
Phillips River	4·83	138	+ 2·33	+ 62
CUPREOUS ORE (Fertiliser)—				
West Pilbara	898·21	10,471	+ 76·81	+ 4,311
Ashburton	39·66	494	+ 39·66	+ 494
Peak Hill	22·00	660	— 71·90	— 1,644
East Murchison	268·93	3,079	+ 268·93	+ 3,079
Yalgoo	40·00	240	+ 40·00	+ 240
Mt. Margaret (Mt. Morgans)	12·55	125	+ 3·34	+ 61
Yilgarn	....	....	— 38·37	— 133
Phillips River	55·70	1,035	+ 48·73	+ 829
DIATOMACEOUS EARTH—				
Outside Proclaimed Goldfield	198·00	2,700	+ 198·00	+ 2,700
DOLOMITE—				
Murchison (Mt. Magnet)	124·25	599	— 195·60	— 669
FELSPAR—				
Coolgardie	1,806·50	7,390	+ 385·50	+ 2,061
GLASS SAND—				
Outside Proclaimed Goldfield	6,172·59	4,417	+ 1,040·34	+ 851
GLAUCONITE—				
Outside Proclaimed Goldfield	506·00	15,033	+ 182·50	+ 6,298
GYPSUM—				
Yilgarn	63,816·00	36,571	+ 43,370·00	+ 22,199
Dundas	7·00	19	+ 7·00	+ 19
Outside Proclaimed Goldfield	14,100·00	10,136	+ 3,710·60	+ 2,566
ILMINITE, RUTILE, ZIRCON SAND—				
Outside Proclaimed Goldfield	....	....	— 84·00	— 521

TABLE 7—*continued.*

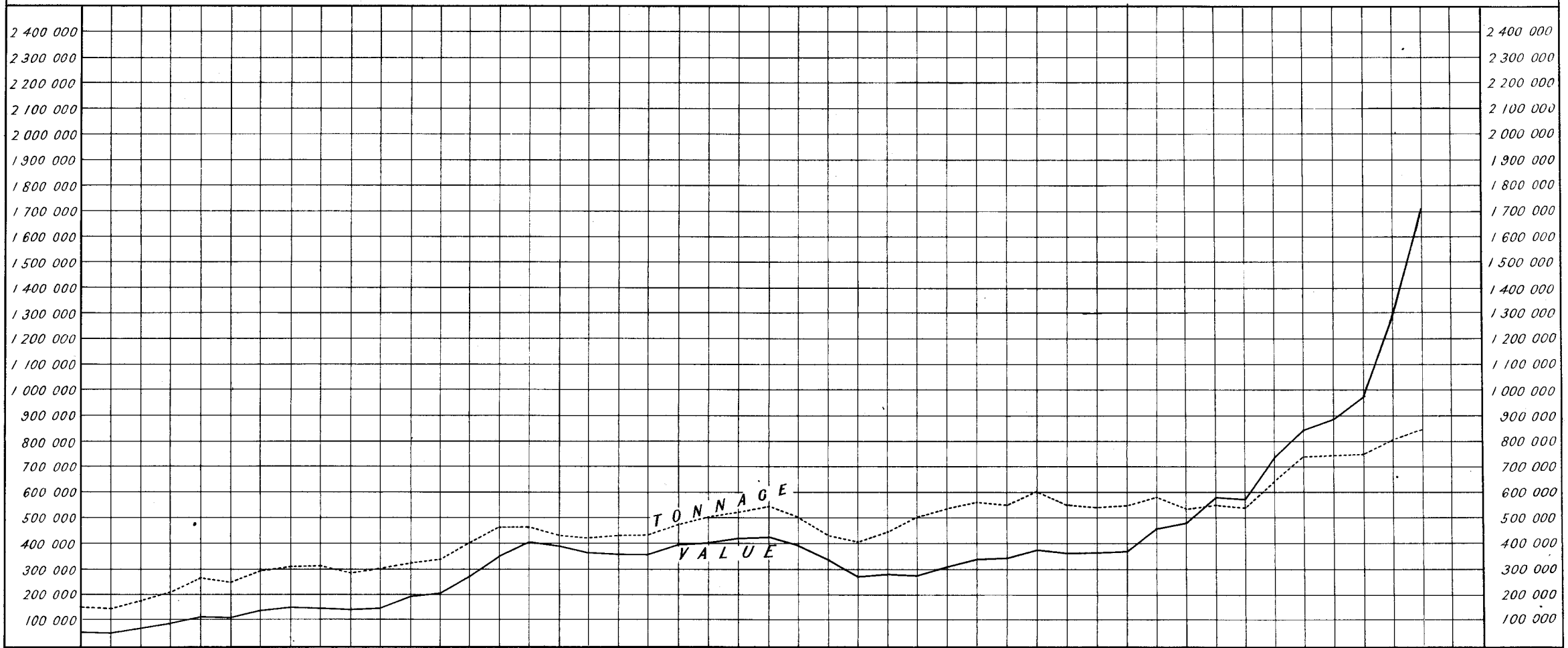
Quantity and Value of Minerals, other than Gold and Silver, reported to the Mines Department during 1951—*continued.*

Goldfield, District or Mineral Field.	1951.		Increase or Decrease as compared with 1950.	
	Quantity.	Value.	Quantity.	Value.
	Tons.	£A.	Tons.	£A.
IRON ORE—				
Yilgarn	(*a*) 13,629·08	139,215	+ 10,559·10	+ 119,293
Outside Proclaimed Goldfield	(*b*) 5,493·19	41,921	— 6,332·06	— 20,839
West Kimberley	(*c*) 10,384·00	10,297	+ 10,384·00	+ 10,297
KAOLIN—				
Outside Proclaimed Goldfield	12·00	19	+ 12·00	+ 19
LEAD ORE AND CONCENTRATES—				
Northampton	1,521·62	148,068	+ 486·57	+ 81,679
*SILVER LEAD ORE AND CONCENTRATES—				
Pilbara	301·72	26,329	— 143·50	+ 3,438
West Pilbara	18·14	2,325	+ 15·90	+ 2,243
Ashburton	648·16	62,909	+ 302·54	+ 40,556
*SILVER, LEAD, ZINC ORE AND CONCENTRATES—				
West Kimberley	49·03	2,630	+ 41·20	+ 2,414
Northampton	....	....	— 29·83	— 1,377
MAGNESITE—				
East Coolgardie (Bulong)	418·00	1,099	+ 418·00	+ 1,099
Coolgardie	344·25	870	+ 304·25	+ 695
Outside Proclaimed Goldfield	....	....	— 1,788·70	— 3,650
MANGANESE—				
Peak Hill	5,256·52	33,789	— 6,705·12	31,670
OCHRES—RED—				
West Pilbara	15·60	234	+ 15·60	+ 234
Murchison (Cue)	612·10	6,817	+ 426·10	+ 4,957
OCHRES—YELLOW—				
Murchison (Cue)	60·00	840	+ 60·00	+ 840
PYRITES, ORES AND CONCENTRATES—				
Dundas	46,615·00	296,988	+ 11,402·00	133,474
SOAP STONE—				
Outside Proclaimed Goldfield	38·40	125	+ 38·40	+ 125
TALC—				
East Coolgardie	54·70	232	— 1·30	+ 22
Outside Proclaimed Goldfield	596·47	7,431	+ 396·47	+ 4,941
TANTALO/COLUMBITE ORE AND CONCENTRATES—				
Pilbara (Marble Bar)	....	....	— 2·29	— 749
Greenbushes	2·06	2,350	— 2·34	+ 241
TIN—				
Kimberley	·17	117	+ ·17	+ 117
West Kimberley	·15	115	+ ·15	+ 115
Pilbara (Marble Bar)	38·31	21,389	+ 17·24	+ 12,912
West Pilbara	·03	18	+ ·03	+ 18
Greenbushes	22·44	17,854	— 7·90	+ 835
TUNGSTEN ORE AND CONCENTRATES—				
SCHEELITE—	lb.		lb.	
Mt. Margaret	84·00	51	+ 84·00	+ 51
Coolgardie	233·00	164	+ 233·00	164
WOLFRAM—				
Pilbara	8,279·00	7,392	+ 8,279·00	+ 7,392
Murchison	2,759·00	2,193	+ 2,759·00	+ 2,193
VERMICULITE—	Tons		Tons	
Outside Proclaimed Goldfield	54·50	490	— 65·50	— 230
ZINC ORE (FERTILISER)—				
Pilbara (Marble Bar)	10·70	50	+ 10·70	+ 50

(*a*) Koolyanobbing. (*b*) Wundowie. (*c*) Yampi—Ore exported to N.S.W. * Value of contained Minerals included.

GRAPH OF COAL OUTPUT

Showing Quantities and Values as reported to Mines Dept.



YEAR	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			YEAR
VALUE £A	57998	55158	75694	90965	113699	111154	135857	153614	148684	137589	147823	191822	204319	270355	350346	407117	381555	368949	363255	363203	394400	407967	420145	426706	394758	336178	270630	289806	278704	318013	331565	340444	376083	362811	364500	389278	461495	489721	583075	572896	730104	840249	880236	972245	1287149	1766788			VALUE £A
TONS	149765	142373	175248	214302	262166	249830	295079	313818	319210	286666	301526	326350	337039	401713	462021	468817	438443	420714	421864	437461	474819	501505	528420	544719	501425	432400	415719	458399	500343	537188	565075	553510	604793	557535	539427	556574	581176	531546	558322	543363	642287	730506	732938	750594	814351	848475			TONS

TABLE 8.

Total Coal output from Collie Coalfield during 1950 *and* 1951, *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—								
1950	556,042	872,952	249	725	974	2,233	767	571
1951	480,145	987,189	264	689	953	1,819	697	504
Open Cut Mining—								
1950	258,310	414,797	125	....	125	2,066	....	2,066
1951	368,330	729,599	172	....	172	2,141	....	2,141
Totals—								
1950	814,352	1,287,749	374	725	1,099	2,177	1,123	741
1951	848,475	1,716,788	436	689	1,125	1,946	1,231	754

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,* 1950 *and* 1951.

Leases and Other Holdings.	1950.		1951.	
	No.	Acreage.	No.	Acreage.
Gold Mining Leases on Crown Lands	1,542	28,140	1,410	25,939
Gold Mining Leases on Private Property	20	480	26	624
Minerals Leases on :—				
(a) Crown Lands	234	42,867	260	43,586
(b) Private Property	16	1,480	20	1,770
Mineral Claims	347	15,826	284	18,279
Prospecting Areas	*591	*16,491	†451	7,850
Totals	2,750	105,284	2,451	98,048

* Includes 65 Prospecting Areas for Minerals of a total of 7,403 acres.

† Includes 61 Prospecting Areas for Minerals of a total of 1,413 acres.

PART IV.—MEN EMPLOYED.

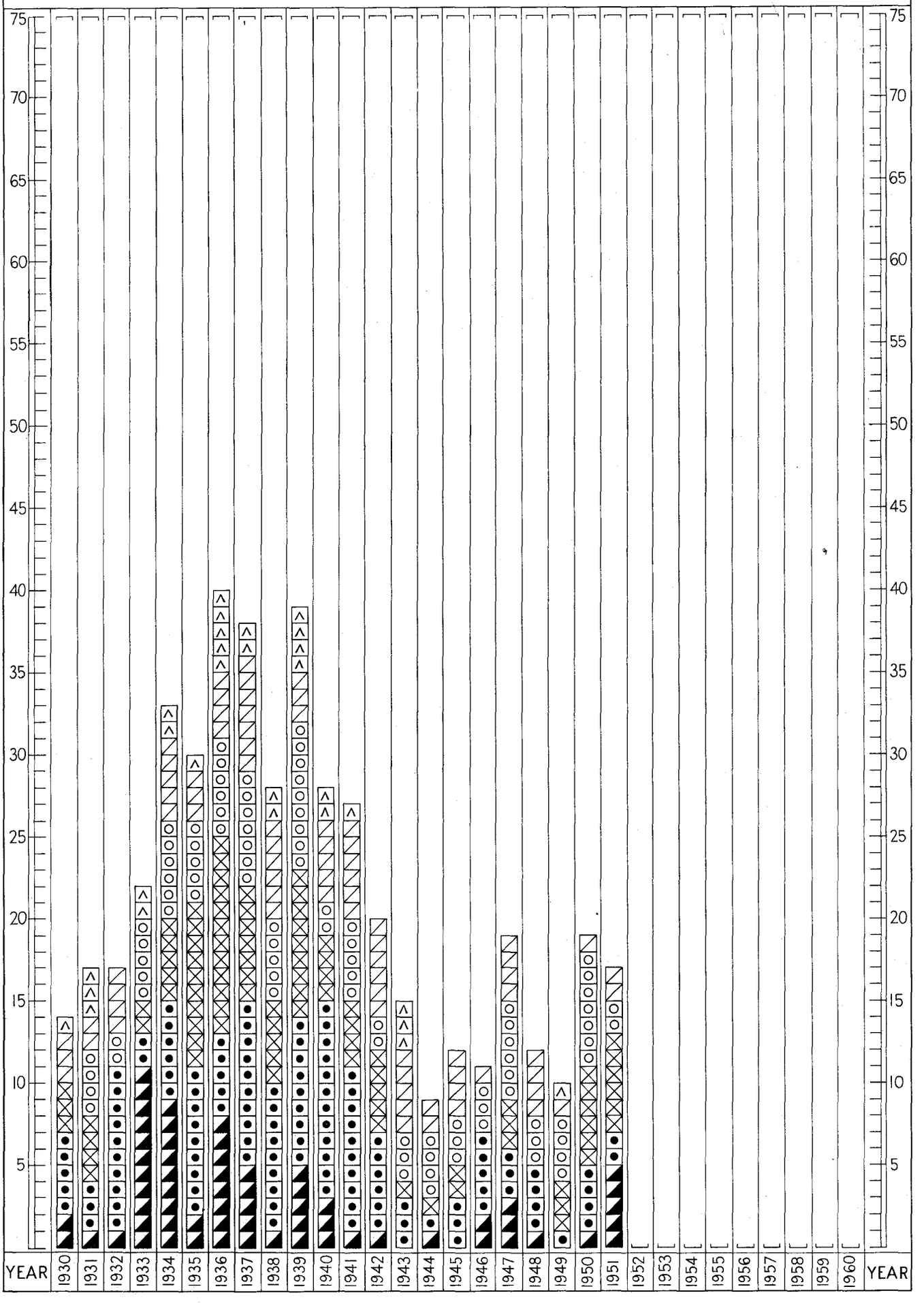
TABLE 10.

Average number of Men reported as engaged in Mining during 1950 *and* 1951.

Goldfield.	District.	Reef or Lode.		Alluvial.		Total.	
		1950.	1951.	1950.	1951.	1950.	1951.
Kimberley		8	8	....	....	8	8
West Kimberley	....	....	....	....	....	....	....
Pilbara	Marble Bar	82	80	....	....	82	80
	Nullagine	65	80	....	....	65	80
West Pilbara		7	6	....	....	7	6
Ashburton		4	2	....	....	4	2
Gascoyne		....	....	....	....	....	....
Peak Hill		28	56	....	....	28	56
East Murchison	Lawlers	21	12	....	....	21	12
	Wiluna	61	36	....	....	61	36
	Black Range	20	11	....	....	20	11
Murchison	Cue	538	518	....	....	538	518
	Meekatharra	67	53	....	....	67	53
	Day Dawn	44	29	....	....	44	29
	Mt. Magnet	165	121	....	....	165	121
Yalgoo		32	33	....	....	32	33
Mt. Margaret	Mt. Morgans	59	43	....	....	59	43
	Mt. Malcolm	313	295	....	....	313	295
	Mt. Margaret	80	70	....	....	80	70
North Coolgardie	Menzies	148	172	3	3	151	175
	Ularring	64	80	4	3	68	83
	Niagara	30	29	....	....	30	29
	Yerilla	79	68	3	2	82	70
Broad Arrow		190	186	4	3	194	189
North-East Coolgardie	Kanowna	27	24	3	3	30	27
	Kurnalpi	12	9	2	2	14	11
East Coolgardie	East Coolgardie	3,758	3,561	10	5	3,768	3,566
	Bulong	32	18	3	3	35	21
Coolgardie	Coolgardie	345	328	....	....	345	328
	Kunanalling	39	35	....	....	39	35
Yilgarn		266	361	....	....	266	361
Dundas		452	403	....	....	452	403
Phillips River		12	15	....	....	12	15
Outside Proclaimed Goldfields	....	....	....	....	....	....	....
Total—Gold Mining		7,048	6,742	32	24	7,080	6,766
MINERALS OTHER THAN GOLD.							
Alunite		28	....	....	....	28	....
Asbestos		153	179	....	....	153	179
Bentonite		1	2	....	....	1	2
Beryl		1	6	....	....	1	6
Clays		7	9	....	....	7	9
Coal		1,099	1,125	....	....	1,099	1,125
Copper Ore		5	....	....	....	5	....
Cupreous Ore (Fertiliser)		....	13	....	....	....	13
Diatomaceous Earth		....	1	....	....	....	1
Dolomite		1	2	....	....	1	2
Felspar		6	6	....	....	6	6
Glass Sand		5	4	....	....	5	4
Glauconite		7	3	....	....	7	3
Gypsum		30	36	....	....	30	36
Iron Ore		34	124	....	....	34	124
Lead		119	189	....	....	119	189
Magnesite		3	3	....	....	3	3
Manganese		8	1	....	....	8	1
Ochre—Red and Yellow		1	3	....	....	1	3
Pyrites		100	138	....	....	100	138
Talc		2	5	....	....	2	5
Tin		21	33	....	....	21	33
Tungsten Ore (Scheelite)		....	2	....	....	....	2
Tungsten Ore (Wolfram)		....	4	....	....	....	4
Vermiculite		2	2	....	....	2	2
Total, Other Minerals		1,633	1,890	....	....	1,633	1,890
GRAND TOTAL		8,681	8,632	32	24	8,713	8,656

DIAGRAM OF ACCIDENTS

Showing the number of Deaths, arranged in Six Classes, in the Mines of Western Australia, from 1930 onwards



Part V.—ACCIDENTS.

Table 11.

MEN EMPLOYED IN MINES KILLED AND INJURED IN MINING ACCIDENTS DURING 1950 AND 1951.

A.—*According to Locality of Accident.*

Goldfield.	Killed.		Injured.		Total Killed and Injured.	
	1950.	1951.	1950.	1951.	1950.	1951.
1. Kimberley	....	....	17	5	17	5
2. West Kimberley	....	....	....	....	....	....
3. Pilbara	....	....	1	1	1	1
4. West Pilbara	1	....	8	12	9	12
5. Ashburton	....	....	....	....	....	....
6. Gascoyne	....	....	....	....	....	....
7. Peak Hill	....	....	1	2	1	2
8. East Murchison	....	....	4	....	4	....
9. Murchison	6	2	37	41	43	43
10. Yalgoo	....	....	....	....	....	....
11. Mount Margaret	1	3	21	16	22	19
12. North Coolgardie	....	....	25	12	25	12
13. North-East Coolgardie	....	....	....	....	....	....
14. Broad Arrow	....	....	....	....	....	....
15. East Coolgardie	6	9	433	358	439	367
16. Coolgardie	1	....	30	23	31	23
17. Yilgarn	1	1	14	23	15	24
18. Dundas	....	....	35	25	35	25
19. Phillips River	....	....	....	1	....	1
Mining Districts—						
Northampton	1	....	1	7	2	7
Greenbushes	....	....	....	....	....	....
Collie	1	2	367	151	368	153
South-West	1	2	7	8	8	10
Totals	19	19	1,001	685	1,020	704

From the above Table it will be seen that the number of fatal accidents for the year 1951 was the same as for 1950. The number injured showed a decrease of 316. In the report of the State Mining Engineer, published as Division II. of this Report, these accidents are classified according to their causes.

B.—*According to Causes of Accidents.*

Cause.	1950.		1951.		Comparison with 1950.	
	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.
1. Explosives	1	12	5	2	+ 4	— 10
2. Falls of Ground	4	85	4	62	....	— 23
3. In Shafts	6	19	6	13	....	— 6
4. Miscellaneous Underground	7	692	2	443	— 5	— 249
5. Surface	1*	190†	2‡	165§	+ 1	— 25
6. Fumes	....	3	....	....	....	— 3
Totals	19	1,001	19	685	....	— 316

* Includes 1 fatal accident in quarries.
† Includes 7 serious accidents in quarries.
‡ Includes 2 fatal accidents in quarries.
§ Includes 8 serious accidents in quarries.

A perusal of the statistics published with this report will show the variety of deposits now being mined, and it is interesting to note the number now being utilised locally. These include clays for fireclay and cement purposes; copper for inclusion in certain superphosphates; coal; felspar and glass sand for glass making; gypsum for plaster of paris, iron ore for Wundowie charcoal iron plant; pyrite for sulphuric acid manufacture; dolomite for foundry purposes; bentonite, a clay used in deep boring operations.

The main minerals exported are asbestos (both blue and white), iron ore, felspar, lead, manganese, silver, tin.

COAL.

The 1951 yield was the highest recorded, the tonnage being 848,475, valued at £A1,716,788. With the State's industrial programme, more coal will be required each year for power, rail, gas and other purposes. This means that operating companies have had to prepare and follow a long-term programme of expansion and development of collieries. Of recent years, the call for increased coal has been mainly met by open-cutting such areas as were suitable for this type of operation.

Under the programmes mentioned which have been possible only with Government assistance, the older mines are being gradually mechanised and new coal areas opened up, while also new mechanised collieries are being developed.

At the end of 1951, there were three open-cuts producing and one being developed, while there were six regular producing collieries, three new ones producing during the course of development and one new one being developed.

Another new one was to be started in 1952.

The Department's deep drill continued to operate satisfactorily during the year and has been a valuable adjunct to the coalfield. A mobile drill is on order from England and will be utilised when received in doing shallower drilling ahead of coal operations. The deep drill had to be used for portion of the year on work of this description.

MINING DEVELOPMENT ACT, 1902-1924.

The expenditure incurred in rendering assistance to mine owners and the industry generally under the provisions of this Act totalled £171,358 4s. 9d.

PART VI—STATE AID TO MINING.

(a) State Batteries.

The number of State batteries existing at the end of the year was 19 with one leased. From inception to the end of 1951 gold and tin to the value of £14,795,452.62 including gold premiums, estimated at £4,624,354.38 have been received from the State batteries, 2,926,681.19 tons of auriferous ore have been treated and have produced £10,076,644.09 plus estimated premium of £4,624,354.38 and 81,810.50 tons of tin ore produced tin to the value of £93,883.16, and residues to the value of £572.

During the year 48,589 tons of ore were crushed for 23,113.12 ounces of bullion estimated to contain 19,588.40 fine ounces of gold equal to eight dwts. one grain per ton. The average value of tailings produced was 3 dwts. 21 grains, making the average head value of 12 dwts. 0 grains. The estimated value of gold produced was 19,588,40 ounces by amalgamation and 6,889.17 from tailings treatment, a total of 26,477.57 ounces valued at £410,290.

The workings expenditure for all plants for the year was £138,170 15s. and the revenue was £77,151 18s. which shows a loss of £61,018 17s. on the year's operations.

The capital expenditure since inception of the scheme has been £590,556 11s.; £424,660 12s. 3d. from the General Loan Fund, £123,487 17s. 4d. from the Consolidated Revenue, £28,621 13s. 5d. from Assistance to Gold Mining Industry and £13,786 8s. from Commonwealth Assistance to Metalliferous Mining.

Head Office expenditure including insurance under the Workers' Compensation Act and Pay Roll Tax was £11,266 10s. 1d. as against £9,430 8s. 1d. for 1948. The working expenditure from inception to the end of the year exceeds revenue by £282,483 16s. 4d.

(b) Geological Survey of Western Australia.

The principal work of the Geological Survey for the year 1951 is covered by the following reports published in Division IV of this Report:

Report on Stock Water Supplies—Moola Bulla Native Station, East Kimberleys.

Peak Hill Goldfield Manganese Deposits.

Report on Underground Water Supplies in the Area East of Wiluna, W.A.

Report on Neville's Scheelite Prospect, P.A. 2476, Noongal, Yalgoo G.F.

Report on the Donnelly River Graphite Deposits, W.A.

Report on a Wolfram Deposit on P.A. 2472, about 6 miles N.E. of Mt. Gibson, Yalgoo Goldfield.

Final Progress Report on a Geological Survey of the Metropolitan Area.

Notes on the Progress of the Ravensthorpe (Phillips River G.F.) Geological Survey as at 31/12/51.

Report on Water Supply at Muresk Agricultural College, Muresk, W.A.

Report on the Exploration of the Southern Portion of Prospecting Area 54, Collie Mineral Field, W.A.

A Note on Prospecting Areas 55 and 56, Collie Mineral Field, W.A.

Report on Further Testing of a Limestone Deposit 3 miles North-West of Capel, South-West Division.

Report on Diamond Drilling Ahead of Existing Collieries, Collie Mineral Field, W.A.

1.—Proprietary Colliery.

Report on Wittenoom Town Water Supply.

Report on Underground Water Supplies South and South-East Stirlings—Mt. Manypeak—North Frankland, South-West Division.

Report on Water Supply on Kimberley Cattle Stations.

Report on Location of Bore Sites for Water at Lake Allanooka.

Report on Laverton Scheelite Prospect, P.A. 2548T, P.A. 2554T, P.A. 2555T, Laverton, Mt. Margaret Goldfield.

Report on Copper Prospect, P.A. 2242, Norseman, Dundas G.F.

Report on a Gold Find on P.A. 6543, Coolgardie.

Report on G.M.L. 462, Loc. 53, Hampton Plains, Coolgardie, Coolgardie G.F.

Report on Diamond Drilling for Chromite at Coobina—North-West Land Division.

Report on Pegmatite at Spargoville, Coolgardie G.F.

During the year the following publications were issued:—

Annual Progress Report of the Geological Survey of Western Australia for 1948.

Bulletin No. 103: Geology of Portion of the Mt. Margaret Goldfield, by R. A. Hobson, B.Sc. (Hons.) and K. R. Miles, D.Sc. (text only).

Mineral Resources of Western Australia Bulleton No. 5: Moulding Sands of Western Australia, by K. R. Miles, D.Sc., and H. A. Stephens, B.Sc.

Geological Sketch Map of Western Australia, Scale 40 miles = 1 inch in 2 sheets.

The following publications are still in the Press:

Annual Progress Report of the Geological Survey of Western Australia for 1949 and 1950.

Bulletin No. 95 (3rd Edition): The Physiography of Western Australia, by J. T. Jutson, B.Sc., LLB.

Bulletin No. 105: The Collie Mineral Field, Part I, by J. H. Lord, B.Sc., F.G.S.

Bulletin No. 103: Atlas No. 1 and Atlas No. 2 (text issued).

The following reports have been compiled and await publication:—

Bulletin No. 107: A Re-Survey of the Coolgardie District, W.A., by J. C. McMath, B.Sc. (Hons. Lond.), F.G.S., M. Aust. I.M.M. and N. M. Gray, B.Sc.

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.).

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.

In course of preparation:—

Maps in connection with the Economic Geological Survey of the Metropolitan Area.

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 1951 under this Act:—

	£	s.	d.
1. Advanced in aid of mining work and equipment of mines with machinery	166,882	3	7
2. Providing means of transport, equipment and sustenance for prospectors	1,920	17	1
3. Other assistance	2,555	4	1
	£171,358	4	9

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

	£	s.	d.
1. Refunds of Advances	30,902	3	2
2. Prospecting Refunds	667	1	5
	£31,569	4	7

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 6,427 against 6,259 total for the preceding year, showing an increase after all adjustments of 168 boilers.

Of the total 6,427 useful boilers, 3,469 were out of use at the end of the year, 2,947 thorough and 773 working inspections were made and 2,959 certificates were issued.

Permanent condemnations totalled 37 and temporary condemnations 10. Five boilers were transferred beyond the jurisdiction of the Act.

The total number of machinery groups registered was 28,260 against 26,596 for the previous year, showing an increase of 1,664.

Inspections made total 20,125 and 4,679 certificates were granted.

The total miles travelled for the year were 71,228 against 73,794 miles for the previous year, showing a decrease of 2,566 miles. The average miles travelled per inspection were 2.91 as against 3.22 miles per inspection for the previous year.

410 applications for engine drivers' and boiler attendants' certificates were received and dealt with, and 364 certificates, all classes were granted as follows:—

Winding Competency (including certificates issued under Regulation 40 and Section 60)	10
First Class Competency (Including certificates issued under Regulations 40 and 45, and Section 60 and 63)	20
Second Class Competency (including Certicates issued under Regulation 40 and Section 60)	26
Third Class Competency (including Certificates issued under Regulations 40 and 45 and Sections 50 and 63 of the Act)	27
Locomotive Competency (including Certificates issued under Regulation 40 and Section 60)	14
Traction Competency (including Certificates issued under Regulation 40 and Section 60)	—
Internal Combustion Competency (including Certificates issued under Regulation 40 and Section 60)	79
Crane and Hoist Competency (including Certificates issued under Regulation 40 and Section 60)	96
Boiler Attendants' Competency (including Certificates issued under Regulation 40 and Section 60)	89
Interim	—
Copies	3
Transfers	—
TOTAL	364

The total revenue from all sources during the year was £13,844 1s. 4d. as against £14,667 18s. previous year, showing a decrease of £823 16s. 8d.

The total expenditure for the year was £18,273 9s. 10d. against £15,634 10s. 6d. for the previous year, showing an increase of £2,638 19s. 4d.

PART VIII—GOVERNMENT CHEMICAL LABORATORIES.

The total number of samples received during the year for examinations was 22,409. This is nearly double the number 11,814 received last year.

The amount of work handled for all Government Departments and State Industries has increased, the biggest increase being from the Metropolitan Water Supply, Sewerage and Drainage Department, in connection with the study of sewer corrosion problems. Arrangements are well in hand for the establishment of an Annexe Laboratory at Lincoln Street, Perth, which handle the bulk of this work. This will relieve congestion in the main laboratory.

The Mineral Division continues to carry out examinations of minerals and ores of economic value for the Government Geologist, the Commonwealth Mineral Resources Bureau, the Mining Industry, prospectors and others. This work is an important factor in the development of the mineral industry of this State. Metals, alloys and building materials are examined for compliance to specification and susceptibility for corrosion or weathering, and advice given to other Government Departments and the general public. A number of samples of minerals and ores have been examined during the year for radio-activity on the Geiger Counter. Umpire and check gold assays are done for the Superintendent of State Batteries on treatment tailings from the State Batteries throughout the State.

The examination of coal samples from the Collie field continues to be carried out by the Fuel Technology Division to gain fundamental knowledge of the composition of the coal to enable a study to be made of the best methods for its utilisation in industry. It is keeping apace with development in the field by continuing a systematic survey of the working faces as development proceeds. Contact with other Government Departments and Industry is maintained whereby we are able to study the results of our research on a practical scale.

The Collie Annexe Laboratory is proceeding steadily with coal washing tests and in August of this year a progress report was issued. It is hoped that when this research is concluded we will be enabled to supply data which will help to arrive at a decision with regard to the washing of Collie coal.

Research continues to be carried out on formation of coked briquettes from Collie coal as a coke substitute. Developments are proceeding satisfactorily and it is hoped that results obtained in the future will justify a study of the economics of production on a plant scale.

A number of foodstuffs including milk samples were examined by the Food and Drug Division for the Public Health Department, Government Institutions and the Milk Board for compliance with Food and Drug regulations. Samples were examined for the Health and Factories Departments and advice given regarding health conditions in factories and works. Toxicological exhibits both human and animal and other miscellaneous exhibits were received from the Police Department and the District Coroner necessitating in many cases the attendance of offifficers at Court proceedings. Drugs and Medicines were tested for the Government Stores and the Royal Perth Hospital.

The number of samples examined by the Agricultural and Water Supply Division this year showed an increase of 20 per cent over that of last year. The materials examined for the Department of Agriculture included soil, pastures, cereals and various plant and tree materials. This work is undertaken for the various branches, Plant Nutrition, Plant Pathology, Horticulture, Dairy, Entomology, etc. The chemical research into the properties of Western Australian tobacco is continuing in co-operation with the Tobacco Officer, of the Department of Agriculture, at Manjimup, Fertilisers and Feeding Stuffs taken by inspectors of the Department of Agriculture, at Manjimup. compliance with the acts. A large number of water samples were examined for bona fide farmers and advice given on their suitability for domestic irrigation and stock purposes. The routine examination of existing water supplies to cities and towns has been continued.

The work of the Industrial Chemistry Division has again been limited by the lack of proper facilities but arrangements are now well in hand for the commencement of the erection of the Unit Process laboratories early next year. However, the year has been a busy one for this Division as apart from routine work there was much activity on the planning and equipping of the new laboratory.

The Chief Industrial Chemist and the Director visited the Eastern States during the year and studied the organisation and equipment of laboratories of similar functions to our Unit Process Laboratory. As a result, much valuable information was collected and a selection of suitable equipment made. The Government provided a grant of £26,000 for the equipping of the Unit Process Laboratory and most of the equipment has been ordered.

During the year with our limited facilities much of the assistance to State Industries, Government Departments and private industry was confined to the provision of technical information and literature. In this connection the Technical Information Service was able to render valuable assistance when over eight hundred queries were answered during the year.

PART IX.—SCHOOL OF MINES.

(a) Kalgoorlie.

The total number of students enrolled for 1951 was 388. This number included two full-time and 40 part-time students under the Commonwealth Reconstruction Training Scheme.

The Metallurgical Laboratory received 345 samples from prospectors, for assay or determination, and 47 samples for investigation as to suitable methods of treatment.

(b) Norseman.

The total number of enrolments at Norseman for 1951 was 52. In addition 40 students of the State and convent schools were enrolled for sub-junior or junior science subjects.

PART X.—EXPLOSIVES.

The quantity of explosives of all types imported during 1951 was as follows:—

	lb.
Gelignite	4,170,400
Gelatine dynamite	123,850
Permitted explosives	188,450
Blasting powder	30,500
	4,513,200
Detonators—	
Ordinary	2,000,000
Electric	133,000
Delay	89,376
	2,222,376
	yards.
Fuse	5,820,000

These figures show an increase on previous years and indicate that general activity in the mining industry.

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

All Goldfields except Ashburton, Gascoyne and Phillips River were visited by the mobile x-ray laboratory and 4,942 examination conducted compared with 5,426 for the previous year.

STAFF.

Throughout an onerous year, all members of the staff, head offices and outstations, rendered excellent service. There were no changes affecting senior positions, but there were many alterations in regard to younger officers. With the keen competition for labour operating today, the Government has lost many younger trained men and women, and this has made it much harder for the senior officials.

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

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

Department of Mines,
Perth, 31st March, 1952.

Division II.

Report of the State Mining Engineer for the Year 1951.

The Under Secretary for Mines.

Sir,

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 1951.

The details of mining activities in the State during the year 1951 have been compiled from information supplied by the Statistician and Inspectors of Mines.

STAFF.

There was no change in staff during the year.

ACCIDENTS.

Fatal and serious accidents in metal mines and quarries reported to the Department are shown below. The corresponding figures for 1950 are shown in brackets.

There were 17 (18) fatal and 534 (634) serious accidents.

In gold mines there were 15 (15) fatal and 493 (596) serious accidents. The number of men employed in such mines was 6,766 (7,080). The accident rate per 1,000 men employed was thus 2.22 (2.54) for fatal accidents and 72.86 (84.18) for serious accidents.

The remaining fatal accidents both occurred in quarries.

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

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

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

TABLE A.

SERIOUS ACCIDENTS FOR 1951.

Class of Accident.	Kimberley and West Kimberley.	East Coolgardie.	Peak Hill.	Yilgarn.	Coolgardie.	Dundas.	Broad Arrow.	Mt. Margaret.	North Coolgardie.	Phillips River.	Murchison.	Pilbara.	West Pilbara.	South-West.	Northampton.	TOTAL.
Major Injuries—Exclusive of Fatal—																
Fractures:																
Head	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Shoulder	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	1
Arm	....	2	....	....	....	....	....	....	....	....	....	....	1	1	....	4
Hand	....	2	....	....	....	....	....	....	....	....	1	....	....	....	....	3
Spine	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Rib	....	4	....	1	1	1	....	....	1	....	1	....	....	1	....	10
Pelvis	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Thigh	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Leg	....	1	....	....	1	....	....	....	....	....	2	....	....	....	....	4
Ankle	....	3	....	....	1	....	....	....	....	....	1	....	....	....	....	5
Foot	....	3	....	1	....	1	....	1	....	....	1	....	....	....	....	7
Amputations:																
Arm	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Hand	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Finger	1	4	....	1	....	2	....	....	....	....	....	....	1	....	....	9
Leg	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Foot	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Toe	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Loss of Eye	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Serious Internal	....	2	....	....	....	....	....	....	....	....	2	....	....	....	....	4
Hernia	....	3	....	....	1	....	....	....	....	....	....	....	....	1	....	5
Dislocations	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	1
Other Major	....	5	1	....	1	....	....	....	....	....	....	1	....	....	....	8
Total Major	1	31	1	4	5	4	....	1	1	....	9	1	2	3	....	63
Minor Injuries—																
Fractures:																
Finger	....	11	....	2	....	1	....	1	1	....	5	....	1	....	....	22
Toe	....	7	....	....	....	2	....	2	....	....	1	....	1	....	....	13
Head	....	8	....	....	....	1	....	2	....	....	1	....	....	....	....	12
Eyes	....	13	....	5	....	1	....	1	2	....	1	....	....	....	....	23
Shoulder	2	1	....	....	....	....	....	1	....	....	....	....	....	....	....	4
Arm	....	19	....	....	1	2	....	....	2	1	2	....	....	....	1	28
Hand	....	97	....	3	10	5	....	....	2	....	5	....	2	....	3	127
Back	1	39	....	3	....	2	....	1	1	....	4	....	1	....	....	52
Rib	....	5	....	....	....	....	....	....	....	....	....	....	....	....	1	6
Leg	1	43	....	6	5	2	....	2	....	....	9	....	1	3	1	73
Foot	....	57	....	....	2	3	....	1	....	....	1	....	2	1	....	67
Other Minor	....	27	1	....	....	2	....	4	3	....	3	....	2	1	1	44
Total Minor	4	327	1	19	18	21	....	15	11	1	32	....	10	5	7	471
Grand Total	5	358	2	23	23	25	....	16	12	1	41	1	12	8	7	534

TABLE B.

Mineral.	Employed.	Accidents.		
		Fatal.	Injured.	
			Serious.	Minor.
Copper	....	....	....	....
Gold	6,766	15	493	1,742
Iron	124	....	5	18
Lead, Zinc, Silver	189	....	7	27
Tin, Wolfram, Tantalite	37	....	....	....
Asbestos	179	....	12	35
Other Minerals	236	....	9	68
Quarries	Not available	2	8	9
Total	7,531	17	534	1,899

TABLE C.

Fatal and Serious Accidents Showing the Causes and Districts in which they occurred.
During Year ended 31st December, 1951.

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.
1. Kimberley and West Kimberley	....	....	....	....	....	....	....	....	....	....	....	5	....	5
2. East Coolgardie	4	....	2	33	2	4	....	....	1	252	....	69	9	358
3. Peak Hill	....	....	....	....	....	....	....	....	....	....	....	2	....	2
4. Yilgarn	....	....	....	1	1	3	....	....	....	9	....	10	1	23
5. Coolgardie	....	....	....	3	....	....	....	....	....	17	....	3	....	23
6. Dundas	....	....	....	4	....	....	....	....	....	14	....	7	....	25
7. Broad Arrow	....	....	....	....	....	....	....	....	....	....	....	....	....	....
8. Mt. Margaret	....	....	....	1	3	2	....	....	....	6	....	7	3	16
9. North Coolgardie	....	....	....	2	....	1	....	....	....	7	....	2	....	12
10. East Murchison	....	....	....	....	....	....	....	....	....	....	....	....	....	....
11. Murchison	1	....	....	....	....	2	....	....	1	25	....	14	2	41
12. Pilbara	....	....	....	....	....	....	....	....	....	1	....	....	....	1
13. West Pilbara	....	1	....	....	....	....	....	....	....	6	....	5	....	12
14. South West	....	1	....	1	....	....	....	....	....	....	2	6	2	8
15. Northampton	....	....	....	....	....	....	....	....	....	4	....	3	....	7
16. North-East Coolgardie	....	....	....	....	....	....	....	....	....	....	....	....	....	....
17. Yalgoo	....	....	....	....	....	....	....	....	....	....	....	....	....	....
18. Greenbushes	....	....	....	....	....	....	....	....	....	....	....	....	....	....
19. Phillips River	....	....	....	....	....	1	....	....	....	....	....	....	....	1
20. Ashburton	....	....	....	....	....	....	....	....	....	....	....	....	....	....
21. Gascoyne	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Total for 1951	5	2	2	45	6	13	....	....	2	341	2	133	17	534
Total for 1950	1	9	4	52	6	19	....	3	6	411	1	140	18	634

FATAL ACCIDENTS.

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

Name and Occupation.	Date.	Mine.	Details and Remarks.
Galbraith, Hubert Roy (Miner)	10–1–51	Great Boulder G.M. Pty., Ltd.	Galbraith was engaged filling rakes of trucks from a chinaman chute on the 1,400 ft. level, Main Lode Cut and Fill Stope. He was apparently working the pass which held approximately 50 tons of broken ore when a bearer collapsed. He became entangled with the timber and the run of ore buried the upper part of his body. By the time assistance was gained he had suffocated.
Hotker, Carl Wilhelm (Tractor Driver)	26–1–51	Katanning Road Board Quarry	Injuries were received when front end loader he was driving turned over sideways and crushed him.
Craig, David (Miner)	16–2–51	Big Bell	Craig, with the aid of shift boss Walter Kelly, was replacing displaced grizzly bars on the 18 section 583 ft. grizzly level. A few minutes after starting work, Kelly heard rock movement and leapt back to safety, whilst Craig was pinned beneath the rock weighing approximately 12 tons. He suffered multiple injuries and death was instantaneous.
Bryans, James (Timberman)	4–4–51	Great Boulder	Bryans and his mate, J. Thomas were trimming hitches and headings preparatory to stulling the 14 Lode leading stope, 900 ft. level. Thomas was trimming a heading and Bryans a hitch, when the hanging wall gave away. Bryans was crushed against the foot wall and fatally injured.
Sobkowics, Michael (Miner)	19–4–51	Big Bell	Sobkowics was engaged in carrying out some minor blasting, *i.e.*, breaking up oversized rocks on the grizzly and possibly also firing a hung up rill. Three shots were heard, and as he had not been seen descend to the level, a train loader went up to look for him and found him dead. He had apparently been killed instantaneously by the blast. It is probable that in firing the three shots he misjudged the time at his disposal and got caught by the blast before he could descend.
Mulligan, Robert Andrew (Miner)	25–4–51	Lake View & Star	Mulligan was engaged as a machine miner and working in the 500 Morrison West Lode shrink stope. He was engaged in barring down after firing in the stope when a fall of earth caught him, inflicting fatal injuries.
Sarell, Richard (Geologist)....	15–5–51	North Kalgurli	Sarell got into the skip at the 500 ft. plat and rang to go to the 700 ft. bin where filling of ore was being done. On arrival at the bin plat a stone weighing 10 lb. came down the shaft, hit the bonnet on the south side and broke the spindle. This caused the bonnet to strike Sarell who was still in the bottom of the skip.
Grazzioli, Angelo (Timberman); Kouzmin, Evan (Timberman); Zanni, Ettore (Shoveller)	1–6–51	Sons of Gwalia	These men were engaged shovelling spillage from the bottom of the shaft into the skip in the south compartment. The north skip with a wooden trailer attached descended to the 27 ft. level. At this point a steel draw bar to which the chain coupling is attached broke and allowed the trailer loaded with timber slabs to run out of control to the bottom, about 600 ft., crushing the three men against the bottom of the shaft killing them instantly.
Turner, John Reginald (Shift Boss)	18–7–51	Lake View & Star	Turner was riding in an ore skip from the 35 ft. level ore bin to the 33 ft. level plat of the Chaffers Shaft. His body was later found on the penthouse at the 37 ft. level. There being no witnesses to accident exactly what occurred is not known.
Harding, Edgar Lawrence (Machine Miner); Heron, Arthur (Bogger)	5–10–51	Lake View & Star	These men were firing the face of a drive on the 1,600 ft. level of the Associated Shaft, when a hole exploded prematurely. Both men appear to have been killed instantaneously.
Donohoe, James Henry (Miner); Pringle, Kenneth Thomas (Diamond Driller)	30–11–51	Great Boulder	Two men were seriously injured and later died in hospital when an explosion of gas occurred at the 2,650 level of the Great Boulder Mine. The gas was encountered in a depressed diamond drill hole which had been drilled for a distance of 1,665 feet.
Baxter, Herbert Henry (Labourer)	15–11–51	White Rock Quarries, Beela	Prior to the accident the deceased was employed in arc welding just outside the engine room. It is thought that the belt driving the generator broke while Baxter was welding. The belt, after the accident, was found wrapped round the mainshaft. He was possibly struck by loose end of belt and dragged to the floor between the bottom of fly wheel and floor.
McGregor, Alexander Wallace (Miner)	3–12–51	Copperhead Mine, Bullfinch	This man was killed in the main shaft when struck by a descending cage. There were no witnesses to the accident but it appears that McGregor, during the course of his duties, had to move across compartments in which the cages were working, in order to ring the signal bell. Apparently he made an error in judgment and failed to leave the compartment in which the cage was descending in time to clear the cage.

WINDING MACHINERY ACCIDENTS.

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

Overwinds.—No overwind was reported.

Skip Derailments (3).—All occurred in the Sons of Gwalia Mine. There is no apparent cause for these derailments and it is thought that spillage on the track may have been responsible.

Cages Hung Up (2).—Both of these accidents occurred in the main shaft of the Kalgoorlie Enterprise Mine. The cause of the trouble could not be definitely ascertained in either case.

Mechanical Failures (4).—The main shaft of the winder on the Sons of Gwalia failed. On the same mine the draw bar of a trolley failed and allowed it to escape down the shaft. Three lives were lost.

On the Lake View Mine a skip escaped when the bridle failed and on the Ivanhoe Mine the draw bar of a skip failed.

Rope Failure (1).—A rope of an ore skip failed on the Big Bell Mine.

PROSECUTIONS.

The only prosecution conducted during the year, which was for a breach of the regulations controlling hygiene, was successful.

SUNDAY LABOUR PERMITS.

Two permits were issued during the year, both of which were to permit shaft sinking to be carried out.

CERTIFICATES OF EXEMPTION (Section 46).

Seven certificates were issued as compared with 16 in 1950.

AUTHORISED MINE SURVEYORS.

The Survey Board issued 15 certificates during the year.

ADMINISTRATIVE.

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

Regulation 114 has been amended to provide that the firing warning (7 knocks or rings) shall be used when firing is carried out adjacent to a shaft.

Regulation 171 has been amended to provide that all change rooms reconstructed for the administration of aluminium therapy shall be divided into two separate sections, one for clean clothes and one for working clothes.

Working clothes may not be placed in the section set aside for clean clothes.

A new regulation has been added to the Mining Act.

Regulation 106B provides that all tailings and mining materials on land leased as a mineral lease shall be reserved to the Crown.

The scale of charges for inspections under the Inspection of Machinery Act has been revised.

VENTILATION.

Primary ventilation is well maintained and the use of fans has been extended. A fan has been installed on the Union Jack Shaft of the North Kalgurli Mine, and some major changes have been made on the Great Boulder Mine.

On the Iron King pyrites mine at Norseman conditions have been improved by two new connections and a further fan is to be applied.

A fan has also been installed on the Timoni Mine and conditions there are good.

Secondary ventilation has also been maintained at a satisfactory level and the use of good equipment is increasing.

Dust sampling has been continued throughout the year and the results are tabulated below.

Aluminium therapy has been installed on most of our major mines with others almost ready to go into operation. A certain lack of co-operation which was noticed in some cases has now been overcome and there is a general acceptance of the treatment.

A record system has been established and the results of the treatment will be studied.

YEARLY TABULATION OF DUST COUNTS, 1951.

Development.		Stoping.		Level.		Surface.		No. of Places showing 1000+p.p.c.c.			
No. of Samples.	Average. Count.	No. of Samples.	Average. Count.	No. of Samples.	Average. Count.	No. of Samples.	Average. Count.	Develop-ment.	Stope.	Level.	Surface.
263	146	445	183	138	184	53	203	4	7	4	1

GOLD MINING.

The ore produced during the year amounted to 2,471,679 tons, slightly higher than the amount of 2,463,423 tons produced in 1950.

The gold recovered was 648,245 fine ounces and the corresponding figure for the previous year was 608,633 fine ounces.

The average grade of 5.25 dwt. per ton is above the figure of 4.94 dwt recorded in 1950, but is lower than for several years past if the record low figure of 1950 is excluded.

The improvement over the previous figures is mainly due to increased production and a higher average grade in the East Coolgardie Goldfield.

The number of men employed in the industry, based on monthly average, was 6,766, which is the lowest figure recorded since 1945. A substantial reduction in the labour force is reported from the East Coolgardie Goldfield where 3,587 men were employed as compared with 3,803 in the previous year.

The calculated value of the gold produced was £A10,042,392, the highest figure recorded since 1941.

The value per ton of ore is 81.26 shillings, which is the highest value recorded for many years.

The average production of ore per man for the year was 365.31 tons equivalent to 95.81 fine ounces of gold as compared with 347.94 tons and 85.96 fine ounces in the previous year.

An outstanding feature of this year's operations has been increased efficiency resulting in a larger output from a reduced labour force.

Some return to confidence is indicated by the improvement in the grade of ore mined.

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

Table "D"—Gold Production Statistics.

Table "E"—Classification of Gold Output by Goldfields and Districts.

Table "F"—Classification of Gold Output, 1947-1951.

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

TABLE E.

Classification of Gold Output for 1951 by Goldfields and Districts.

Goldfield and District.	Unclassified, Sundry Claims, Alluvial, etc. (fine ozs.)	Under 100 ozs.		100–500 ozs.		500–1,000 ozs.		1,000–2,000 ozs.		2,000–3,000 ozs.		3,000–4,000 ozs.		4,000–5,000 ozs.	
		No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).	No. of Producers.	Gold (fine ozs.).
Kimberley Goldfield	120	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Ashburton Goldfield	....	1	7	....	....	....	....	....	....	....	....	....	....	....	....
Pilbara Goldfield—															
Marble Bar	66	7	270	6	1,610	1	656	....	....	1	2,760	....	....	....	....
Nullagine	195	10	232	2	578	....	....	....	....	1	2,787	....	....	....	....
West Pilbara Goldfield	8	1	13	....	....	....	....	....	....	....	....	....	....	....	....
Peak Hill Goldfield	....	5	135	1	135	....	....	....	....	....	....	....	....	....	....
East Murchison Goldfield—															
Lawlers	204	3	125	....	....	....	....	....	....	....	....	....	....	....	....
Wiluna	....	2	16	2	374	....	....	....	....	....	....	....	....	....	....
Black Range	....	....	....	1	170	....	....	....	....	....	....	....	....	....	....
Murchison Goldfield—															
Cue	230	6	101	3	554	....	....	1	1,089	....	....	....	....	....	....
Meekatharra	322	10	230	8	1,960	1	522	....	....	....	....	....	....	....	....
Day Dawn	87	....	....	1	489	....	....	....	....	....	....	....	....	....	....
Mt. Magnet	60	7	134	1	357	....	....	....	....	....	....	....	....	....	....
Yalgoo Goldfield	155	6	157	2	639	1	706	....	....	....	....	....	....	....	....
Mt. Margaret Goldfield—															
Mt. Morgans	55	3	48	3	469	....	....	....	....	....	....	....	....	....	....
Mt. Malcolm	108	7	237	1	217	....	....	....	....	....	....	....	....	....	....
Mt. Margaret	57	4	84	4	1,126	2	1,433	1	1,209	....	....	....	....	....	....
North Coolgardie Goldfield—															
Menzies	107	9	189	2	508	1	585	....	....	....	....	....	....	....	....
Ularring	23	3	165	4	757	2	1,285	....	....	....	....	....	....	1	4,283
Niagara	1	1	94	2	281	1	966	1	1,205	....	....	....	....	....	....
Yerilla	136	1	57	2	510	....	....	1	1,710	....	....	....	....	....	....
Broad Arrow Goldfield	553	12	644	6	1,348	1	927	....	....	....	....	....	....	....	....
North-East Coolgardie Goldfield—															
Kanowna	62	3	138	1	140	....	....	....	....	....	....	....	....	....	....
Kurnalpi	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....
East Coolgardie Goldfield—															
East Coolgardie	678	27	796	7	1,415	1	564	1	1,508	3	6,975	1	3,327	....	....
Bulong	25	2	64	....	....	....	....	....	....	....	....	....	....	....	....
Coolgardie Goldfield—															
Coolgardie	2,279	9	267	4	736	3	1,737	....	....	....	....	....	....	....	....
Kunanalling	170	1	125	....	....	....	....	....	....	....	....	....	....	....	....
Yilgarn Goldfield	182	23	709	7	1,652	1	841	1	1,796	....	....	....	....	....	....
Dundas Goldfield	48	8	174	1	183	....	....	....	....	....	....	....	....	....	....
Phillips River Goldfield	....	4	63	....	....	....	....	....	....	....	....	....	....	....	....
State Generally	23	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Totals	5,959	175	5,274	71	16,208	15	10,222	6	8,517	5	12,522	1	3,327	1	4,283

Goldfield and District.	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 Goldfield	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Ashburton Goldfield	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Pilbara Goldfield—														
Marble Bar	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Nullagine	....	....	....	....	....	....	....	....	....	....	....	....	....	....
West Pilbara Goldfield	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Peak Hill Goldfield	....	....	....	....	....	....	....	....	....	....	....	....	....	....
East Murchison Goldfield—														
Lawlers	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Wiluna	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Black Range	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Murchison Goldfield—														
Cue	....	....	....	....	....	....	....	....	1	49,726	....	....	....	....
Meekatharra	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Day Dawn	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Mt. Magnet	1	7,557	....	....	....	....	....	....	....	....	....	....	....	....
Yalgoo Goldfield	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Mt. Margaret Goldfield—														
Mt. Morgans	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Mt. Malcolm	....	....	1	19,186	....	....	....	....	....	....	....	....	....	....
Mt. Margaret	....	....	....	....	....	....	....	....	....	....	....	....	....	....
North Coolgardie Goldfield—														
Menzies	....	....	1	11,402	....	....	....	....	....	....	....	....	....	....
Ularring	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Niagara	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Yerilla	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Broad Arrow Goldfield	....	....	....	....	....	....	....	....	....	....	....	....	....	....
North-East Coolgardie Goldfield—														
Kanowna	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Kurnalpi	....	....	....	....	....	....	....	....	....	....	....	....	....	....
East Coolgardie Goldfield—														
East Coolgardie	1	6,559	1	16,897	1	24,426	1	33,126	1	46,843	2	146,381	1	155,044
Bulong	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Coolgardie Goldfield—														
Coolgardie	....	....	....	....	1	20,194	....	....	....	....	....	....	....	....
Kunanalling	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Yilgarn Goldfield	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Dundas Goldfield	....	....	....	....	....	....	....	....	1	43,868	....	....	....	....
Phillips River Goldfield	....	....	....	....	....	....	....	....	....	....	....	....	....	....
State Generally	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Totals	2	14,116	3	47,485	2	45,340	1	33,126	3	140,437	2	146,381	1	155,044

TABLE F.

Classification of Gold Output, 1947–1951.

Range of Output.	1951.			1950.			1949.			1948.			1947.		
	No. of Producers.	Production.	Percentage of Total.	No. of Producers.	Production.	Percentage of Total.	No. of Producers.	Production.	Percentage of Total.	No. of Producers.	Production.	Percentage of Total.	No. of Producers.	Production.	Percentage of Total.
		Fine ozs.			Fine ozs.			Fine ozs.			Fine ozs.			Fine ozs.	
Over 100,000	1	155,044	23.9	1	126,749	20·9	1	132,984	20·5	1	137,502	20·7	1	141,436	20·1
50,000 to 100,000	2	146,381	22.6	2	139,252	22·9	3	202,381	31·2	3	190,031	28·8	1	94,051	13·4
40,000 to 50,000	3	140,437	21.7	3	131,549	21·6	2	87,936	13·5	1	40,412	6·1	2	86,657	12·2
30,000 to 40,000	1	33,126	5.1	....	....	....	1	32,529	5·0	3	74,814	11·3	3	107,047	15·3
20,000 to 30,000	2	45,340	7.0	3	71,291	11·7	2	44,227	6·8	1	22,508	3·4	2	46,415	6·6
10,000 to 20,000	3	47,485	7.3	4	59,421	9·8	5	70,922	10·9	7	107,634	16·2	7	103,154	14·7
5,000 to 10,000	2	14,116	2.2	3	22,527	3·7	2	15,306	2·4	1	5,798	0·9	4	24,826	3·5
4,000 to 5,000	1	4,283	0.7	....	....	....	....	....	....	1	4,225	0·6	1	4,645	0·7
3,000 to 4,000	1	3,327	0.5	....	....	....	1	3,743	0·6	1	3,174	0·5	2	7,448	1·1
2,000 to 3,000	5	12,522	1.9	3	6,770	1·1	3	6,275	1·0	3	7,438	1·1	2	4,359	0·6
1,000 to 2,000	6	8,517	1.3	8	10,592	1·7	7	10,089	1·5	7	11,300	1·7	6	8,754	1·2
500 to 1,000	15	10,222	1.6	15	10,596	1·7	24	14,933	2·3	18	11,335	1·7	11	8,428	1·2
100 to 500	71	16,208	2.5	76	17,620	2·9	70	15,734	2·4	96	20,812	3·1	75	16,510	2·4
Under 100	175	5,277	0.8	211	5,890	1·0	194	6,132	0·9	206	6,503	1·0	259	7,805	1·1
Sundry Claims, etc.	....	5,960	0.9	....	6,376	1·0	....	6,381	1·0	....	19,254	2·9	....	41,217	5·9
Total	288	648,245	100.0	329	608,633	100·0	315	649,572	100·0	349	662,740	100·0	376	701,752	100·0

TABLE G.

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

Mine.	1951.			1950.			1949.			1948.			1947.		
	Tons Treated.	Ounces Gold.	Dwts. per Ton.	Tons Treated.	Ounces Gold.	Dwts. per Ton.	Tons treated.	Ounces Gold.	Dwts. per ton.	Tons treated.	Ounces Gold.	Dwts. per Ton.	Tons Treated.	Ounces Gold.	Dwts. per Ton.
1. Big Bell Mines, Ltd.	369,412	49,726	2·69	359,082	47,592	2·65	424,525	56,071	2·64	424,584	51,770	2·44	357,623	41,048	2·30
2. Boulder Perseverance, Ltd.	135,474	33,126	4·89	114,443	24,455	4·27	133,000	32,529	4·89	135,832	32,324	4·76	137,456	33,498	4·88
3. Central Norseman Gold Corporation, N.L.	151,322	43,868	5·80	155,822	42,475	5·45	132,930	46,865	7·05	118,763	39,150	6·59	107,760	34,411	6·39
4. Gold Mines of Kalgoorlie	167,899	46,843	5·58	163,829	41,482	5·06	163,552	41,071	5·02	161,516	40,412	5·00	158,337	39,138	4·94
5. Great Boulder Pty., Gold Mines, Ltd.	325,924	96,985	5·34	331,739	79,827	4·81	333,109	83,259	5·00	326,685	81,457	4·99	367,293	94,051	5·15
6. Hannan's North (Broken Hill Pty. Ltd.)	9,324	3,327	7·13	39,166	9,256	4·73	42,490	13,027	6·13	42,963	12,878	6·00	44,307	13,893	6·27
7. Hill 50 Gold Mine, N.L.	28,352	7,557	5·33	44,632	11,517	5·16	49,230	13,128	5·33	50,771	13,417	5·28	50,659	13,673	5·39
8. Kalgoorlie Enterprise, Ltd.	56,050	16,897	6·03	46,940	14,417	6·14	52,489	16,981	6·47	53,884	16,692	6·20	57,277	17,807	6·22
9. Lake View and Star, Ltd.	614,051	145,681	4·75	525,924	122,083	4·64	501,261	130,169	5·19	502,534	131,387	5·23	518,431	141,436	5·46
10. Mountain View Gold N.L.	805	489	11·98	1,655	2,332	28·18	3,638	6,007	33·02	1,395	5,798	83·12	1,922	12,795	133·14
11. New Coolgardie Gold Mines N.L.	41,756	20,914	10·02	32,154	16,429	10·22	24,062	9,299	7·73	....	....	....	....	....	....
12. North Kalgurli (1912), Ltd.	255,315	59,395	4·65	241,365	59,425	4·92	231,836	63,051	5·44	211,784	56,804	5·36	151,710	44,608	5·87
13. Paringa Mining and Exploration, Ltd.	8,231	2,811	6·83	96,488	17,058	3·54	91,811	17,782	3·87	100,642	22,508	4·47	99,702	21,429	4·39
14. South Kalgurli Consolidated, Ltd.	98,594	24,426	4·96	90,094	21,279	4·72	84,785	20,654	4·87	77,395	19,037	4·93	79,173	19,503	4·93
15. State Batteries	48,959	19,578	8·00	50,871	20,390	8·02	41,171	22,555	10·96	40,634	24,451	12·03	49,168	33,147	13·48
16. The Sons of Gwalia	73,825	19,186	5·20	88,745	25,558	5·76	81,395	23,573	5·79	60,093	18,139	6·03	81,510	24,986	6·13
17. Timoni (Moonlight Wiluna G.M., Ltd.)	23,976	11,402	9·51	11,211	5,610	10·00	....	....	....	....	....	....	....	....	....
Total	2,409,269	592,211	4·92	2,394,160	561,185	4·69	2,391,284	596,021	4·99	2,309,475	566,224	4·90	2,262,318	585,423	5·18
Other Sources (excluding large retreatment plants)	62,410	32,078	10·28	69,262	25,115	7·25	77,013	31,162	8·09	138,070	62,162	9·00	244,988	80,639	6·58
Total (excluding large retreatment plants)	2,471,679	624,289	5·05	2,463,422	586,300	4·82	2,468,297	627,183	5·08	2,447,545	628,386	5·13	2,507,306	666,062	5·31
Golden Horseshoe Sands Retreatment	....	6,559	....	....	7,661	....	....	10,004	....	....	9,982	....	....	10,648	....
Lake View and Star Retreatment	....	9,364	....	....	4,665	....	....	2,815	....	....	6,113	....	....	7,330	....
Wiluna Gold Mines Retreatment	....	....	....	....	503	....	....	3,743	....	....	11,820	....	....	10,262	....
State Batteries Tailings Treatment	....	7,511	....	....	7,159	....	....	5,827	....	....	6,440	....	....	7,450	....
Meekatharra Sands Treatment	....	522	....	....	2,345	....	....	....	....	....	....	....	....	....	....
GRAND TOTAL	2,471,679	648,245	5·25	2,463,422	608,633	4·94	2,468,297	649,572	5·26	2,447,545	662,741	5·42	2,507,306	701,752	5·60

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—							
Peak Hill	Horseshoe	84	....	90	....	....	174
Pilbara	Comet	....	156	50	60	....	266
	Alexander	40	50	10	40	....	140
Murchison	Big Bell	202	2,194	2,067	2,581	1,222	8,266
	Mountain View	231	288	7	....	....	526
	Caledonian	....	....	37	....	....	37
	Hill 50	....	908	564	276	....	1,748
	Margueritta	....	15	....	....	....	15
Mt. Margaret	Sons of Gwalia	....	403	439	727	2,387	3,956
	Jessie Alma	....	95	....	10	....	105
	Queen of the May	150	187	44	14	....	395
	Boomerang	250	35	....	14	....	299
	Lancefield	33	500	70	....	....	603
	White Horse	260	150	10	....	....	420
	Golden Bell	220	80	50	40	....	390
	Little Gwalia	100	80	....	....	....	180
	Nil Desperandum	80	100	25	....	....	205
North Coolgardie	Porphyry	42	....	25	....	....	67
	Yilgangie Queen	....	335	9	215	....	559
	Callion	216	831	49	241	951	2,288
	Timoni	703	335	66	93	....	1,197
	Oakley	355	....	....	....	....	355
	New Gladstone	....	20	....	15	....	35
East Murchison	Apples	90	105	....	20	....	215
	Hawk	25	140	....	15	....	180
	North End	....	85	....	....	....	85
East Coolgardie	Boulder Perseverance, Ltd.	....	1,433	....	1,434	18,886	21,753
	Kalgoorlie Enterprise, Ltd.	....	1,468	117	637	4,996	7,218
	Gold Mines of Kalgoorlie	....	5,348	2,154	2,241	7,583	17,326
	Great Boulder Pty.	....	5,056	2,157	3,219	12,849	23,281
	Lake View & Star, Ltd.	....	13,230	1,974	6,492	7,579	29,275
	South Kalgurli Consolidated	....	3,155	1,007	1,073	3,805	9,040
Coolgardie	New Coolgardie G.M.—						
	Hampton Plains	392	1,463	547	932	4,250	7,584
	Burbanks	....	46	....	....	....	46
Dundas	Norseman Gold Mines N.L.	159	1,114	147	775	4,573	6,768
	Central Norseman Gold Corporation—						
	Pheonix	360	3,100	140	1,678	1,666	6,944
	Princess Royal	104	1,499	360	805	5,648	8,416
	Lady Miller	....	158	17	79	2,424	2,678
Yilgarn	Great Western Consolidated N.L.	677	1,235	964	1,665	7,222	11,763
	Haoma Gold Mine	32	2,250	40	41	....	2,363
	Sunshine Reward Amalgamated	....	352	....	....	....	352
	Total in Gold Mines	4,805	47,999	13,236	25,432	86,041	177,513
Lead—							
Ashburton	Silent Sister Lead Mine	....	20	....	....	....	20
West Pilbara	Andover Lead Mine	26	....	....	....	....	26
Pilbara	Ragged Hills Lead Mine	....	244	....	28	....	272
Northampton	Rhys Hope Lead Mine	85	50	....	....	....	135
	Protheroe Lead Mine	103	40	84	66	....	293
	Galena Lead Mine	....	12	53	....	....	65
	Baddera Lead Mine	....	234	....	135	....	369
	Great Western Lead Mine	50	....	15	....	....	65
	Wheel Fortune Extended	....	231	90	312	....	633
	Mulligan's Lead Mine	40	80	....	....	....	120
	Maguire's Lead Mine	45	....	....	....	....	45
	Mary Springs Lead Mine	7	....	....	....	....	7
	Kirton's Lead Mine	200	80	....	....	....	280
	Total in Lead Mines	556	991	242	541	....	2,330
Asbestos—							
West Pilbara	Australian Blue Asbestos	....	6,632	....	....	....	6,632
	Total in All Mines	5,361	55,622	13,478	25,973	86,041	186,475

OPERATIONS OF THE PRINCIPAL MINES.

East Coolgardie Goldfield.—The total ore treated in this goldfield amounted to 1,703,035 tons and the gold yield of 444,629 fine ounces is an average of 5.22 dwt. per ton. In the previous year 1,662,147 tons of ore averaging 4.91 dwt. per ton was treated for a recovery of 408,169 fine ounces.

The number of men employed was 3,587 as compared with 3,803 in the previous year.

The production is equal to 68.5 per cent. of the total production for the State.

Almost all of this gold was derived from the *East Coolgardie District*, the *Bulong District* contributing only 89 fine ounces. The principal mine, the *Lake View & Star*, treated 614,051 tons, averaging 4.75 dwt. for a return of 145,681 fine ounces and obtained 9,364 fine ounces from the re-treatment of old tailings.

The figures for the previous year were 525,924 tons, averaging 4.64 dwt. for 122,083 fine ounces and 4,665 fine ounces from re-treatment.

This represents an improvement of 28,297 fine ounces, or nearly three-quarters of the increase in the State's output.

Although no outstanding development was recorded a good tonnage of average grade ore was opened up and ore reserves are almost 4,000,000 (short) tons.

Great Boulder with 96,985 fine ounces from the treatment of 325,924 tons, averaging 5.34 dwt. was also ahead of the figures 79,827 fine ounces produced in the previous year, but the tonnage declined from 331,739 and there was a corresponding increase above the previous grade of 4.81 dwt.

The cut and fill system in use on this mine is being extended.

Development of the known ore channels has proceeded satisfactorily.

The power plant purchased from Wiluna Gold Mines is being erected to provide this mine with its own power station.

North Kalgurli treated 255,315 tons for a return of 59,395 fine ounces, the average grade being 4.65 dwt. The return of gold is almost identical with the figure 59,425 fine ounces for the previous year. Tonnage treated is above last year's figure of 241,365 and the grade has fallen below the 4.92 dwt. obtained in that year.

The new main shaft is complete to 1,200 feet and the head frame and winder are nearing completion.

Development has broken new ground and payable values have been obtained.

A ventilating fan of 40,000 cubic feet per minute capacity has been installed on the *Union Jack* mine.

Gold Mines of Kalgoorlie with a production of 46,843 fine ounces was ahead of the figure of 41,482 fine ounces for the previous year. Tonnage treated advanced from 163,829 to 167,899 and the grade increased from 5.06 to 5.58 dwt. per ton.

The increase in tonnage milled was due to the addition of another ball mill to the fine grinding section of the plant.

An interesting operation in connection with the open cut work was the removal of a pillar by diamond drilling, the explosive being detonated by Cordtex with milli-second delay detonators.

Boulder Perserverance with a production of 33,126 fine ounces was well ahead of the 24,455 fine ounces in the previous year. Tonnage treated also advanced from 114,443 to 135,474 and the grade was 4.89 dwt. as compared with 4.27 dwt.

Good values were encountered in a south drive east of the Lake View Lode at the 200 level and a winze from the 100 level to intersect the same ore body was also in good values.

The testing of unexplored ground between the main shaft and the western boundary has been commenced at the 1450 level.

South Kalgurli crushed 98,574 tons as compared with 90,094 in the previous year and produced 24,426 fine ounces of gold as compared with 21,279 fine ounces. The grade increased from 4.72 to 4.96 dwt. per ton.

Good developments are reported from the 1920, 2050 and 2180 levels.

Kalgoorlie Enterprise, with 56,050 tons treated showed an increase over 46,940 for the previous year. The yield of 16,897 ounces was also above the 14,417 ounces for the previous year, while the grade of 6.03 dwt. was slightly below the 6.14 dwt. recorded for the previous year.

Development at the 25 level disclosed good values.

Paringa was closed down during the year owing to the exhaustion of payable ore.

At *Mount Monger* the *Daisy* and *Haoma* both worked throughout the year. The *Daisy* obtained 564 fine ounces from the treatement of 951 tons of ore and the *Haoma* produced 2,023 fine ounces from the treatment of 2,836 tons of ore.

MURCHISON GOLDFIELD.

Murchison Goldfield produced 63,419 fine ounces from the treatment of 406,361 tons of ore, averaging 3.12 dwt. per ton. In the previous year 69,058 fine ounces of gold was obtained from the treatment of 416,064 tons of ore, averaging 3.32 dwt. per ton. Results are thus somewhat similar to those obtained in the previous year, except that the average grade is slightly lower. The number of men employed was 721 as compared with 814 in the previous year.

The gold produced represents 9.8 per cent. of the State's production.

Cue District produced 51,701 fine ounces from the treatment of 371,427 tons of ore, averaging 2.78 dwt. per ton, as compared with 49,785 fine ounces from 361,901 tons, averaging 2.75 dwt. in the previous year.

The *Big Bell* mine, which obtained 49,726 fine ounces from the treatment of 369,412 tons, averaging 2.69 dwt. per ton as compared with 47,592 fine ounces from 359,082 tons averaging 2.65 dwt. per ton, was the principal producer.

Meekatharra District produced 3,033 fine ounces from the treatment of 5,102 tons, the average being 11.89 dwt. per ton. In the previous year, 4,902 fine ounces was obtained from the treatment of 6,435 tons, averaging 15.23 dwt.

Day Dawn District produced 576 fine ounces from the treatment of 935 tons, averaging 12.32 dwt. per ton. In the previous year, 2,519 fine ounces of gold was obtained from the treatment of 2,208 tons of ore, averaging 22.82 dwt. per ton. The rich shoot of ore on the *Mountain View* mine has been exhausted.

Mount Magnet District produced 8,108 fine ounces from the treatment of 28,898 tons of ore, averaging 5.61 dwt., as compared with 11,854 fine ounces from 45,520 tons, averaging 5.21 dwt. per ton in the previous year.

The plant at *Hill 50* was not in operation for the early part of the year, but extensions are now complete and the tonnage is approaching the designed capacity of the plant. This mine treated 9,324 tons, averaging 7.13 dwt. per ton for a recovery of 3,327 fine ounces. In the previous year, 39,168 tons averaging 4.73 dwt. produced 9,256 fine ounces of gold.

DUNDAS GOLDFIELD.

Dundas Goldfield produced 44,274 fine ounces from the treatment of 152,180 tons of ore averaging 5.82 dwt. per ton, as compared with 43,654 fine ounces from 158,285 tons averaging 5.52 dwt. per ton in the previous year. This represents 6.8 per cent. of the State's total and there is thus some reduction in the percentage, which was 7.2 in the previous year, but the field is still third on the list.

The number of men employed was 403, as compared with 452 in the previous year.

The principal producer was *Central Norseman* with 43,868 fine ounces from 151,322 tons, averaging 5.80 dwt., as compared with 42,475 fine ounces from 155, 822 tons averaging 5.45 dwt. per ton in the previous year.

Developments from the *Regent Shaft* were satisfactory and high values were encountered in the *Princess Royal* mine.

COOLGARDIE GOLDFIELD.

Coolgardie Goldfield was responsible for 26,229 fine ounces from the treatment of 47,450 tons of ore averaging 11.06 dwt., the figures for the previous year being 20,913 fine ounces from the treatment of 47,005 tons averaging 8.90 dwt. per ton.

The number of men employed was 363 as compared with 384 in the previous year.

Coolgardie District with 25,933 fine ounces from 46,516 tons averaging 12.49 dwt. as compared with 20,868 fine ounces from the treatment of 46,093 tons averaging 8.97 dwt. per ton in the previous year was responsible for most of the production, the Kunanalling District producing only 296 ounces from the treatment of 933 tons averaging 6.35 dwt. per ton.

New Coolgardie was the principal producer. The treatment of 41,756 tons of ore averaging 10.02 dwt. yielded 20,914 fine ounces and thus improved on the figures for the previous year when 32,154 tons of ore averaging 10.22 dwt. yielded 16,429 fine ounces of gold.

Several small mines in the district have done well and some spectacular returns have been obtained from small patches.

NORTH COOLGARDIE GOLDFIELD.

The North Coolgardie Goldfield recorded a further increase, 24,265 fine ounces being obtained from the treatment of 41,471 tons of ore averaging 11.70 dwt. per ton. In the previous year 11,889 fine ounces was obtained from the treatment of 18,651 tons, the average recovery being 12.75 dwts. per ton. The number of men employed was 357 as compared with 331 in the previous year.

This goldfield which has been dormant for several years, has, in the last two years, come into prominence and is now fifth in order of importance and only slightly below Coolgardie.

Menzies District with 12,790 fine ounces from the treatment of 24,866 tons averaging 10.28 dwts. per ton was the principal contributor. The *Timoni* mine at Mt. Ida obtained 11,402 fine ounces from the treatment of 23,976 tons averaging 9.51 dwts. per ton. Development is well advanced and results have been satisfactory.

In the *Ularring District* 6,514 fine ounces was obtained from 11,835 tons averaging 11.01 dwts. per ton, the principal producer being the *New Callion* with 4,283 fine ounces from 10,140 tons averaging 8.44 dwts. per ton. The ore from this mine is carted to Coolgardie for treatment.

In the *Niagara* and *Yerilla Districts* the returns were 2,548 fine ounces from 1,408 tons averaging 36.19 dwts. per ton and 2,413 fine ounces from 3,360 tons averaging 14.36 dwts. per ton.

MOUNT MARGARET GOLDFIELD.

The Mount Margaret Goldfield produced 24,228 fine ounces from the treatment of 83,411 tons of ore averaging 5.81 dwts. per ton. There is thus a considerable decline from the figures for the previous year when 32,675 fine ounces was obtained from the treatment of 97,602 tons averaging 6.09 dwts. per ton.

The number of men employed was 408 as compared with 452 in the previous year.

The *Mount Morgans District* produced only 572 fine ounces.

The *Mount Malcolm District* produced 19,747 fine ounces from the treatment of 75,783 tons averaging 5.21 dwts. per ton. The main producer the *Sons of Gwalia* had a poor year and obtained 19,186 fine ounces from the treatment of 73,825 tons averaging 5.20 dwts. as compared with 25,558 fine ounces from 88,745 tons averaging 5.76 dwts. in the previous year. Shortage of labour was the principal difficulty and the mine was idle for a short period owing to the failure of the main shaft of the winding engine.

The *Mount Margaret District* produced 3,908 fine ounces from the treatment of 7,107 tons of ore averaging 11.0 dwts. per ton. The principal source of gold was the sands treatment plant at the State Battery, which returned 1,209 fine ounces.

PILBARA GOLDFIELD.

In the Pilbara Goldfield the treatment of 16,994 tons of ore yielded 9,154 fine ounces, the average being 10.77 dwts. per ton. In the previous year 9,735 tons yielded 5,408 fine ounces, the average being 11.11 dwts. per ton.

The number of men employed was 160 as compared with 147 in the previous year.

In the *Marble Bar District* 5,362 fine ounces was obtained from the treatment of 7,378 tons of ore averaging 14.54 dwts. per ton, the principal producer being the *Comet* with 2,760 fine ounces from 2,475 tons of ore averaging 22.30 dwts per ton.

The *Nullagine District* reported 3,792 fine ounces from the treatment of 9,616 tons of ore, the average being 7.89 dwts. per ton. The *Blue Spec* treated 8,108 tons for a return of 2,787 fine ounces, the average being 6.88 dwts. per ton.

YILGARN GOLDFIELD.

The Yilgarn Goldfield produced 5,180 fine ounces from the treatment of 10,501 tons of ore averaging 9.87 dwts. per ton. In the previous year the output from 41,648 tons averaging 3.47 dwts. per ton was 7,220 fine ounces.

The number of men employed was 361 as compared with 266 in the previous year.

The reduction is due to the closing of the *Burbidge* mine, to restricted output from *Sunshine Reward* on account of development and plant reorganization, and to lower returns from the *Radio*. Development of the *Great Western* at Bullfinch is proceeding with satisfactory results and the erection of the treatment plant is well advanced.

BROAD ARROW GOLDFIELD.

The Broad Arrow Goldfield produced 3,476 fine ounces from the treatment of 5,658 tons of ore averaging 12.29 dwts. per ton. In the previous year the yield was 3,376 fine ounces from 3,592 tons averaging 18.8 dwts. per ton.

The number of men employed was 189 compared with 194 in the previous year.

YALGOO GOLDFIELD.

The Yalgoo Goldfield with 1,657 fine ounces from the treatment of 2,294 tons averaging 14.44 dwts. per ton was ahead of the previous year's output of 733 fine ounces from 1,115 tons averaging 13.16 dwts. per ton. The number of men employed was 33 as compared with 32 in the previous year.

EAST MURCHISON GOLDFIELD.

Mining activity in the East Murchison Goldfield was practically at a standstill the total reported gold amounting to 890 fine ounces.

NORTH-EAST COOLGARDIE GOLDFIELD.

There was little activity in this Goldfield the total return being only 345 fine ounces.

PEAK HILL GOLDFIELD.

This Goldfield reported only 271 fine ounces but steady production from the *Horseshoe* mine is anticipated in the coming year.

OTHER GOLDFIELDS.

Phillips River Goldfield reported 63 fine ounces and *West Pilbara Goldfield* 21 fine ounces.

In the *Kimberley Goldfield* fossickers obtained 120 fine ounces.

No production was reported from *West Kimberley, Ashburton* or *Gascoyne Goldfields.*

MINERALS OTHER THAN GOLD OR COAL.

The production of minerals other than gold and coal for 1950 and 1951 is shown in the table below.

The production of lead has increased very considerably and we have at least four mines which are likely to continue for some years.

Copper also shows an increase but the main production has been carbonate ore for fertilizer. The search for this material has stimulated interest in copper deposits and some promising results have been obtained.

Tin production continues to increase and plants at both Marble Bar and Greenbushes are expanding.

The shipment of iron ore from Cockatoo Island was commenced during the year and the output of pig iron from Wundowie has increased.

PRINCIPAL MINERALS OTHER THAN GOLD AND COAL.

Mineral.	1950.		1951.	
	Tons.	Value.	Tons.	Value.
		£A.		£A.
Asbestos	1,230	152,678	2,119	225,639
Bentonite	213	599	449	1,347
Beryl	17	1,431	91	11,174
Clays	6,439	4,936	47,559	20,687
Copper	972	9,050	1,380	16,862
Felspar	1,421	5,329	1,806	7,390
Glass Sand	5,132	3,566	6,173	4,417
Glauconite	324	8,735	506	15,033
Gypsum	30,835	21,942	77,923	46,726
Iron Ore (as Pig Iron)	14,895	82,682	19,122	181,136
Iron Ore (exported)	....	....	10,384	10,297
Lead	1,866	111,648	2,539	240,176
Magnesite	1,829	3,825	762	1,969
Ochre	186	1,860	688	7,891
Pyrites	35,213	163,514	46,615	296,988
Talc	256	2,700	651	7,663
Tantalite Concentrates	7	2,858	2	2,350
Tin	51	25,496	61	39,493
Tungsten	....	....	5	9,800
Total	100,886	602,849	218,835	1,147,038
Silver (in Gold Bullion)	....	57,984	....	77,137
Other Minerals	....	75,045	....	39,941
Grant Total	....	735,878	....	1,264,116

Notes on the various minerals are given below.

Antimony.

The Blue Spec mine at Nullagine reported the treatment of 6,612 tons of ore for a recovery of 2,306 fine ounces of gold. The sale of antimonial concentrates has not yet been finalised.

Asbestos.

Chrysotile amounting to 726 tons from Lionel and Nunyerri realised £29,301, while Australian Blue Asbestos produced 1,393 tons of Crocidolite valued at 196,338, from its mine at Wittenoom Gorge. A considerable improvement on the figures of 211 tons of Chrysotile and 1,018 tons of Crocidolite is thus recorded.

Barytes.

The Cranbrook deposit yielded five tons valued at £18.

Bentonite.

Imported bentonite has been difficult to obtain and there has been an increased demand for bentonite to be used in diamond drilling with mud. The Marchagee deposit produced 449 tons as against 213 tons in the previous year, and the value of the current year's production was £1,347.

Beryl.

Production for the year amounted to 90 tons valued at £11,174, the production for the previous year being 17 tons. Parcels were received from various localities, the most important being 45 tons from the Pilbara and 13 tons from the felspar quarry at Londonderry.

Bismuth.

Ore amounting to 187 lb. which contained 128 lb. of bismuth valued at £84 was obtained from Yinnietharra.

Clay.

Fireclay, pottery clay and kaolin for industrial purposes aggregated 47,547 tons valued at £20,668. There was a considerable increase over the 1950 production of 6,439 tons.

Copper.

Various parcels of ore from the Ashburton, Pilbara, Mount Margaret and Phillips River districts amounting to 43.13 tons were shipped to Port Kembla and yielded 6.82 tons of copper valued at £758.

Carbonate ores mixed with superphosphate fertilizers amounted to 1,337 tons, the average grade being 9.95 per cent. and the value £16,104.

Diatomaceous Earth.

The Lake Gnangara deposits yielded 198 tons valued at £2,700, which was used by local manufacturers of Ceramic products.

Dolomite.

Dolomite for metallurgical purposes amounting to 124 tons and valued at £599 was obtained from Mount Magnet.

Felspar.

Australian Glass Manufacturers obtained 1,807 tons of microcline felspar, valued at £7,390 from their quarry at Londonderry. In the previous year the output was 1,421 tons.

Glauconite.

The Gingin greensand is the regular source of supply of glauconite for a firm producing water softeners. The amount obtained this year was 3,036 tons which yielded 506 tons of glauconite valued at £15,033.

Glass Sand.

Glass Sand from Lake Gnangara was obtained for use in local glass making and amounted to 6,173 tons. The value was £4,416.

Gypsum.

A rather spectacular increase is reported here. The production of 77,923 tons is valued at £46,726, as compared with 30,835 tons valued at £21,942 in the previous year. The jump in production is accounted for by the production at Chandler of plaster for export to the Eastern States. Production from this source was 43,540 tons—more than half the total production. The remaining 34,383 tons, representing the local demand, was in excess of the previous year's production.

Iron Ore.

The Charcoal Iron and Steel Industry's plant at Wundowie treated 19,122 tons of ore, of which 13,629 tons came from Koolyanobbing and 5,493 tons from Wundowie. The pig iron recovered was 11,014 tons, which is valued at £181,136.

The shipment of iron ore from Australian Iron and Steel's quarries at Cockatoo Island commenced during the year. Ore amounting to 10,384 tons and containing 6,500 tons of iron is valued at £10,297.

Lead.

Lead concentrates from the Northampton area amounted to 1,522 tons and contained 1,186 tons of lead valued at £148,068. The principal producer was Anglo-Westralian's Protheroe Mine at Nabawa which shipped 784 tons of concentrate. Wheel of Fortune Extended obtained 134 tons. These concentrates do not contain payable amounts of silver.

Other producers, mostly in the Ashburton area, obtained a total of 968 tons of concentrate, the principal contributors being Camp and party with 403 tons, Holben and party with 71 tons, and R. O. Moore with 292 tons. The lead content of these concentrates is valued at £89,540 and they contained 7,164 fine ounces of silver valued at £2,023.

The Devonian Lead Mine in the West Kimberley district produced 49.03 tons of concentrate containing 22 tons lead, 7 tons zinc and 349 fine ounces of silver. The value is estimated at £2,630.

The gross value of all lead concentrates amounts to £242,261 and the only mineral other than gold and coal which exceeds this value is pyrites.

Magnesite.

Magnesite was obtained from Bulong and Coolgardie but the output was small, the total production amounting to 762 tons valued at £1,969.

Manganese.

The deposits at Peak Hill yielded 5,257 tons of ore which averaged 48.36 per cent. manganese, the reported value being £33,789.

Ochre.

Production from Ophthalmia Range and Wild Ranges deposits amounted to 688 tons valued at £7,891.

Pyrites.

The shortage of brimstone from overseas sources has concentrated attention on our local sources of sulphur. Proposals for the recovery of sulphur from the tailings of gold mines mining pyritic ore have been considered and a pilot plant is in operation at Big Bell Mines, but no finality has been reached in regard to any of these projects.

The Norseman Gold Mines have produced from their Iron King Mine 12,134 tons of selected ore and 34,481 tons of concentrate containing altogether 19,820 tons of sulphur. The value is calculated at £296,988. An extensive development programme, including the sinking of a new shaft to 1,000 feet, is in progress.

Silver.

Silver obtained as a by-product in both gold and base metal mining amounted to 196,743 fine ounces as compared with 205,104 fine ounces in the previous year. The value was £79,222.

Talc.

An increase from 256 tons in the previous year to 651 tons in the year under review indicates a steady demand for West Australian talc. The bulk of the production was from the deposit near Three Springs. The value was £7,663.

Tantalite-Columbite Ores.

The tin concentrates from Greenbushes contain some tantalite and columbite and 3,497 lbs. of combined oxides valued at £17,712 was obtained from 22 tons of tin concentrates. No other production was recorded.

Tungsten.

Production was stimulated by increased prices and 317 lb. of Scheelite concentrates and 11,038 lbs. of Wolfram concentrates were obtained, the value being £9,800.

Vermiculite.

Perth Modelling Works produced 54.5 tons of crude Vermiculite from the Young River deposit. From their stock they treated 76 tons of ore to produce 60 tons of expanded Vermiculite and exports of crude ore amounted to 21 tons.

Zinc.

Ore from Yandicoogina amounting to 11 tons was used as fertiliser.

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

Appendix No. 1.

REPORT ON ACTIVITIES OF EXAMINERS FOR UNDERGROUND SUPERVISORS' AND MINE MANAGERS' CERTIFICATES FOR 1951.

School of Mines,
Kalgoorlie.
20th November, 1951.

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

I hereby submit the annual report on the work of the Board of Examiners for Mine Managers' and Underground Supervisors' Certificates for the year 1951.

In July Mr. J. F. Breen, the Chamber of Mines representative, resigned from the Board as he had accepted a position in Victoria. Mr. H. B. Newman was appointed in his place.

Mine Managers' Certificates of Competency.

Applications for Mine Managers' Certificates of Competency totalled 15, resulting as follows—

Approved	8
Approved (subject to passing Mining Law Examination)	2
Refused	5

The names of the successful applicants are as follows:—

Brodie-Hall, L. C.	Lloyd, J. K. N.
Collin, A.	Olds, H. L.
Faichney, J. M.	Power, F. W. G.
Jensen, T. B.	Thomson, L. D.

Approved, subject to passing the Mining Law Examination:—

Engstrom, J. A.	Walker, L. J.

Applications for Mine Managers' Certificates of Service.

Two applications were received for Mine Managers' Certificates of Service, resulting as follows:—

Approved	1
Refused	1

Following is the name of the successful applicant:—

Landwehr, A. B.

Examination in Mining Law.

An examination in Mining Law was held on April 16th, the results of which were as follows:—

Number entered	18
Number passed	9

Following are the names of the successful candidates:—

Brodie-Hall, L.	Lloyd, J. K. N.
Faichney, J. M.	Morris, L. W.
Hooper, R. W.	Olds, H. L.
Jensen, T. B.	Sarell, R. G.
Lewis, B. R.	

Underground Supervisors' Examination.

An examination for Underground Supervisors' Certificates was held on October 1st.

Applications were received from the following places:—

Kalgoorlie	15
Norseman	1
Bullfinch	1
Nullagine	1
Big Bell	4
Wittenoom Gorge	2

The results of the examination were as follows:—

Number entered	24
Number passed	8
Deferred	1

Following are the names of the successful candidates:—

Armstrong, E. D.	Hansen, F.
Ball, I. R.	Lawler, F. G.
Baster, L. R.	Phillips, A. J.
Bracegirdle, L.	Zani, J. A.

At the request of the Manager, Australian Blue Asbestos Ltd., who was having great difficulty in obtaining Underground Supervisors a special examination was held at Wittenoom Gorge on June 2nd.

The results were as follows:—

Entered	4
Sat for examination	2
Passed	2

(One being a restricted certificate.)

The names of the successful candidates are as follows:—

Crouse, B. M.

Goytan, N. N.

(Certificate restricted to asbestos mining in Hamersley Range District.)

Standard of Examination for Underground Supervisors.

The Board is desirous of maintaining a high standard for the Underground Supervisors' Examination, and it is proposed to include questions on mensuration next year.

Amendment to Regulation 33 (2) (a).

An amendment to Regulation 33 (2) (a) of the Mines Regulation Act (which relates to the subjects of examination for an Underground Supervisor's Certificate of Competency) was recommended by the Board. The amendment is in the form of an additional sub-clause and reads as follows—"approved first aid certificate".

Reciprocity.

During the year advice was received from the Victorian Board of Examiners for Mining Managers that they had agreed to recognise First Class Mine Managers' Certificates issued by the W.A. Board of Examiners, on condition that the W.A. Board grants equal recognition to First Class Certificates issued in Victoria. This was agreed to by the Board, with the proviso that applicants with Victorian Certificates shall be required to pass the examination in Mining Law.

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

Index to State Mining Engineer's Annual Report for 1951.

LIST OF TABLES.

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, 1951.

CRUSHING.

One 15-head, seven ten-head, and eight five-head mills crushed 48,589 tons of ore made up of 551 separate parcels an average of 86.3 tons per parcel. The bullion produced amounted to 23,114 oz. which is estimated to contain 19,588 oz. of fine gold, or 8 dwt. 1 gr. of gold per ton of ore.

The cost of crushing including administration was 34s. 2d. per ton as against 24s. 8d. for the previous year, a rise of 9s. 6d. per ton. Kalgoorlie, the only 15-head mill which operates continuously had the best cost figure at 18s. 11d. per ton.

The average assay value of all the ore after amalgamation but before cyanidation was 3 dwt. 21 gr. Thus the total head value of the ore was 11 dwt. 22 grains which is 6 grains less than the previous year's figure.

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

	Tons.	%
Over 2 dwt. 8 gr. per ton	30,804	63.4
1 dwt. 18 gr. to 2 dwt. 8 gr. per ton	5,276	10.9
Under 1 dwt. 18 gr. per ton	8,235	16.9
Refractory	4,274	8.8
	48,589	100.0

CYANIDING

Twelve plants handled 44,634 tons of crushed ore for a production of 6,889 fine oz. worth £106,827. The average content of this tonnage was 4 dwt. 2 grains before treatment while the residue contained 23.8 grains. The theoretical extraction by cyanidation was therefore 75.7 per cent. and the actual extraction 74.9 per cent.

The cost of cyanidation was 23s. 10d. per ton, an increase of 4s. 9d. per ton on the previous year. Yarri and Kalgoorlie showed the best figures with 18s. 6d. and 18s. 8d. respectively.

ESTIMATED OVERALL RECOVERY.

With the average extraction in all cyanide plants at 74.9 per cent. and the average grade before cyanidation at 3 dwt. 21 grains the average cyanidation recovery would be 3 dwt. 1.4 gr. Figures for estimated recovery would then be:—

	Dwt.	Gr.	%
Head value	11	22	100
Amalgamation recovery	8	1	67.48
Cyanidation recovery	3	1	25.66
Total recovery	11	2	93.14

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

	1951. £	Grand Total. £
Par production:		
Crushing	83,209	8,080,861
Cyanidation	29,365	1,995,783
Gold Premium:		
Crushing	220,254	3,550,894
Cyanidation	77,462	1,073,460
Open Market Premium:		
Crushing	6,547	6,547
Cyanidation	1,432	1,432
Tin Production:		
Ore	—	93,883
Residues	—	572
Tungsten Production:		
Concentrates	3,396	3,396
	421,665	14,806,828

FINANCIAL.

	Tons.	Expenditure.	Receipts.	Profit.	Loss.
					£
Crushing	48,589	85,012	24,735	—	60,277
Cyaniding	44,634	53,159	52,417	—	742
		138,171	77,152	—	61,019

The loss of £61,019 is an increase of £36,311 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.
Boogardie	Berryman Loader	....	232 14 2
Coolgardie	Battery Reconstruction	....	2,703 12 10
Lake Darlot	Battery Reconstruction	....	1,390 14 7
Kalgoorlie	Electrical Conversion	....	294 11 4
Norseman	Electrical Conversion	137 19 1	65 9 2
Ora Banda	Rotary Hoe	....	283 16 8
Payne's Find....	Diesel Installation....	....	2,091 11 4
Peak Hill	Diesel Installation....	....	1,256 12 4
Marvel Loch	Cyanide Plant	2,832 17 3	2,808 9 1
Yarri	Buildings	....	716 7 5
Wiluna	Manager's Residence	250 0 0	....
Ora Banda	Austin Truck	....	2,025 11 0
Meekatharra	Austin Truck	....	
	Berryman Loader....	....	17 18 7
		£3,220 16 4	£13,887 18 6

Cartage Subsidies:

	Tons.	Cost. £
On ore carted to State plants	12,489	6,049
On ore carted to private plants	844	314
	13,333	6,363

Comparative figures for the last three years are:—

	State Plants.				Private Plants.		
	Tons crushed.	Tons Subsidised.	Per cent. Subsidised.	Cost.	Tons crushed.	Cost.	Total Cost.
				£		£	£
1949	41,171	9,818	23·8	4,612	1,729	694	5,306
1950	50,871	18,278	35·9	7,719	1,247	528	8,246
1951	48,589	12,489	25·7	6,049	844	314	6,363

STAFF.

The end of the year saw the retirement of Inspecting Manager Kennedy Smith after almost 40 years' service in the Northern and Eastern Goldfields. He was one of the last of the older school of managers and was a fully qualified metallurgist. C. K. as he was known to many was an impartial officer, devoted to service and therefore to be fully relied upon by prospector and superintendent alike. Manager Breustedt was transferred to Kalgoorlie and Manager Young from Laverton to Coolgardie while Manager Sturman took over Cue and the North-West circuit was in charge of Manager Ball.

In the previous year Mr. J. F. D. Cherry was appointed to the position of Field Engineer in charge of erection and maintenance at all plants.

ADMINISTRATION.

Expenditure amounted to £11,266 10s. 1d. as against £9,430 8s. 1d. for 1950 and was equivalent to 2s. 5d. per ton of ore crushed and cyanided as against 1s. 11d.

Details are as follows:—

	1950			1951		
	£	s.	d.	£	s.	d.
Salaries	5,326	6	8	5,973	4	3
Pay Roll Tax	1,669	9	10	2,078	17	6
Workers' Compensation	1,664	17	7	2,349	4	4
Travelling and Inspection	548	14	11	639	11	0
Sundries	220	19	1	225	13	0
	9,430	8	1	11,266	10	1

GENERAL REMARKS.

The basic wage and the cost of supplies still continue to rise with a consequent increase in our working loss. We used to make up part of our crushing losses from cyanidation but this year the cyanide plants show a small loss despite rejection of much low grade material. For the last two months of the year a small measure of relief in the unequal struggle against increasing costs was afforded to the industry by the activities of the Gold Producers Association Ltd. This company was formed by permission of the Commonwealth Government with the object of selling gold on the free market, and I was appointed to the executive committee to represent the small producers in Australia and Mandated Territories. Unfortunately that portion of the gold from cyanide operations which we are allowed by law to keep to cover our costs is not eligible under Section 23c of the Income Tax and Social Services Assessment Act. State Batteries therefore receive no benefit whatever from premium sales effected by Gold Producers Association Ltd.

During the year a few parcels of wolfram and scheelite ore were crushed at those mills which are equipped with either a Curvilinear or Wilfley table. As was to be expected extraction is low due to the tendency of stamps to rapidly slime friable minerals like scheelite and wolfram, variation of table speed where gas engines are the prime mover, and the use of one table only with no sizing of particles. Although we cannot get a good recovery under these conditions we are able to afford the prospector some return, as well as a much more accurate idea of the value of his ore than can be got by chip sampling.

C. ADAMS,
Superintendent of State Batteries.

SCHEDULE 1.

Number of Parcels Treated, Tons Crushed and Head Value for the Year ended 31st December, 1951.

No. of Parcels Treated.	Battery.	Tons Crushed.	Yield by Amalgamation. (Bullion).	Yield by Amalgamation. (Fine Gold).	Gross Contents of Tailings on 100% (including refractory).	Total Contents of Ore. (Fine Gold).	Average per Ton (Fine Gold).	Gross Value per Ton at £4 4s. 11½d. per Ounce.
			oz. dwt.	oz. dwt.	oz. dwt.	oz. dwt.	dwt. grs.	£ s. d.
16	Bamboo Creek	1,614	1,268 6	1,074 17	347 8	1,422 5	17 15	3 14 10
15	Boogardie	530¾	140 18	119 8	99 5	218 13	8 6	1 15 1
72	Coolgardie	4,405	1,771 1	1,500 18	762 12	2,263 10	10 7	2 3 8
56	Cue	2,948	2,109 12	1,787 17	482 19	2,270 16	15 10	3 5 6
122	Kalgoorlie	12,208½	3,983 15	3,376 3	2,301 12	5,677 15	9 7	1 19 6
19	Lake Darlot	1,409	407 12	345 8	353 8	698 16	9 1	1 18 4
43	Laverton	6,918½	2,156 16	1,827 17	2,120 6	3,948 3	11 10	2 8 6
11	Marble Bar	593½	126 1	106 17	160 3	267 0	8 23	1 18 0
28	Marvel Loch	2,443½	925 7	784 4	267 0	1,051 4	8 14	1 16 6
38	Meekatharra	4,329½	2,736 0	2,318 14	763 19	3,082 13	14 5	3 0 4
19	Norseman	884½	395 10	335 3	136 6	471 9	10 16	2 5 4
17	Nullagine	684	253 14	215 0	99 3	314 3	9 4	1 18 11
42	Ora Banda	3,432¾	2,123 4	1,799 7	766 6	2,565 13	14 23	3 3 7
4	Peak Hill	250	71 16	60 17	38 9	99 6	7 23	1 13 9
14	Paynes Find	2,283½	1,783 17	1,511 15	293 8	1,805 3	15 19	3 7 1
35	Yarri	3,654½	2,860 3	2,423 19	487 6	2,911 5	15 22	3 7 8
551		48,589	23,113 12	19,588 4	9,479 10	29,067 14	11 23	2 10 10

Average Tons per parcel	86·3
Average Yield by Amalgamation per ton (fine gold)	8 dwts. 1 grs.
Average Value by Amalgamation per ton	£1 14s. 1·75d.
Average Head value of tailing (fine gold)	3 dwts. 21 grs.
Average value of tailing per ton	16s. 5·5d.

SCHEDULE 2.

Details of Extraction—Tailing Treatment, 1951.

Battery.	Tons Treated.	Head Value.	Contents.	Tail Value.	Contents.	Recovery.	Call.	Recovery.	Shortage.	Surplus
		dwts. grs.	dwt	dwts. grs.	dwts.	%	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Bamboo Creek	364	5 19	2,120	1 8	480	77	348 8 6	350 0 7	....	1 12 1
Boogardie	1,644	5 11	9,420	1 9	2,276	75	1,525 9 0	1,517 6 4	8 2 8	....
Coolgardie	4,509	2 19	12,880	0 18	3,418	73	2,013 12 9	1,984 12 2	29 0 7	....
Cue	4,424	4 6	18,900	0 19	3,660	81	3,237 12 10	3,459 18 3	....	222 5 5
Kalgoorlie	10,660	3 14	38,360	0 19	9,153	78	6,203 11 4	6,188 17 11	14 13 5	....
Laverton....	5,925	5 18	34,120	1 7	7,738	76	5,603 19 6	5,642 15 6	....	38 16 0
Marble Bar	1,023	9 10	9,660	2 18	2,823	70	1,612 13 2	1,479 9 8	133 3 6	....
Marvel Loch	3,846	1 9	5,400	0 9	1,427	73	844 4 9	760 14 5	83 10 4	....
Meekatharra	3,712	3 6	13,620	1 1	3,961	68	2,051 12 9	2,016 18 5	34 14 4	....
Ora Banda	2,787	8 10	23,460	1 23	5,463	76	3,822 15 1	3,612 12 8	210 2 5	....
Wiluna	1,988	2 7	5,400	0 20	1,663	64	793 10 0	708 3 2	85 6 10	....
Yarri	3,752	2 10	9,220	0 14	2,281	76	1,473 17 11	1,508 0 6	....	34 2 7
	44,634	4 21	182,560	0 23·8	44,343	75·7	29,531 7 7	29,229 9 7	301 18 0	....

Head Value	4 dwts. 2·1 grs.
Tail Value	23·8 grs.
Theoretical Recovery	75·7 per cent.
Actual Recovery	74·9 per cent.

SCHEDULE 3.

Cyanide Yield, 1951.

Battery.	Tons.	Fine ozs.	Value.	Premium.	Total.
			£	£	£
Bamboo Creek	364	83·31	354·754	936·737	1,291·491
Boogardie	1,644	357·21	1,517·316	4,016·409	5,533·725
Coolgardie	4,509	467·20	1,984·607	5,253·345	7,237·952
Cue	4,424	813·06	3,459·911	9,144·643	12,604·554
Kalgoorlie	10,660	1,454·94	6,188·894	16,360·732	22,549·626
Laverton	5,925	1,311·57	5,642·774	14,746·965	20,389·739
Marble Bar	1,023	348·12	1,479·482	3,914·142	5,393·624
Marvel Loch	3,846	201·97	861·475	2,270·920	3,132·395
Meekatharra	3,712	479·93	2,038·569	5,396·190	7,434·759
Ora Banda	2,787	850·69	3,621·524	9,564·953	13,186·477
Wiluna	1,988	166·95	708·158	1,874·528	2,582·686
Yarri	3,752	354·22	1,508·025	3,982·771	5,490·796
Total	44,634	6,889·17	29,365·489	77,462·335	106,827·824

SCHEDULE 4.

Statement of Receipts and Expenditure for Year ended 31st December, 1951.

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.	£ s. d.
Bamboo Creek	1,659	223 7 1	2,175 1 7	596 18 0	2,995 6 8	36 1·3	339 15 10	404 18 2	3,740 0 8	45 1·0	869 13 5	10 5·8	....	2,870 7 3
Boogardie	530·75	162 8 4	516 11 4	250 10 0	929 9 8	35 0·2	511 9 8	176 5 1	1,617 4 5	60 11·2	302 13 5	11 4·8	....	1,314 11 0
Coolgardie	4,375	271 15 0	2,959 10 10	1,795 9 0	5,026 14 10	22 11·7	1,233 15 1	817 14 10	7,078 4 9	32 4·0	2,159 6 1	9 10·4	....	4,918 18 8
Cue	2,976·25	517 9 10	2,977 16 4	1,422 4 3	4,917 10 5	33 0·5	2,420 18 10	602 17 3	7,941 6 6	53 4·3	2,131 16 11	14 3·9	....	5,809 9 7
Kalgoorlie	12,604·25	1,369 0 2	3,807 6 9	3,864 7 0	9,040 13 11	14 4·1	792 6 7	2,111 4 2	11,944 4 8	18 11·4	5,074 12 11	8 0·5	....	6,869 11 9
Lake Darlot	1,409	623 7 1	2,191 4 9	757 3 6	3,571 15 4	50 8·3	490 2 11	577 19 5	4,639 17 8	65 10·3	805 18 8	11 5·2	....	3,833 19 0
Laverton	6,842·25	566 3 0	4,299 2 10	1,426 6 4	6,291 12 2	18 4·6	1,040 0 8	1,262 2 5	8,593 15 3	25 10·4	3,707 12 7	10 10	....	4,886 2 8
Linden	....	....	....	....	....	....	....	....	....	....	15 9 0	....	15 9 0	....
Marble Bar	723·5	409 2 0	550 12 10	551 2 11	1,510 17 9	41 9·1	1,088 11 4	224 13 2	2,824 2 3	78 0·8	432 19 11	11 11·6	....	2,391 2 4
Marvel Loch	2,742·75	347 5 1	2,382 6 4	948 4 1	3,677 15 6	26 8·9	620 16 11	709 5 2	5,007 17 7	36 6·2	1,416 1 3	10 3·9	....	3,591 16 4
Meekatharra	4,519·5	585 9 4	3,064 1 7	1,403 1 11	5,052 12 10	22 4·3	508 11 11	733 13 11	6,294 18 8	27 10·2	2,080 17 8	9 2·5	....	4,214 1 0
Mt. Sir Samuel	....	....	....	....	....	....	....	....	....	....	42 0 10	....	42 0 10	....
Norseman	884·25	98 8 11	1,262 12 4	560 17 2	1,921 18 5	43 5·6	113 18 2	467 3 7	2,503 0 2	56 7·3	435 1 6	9 10	....	2,067 18 8
Nullagine	684	698 7 8	901 11 0	662 7 5	2,262 6 1	67 10·8	1,252 4 3	385 8 2	3,899 18 6	114 0·3	316 4 4	9 2·9	....	3,583 14 2
Ora Banda	3,571·75	362 15 5	1,694 10 5	1,340 16 5	3,398 2 3	19 0·3	1,433 17 4	598 3 5	5,430 3 0	30 4·8	1,483 2 5	8 3·6	....	3,947 0 7
Paynes Find	2,283·5	91 6 8	2,675 13 9	755 8 6	3,522 8 11	30 10·2	1,096 8 2	897 18 6	5,516 15 7	48 3·8	1,592 7 0	13 11·3	....	3,924 8 7
Peak Hill	250	39 9 10	226 19 1	85 4 3	351 13 2	28 1·5	307 1 9	151 10 3	810 5 2	64 9·8	86 18 2	6 11·4	....	723 7 0
Sandstone	....	....	....	2 8 2	2 8 2	....	8 0	19 8 8	22 4 10	....	....	....	....	22 4 10
Wiluna	....	....	....	8 15 3	8 15 3	....	23 9 2	31 6 6	63 10 11	....	30 16 9	....	....	32 14 2
Yarri	3,686·5	524 4 9	3,536 14 1	1,362 17 4	5,423 16 2	29 5·1	775 7 3	885 11 6	7,084 14 11	38 5·2	1,751 12 3	9 6	....	5,333 2 8
	49,742·25	6,890 0 2	35,221 15 10	17,794 1 6	59,905 17 6	24 1·03	14,049 3 10	11,057 4 2	85,012 5 6	34 2·1	24,735 5 1	9 11·3	57 9 10	60,334 10 3
Total Loss	....	....	....	....	....	....	....	....	....	....	....	....	....	60,277 0 5

SCHEDULE No. 5.

Statement of Receipts and Expenditure for Year ended 31st December, 1951.

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	364	70 3 2	215 18 3	275 18 5	561 19 10	30 10·5	63 9 0	129 3 6	754 12 4	41 5·2	583 14 6	32 0·8	....	170 17 10
Boogardie	1,644	760 10 2	945 10 11	339 2 10	2,045 3 11	24 10·5	1,060 11 9	701 4 8	3,807 0 4	46 3·7	2,285 6 10	27 9·6	....	1,521 13 6
Coolgardie	4,509	462 14 0	3,133 11 0	1,566 15 8	5,163 0 8	22 10·8	368 12 0	759 1 (	6,290 14 2	27 10·8	4,978 2 11	22 0·9	....	1,312 11 3
Cue	4,424	488 4 4	2,493 0 6	1,210 18 10	4,192 3 8	18 11·4	223 2 3	610 12 1	5,025 18 0	22 8·6	7,828 8 3	35 4·6	2,802 10 3	....
Kalgoorlie	10,660	568 19 1	4,979 14 11	2,623 6 8	8,172 0 8	15 3·9	281 0 5	1,475 0 2	9,928 1 3	18 7·5	12,537 17 2	23 6·2	2,609 15 11	....
Laverton	5,925	529 5 1	3,430 5 3	1,329 4 5	5,288 14 9	17 10·2	200 5 3	938 4 0	6,427 4 0	21 8·3	9,366 16 4	31 7·4	2,939 12 4	....
Marble Bar	1,023	199 13 2	774 6 0	767 1 7	1,741 0 9	34 0·4	132 4 0	442 14 0	2,315 18 9	45 3·3	1,140 12 9	22 3·5	....	1,175 6 0
Marvel Loch	3,846	210 12 2	2,074 19 11	598 8 1	2,884 0 2	14 11·9	59 12 0	664 4 8	3,607 16 10	18 9·1	2,377 0 6	12 4·3	....	1,230 16 4
Meekatharra	3,712	372 17 5	2,058 6 2	778 13 9	3,209 17 4	17 3·5	167 2 11	692 0 9	4,069 1 0	21 11	4,030 19 9	21 8·6	....	38 1 3
Mt. Ida	....	....	....	....	....	....	....	....	....	....	134 5 10	....	134 5 10	....
Norseman	....	24 4 9	....	....	24 4 9	....	....	16 11 1	40 15 10	....	10 0	....	....	40 5 10
Ora Banda	2,787	548 2 6	1,953 15 11	1,321 13 8	3,823 12 1	27 5·2	324 8 1	469 2 4	4,617 2 6	33 1·5	3,067 3 11	22 0·1	....	1,549 18 7
Peak Hill	....	....	....	....	....	....	....	7 0	7 0	....	....	....	....	7 0
Sandstone	....	....	23 1 6	23 1 1	46 2 7	....	304 10 6	27 11 11	378 5 0	....	....	....	....	378 5 0
Wiluna	1,988	48 4 6	1,372 2 10	630 9 0	2,050 16 4	20 7·5	27 16 8	347 3 1	2,425 16 1	24 4·8	1,759 17 6	17 8·4	....	665 18 7
Yarri	3,752	467 13 10	1,702 1 1	663 13 8	2,833 8 7	15 1·2	88 17 5	547 17 5	3,470 3 5	18 5·9	3,885 16 8	20 8·5	415 13 3	....
	44,634	4,751 4 2	25,156 14 3	12,128 7 8	42,036 6 1	18 1	3,301 12 3	7,820 18 2	53,158 16 6	23 9·8	53,976 12 11	24 2·2	8,901 17 7	8,084 1 2
Interest paid to Treasury	....	....	....	....	....	....	....	....	....	....	1,560 0 0	....	....	1,560 0 0
Net Receipts	....	....	....	....	....	....	....	....	....	....	52,416 12 11		Total Losses	9,644 1 2
													Total Profits	8,901 17 7
Net Loss	....	....	....	....	....	....	....	....	....	....	....		Net Loss	742 3 7

ANNUAL PROGRESS REPORT OF THE GEOLOGICAL SURVEY BRANCH OF THE MINES DEPARTMENT FOR THE YEAR 1951.

Contents.

List of Plates.

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Division IV.

Annual Progress Report of the Geological Survey of Western Australia for the Year ended 31st December, 1951.

The Under Secretary for Mines,

I have the honour to submit, for the information of the Honourable the Minister for Mines, my report on the operations and progress of the Geological Survey for the year ended 31st December, 1951.

The work of the Geological Survey was carried out by 11 classified officers consisting of the Government Geologist, seven geologists and three office staff.

Availability of Geologists.

Period.	No. of Geologists available, including Govt. Geologist.	Area of State.	Square Miles per Geologist.	Population.
1951.		sq. miles.		
Jan.-Feb.	7	975,920	139,410	570,000
Feb.-Dec.	8	....	121,990	....

FIELD WORK.

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

(1) The field work in connection with the detailed economic geological survey of an area of approximately 2,000 square miles of country surrounding the City of Perth was completed in September, and drafting work on the maps was still in progress at the end of the year.

(2) An extensive water bore-site selection programme on Cattle Stations in the East and West Kimberley Divisions was commenced and completed.

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

(4) Work was commenced on the collection of a representative suite of samples of gold bearing ore from various depths on the principal lodes of the main operating gold mines of the Golden Mile, Kalgoorlie. It is intended to submit this material to the Mineral Section of the Government Chemical Laboratories for research into mineral content and order of deposition, in order to see if any relation exists between mineralisation and attitude of ore bodies.

(5) A large number of bore-sites for water were selected on the Esperance Plains, north of Esperance, in a programme designed to investigate the underground water prospects of an area likely to be suitable for certain types of agriculture. This work was done in collaboration with the Department of Agriculture, and entails close supervision in the coming year. The Geological Survey has control of the drilling operations.

(6) A detailed geological survey of about 4,500 square miles of the Phillips River Goldfield was commenced in November.

PUBLICATIONS.

Issued during 1951.

Annual Progress Report of the Geological Survey of Western Australia for 1948.

Bulletin No. 103: Geology of Portion of the Mt. Margaret Goldfield, by R. A. Hobson, B.Sc. (Hons.) and K. R. Miles, D.Sc. (text only).

Mineral Resources of Western Australia Bulletin No. 5: Moulding Sands of Western Australia, by K. R. Miles, D.Sc. and H. A. Stephens, B.Sc.

Geological Sketch Map of Western Australia, Scale 40 miles equals one inch, in two sheets.

In the Press.

Annual Progress Report of the Geological Survey of Western Australia for 1949 and 1950.

Bulletin No. 95 (3rd Edition): The Physiography of Western Australia, by J. T. Jutson, B.Sc., LL.B.

Bulletin No. 105: The Collie Mineral Field, Part I, by J. H. Lord, B.Sc., F.G.S.

Bulletin No. 103: Atlas No. 1 and Atlas No. 2 (text issued).

Compiled and Awaiting Authority to Print.

Bulletin No. 107: A Re-Survey of the Coolgardie District, W.A., by J. C. McMath, B.Sc. (Hons. Lond.), F.G.S., M. Aust. I.M.M., and N. M. Gray, B.Sc.

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.).

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.

In Course of Preparation.

Maps in connection with the Economic Geological Survey of the Metropolitan Area.

As this report demonstrates, a large amount of work has been performed during the year by both the field and office staffs, and my thanks are due to all members of the staff for their contribution, and to the Under Secretary for Mines for administratively facilitating our work.

H. A. ELLIS,
Government Geologist.

18th January, 1952.

REPORT ON STOCK WATER SUPPLIES—MOOLA BULLA NATIVE STATION—EAST KIMBERLEYS.

Approximate Latitude 18° 12′ S.
Approximate Longitude 127° 29′ E.

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

Introduction.

Moola Bulla Native Station is owned by the Native Affairs Department of the Western Australian Government, and constitutes an Aboriginal Reserve of some 1,123,500 acres. It carries a large number of beef cattle, and under normal seasonal conditions despatches about 1,800 bullocks by road to the Wyndham Meat Works each year. The

station homestead is situated near the south-eastern corner of the reserve in approximate Latitude 18° 12′ S. and approximate Longitude 127° 29′ E., some 23 miles by road a little north of west from Halls Creek township, and four miles a little south of west from Mt. Barrett, a dominating landmark in the area.

In recent years the several managers have been endeavouring to locate additional water supplies by boring with a 6in. percussion boring plant, and as a result of representations made by Mr. McBeath, the present manager, to the Native Affairs Department for some geological guidance in this search, the Geological Survey was asked to help. Accordingly, the writer visited the station between 29th May and 4th June and accompanied by Mr. McBeath made wide reconnaissances of the south-eastern portion of the station in a Land Rover (4 x 4) motor vehicle. Approximately one-third of the total area was inspected in these reconnaissances, but this was the area in which additional artificial water supplies are urgently needed.

General Geology and Topography.

Moola Bulla Station occupies an area of Pre-Cambrian rocks consisting predominantly of granite, grano-diorite, steeply-dipping schists, slates, and quartzites of Archaean age, overlain by remnants of quartzites and shales belonging to the Nullagine system of Proterozoic age. The area concerned in this report contains only relatively small areas of horizontally-bedded sedimentary rocks of Nullagine age, and even smaller remnants of steeply-dipping schists, slates and quartzites of the Mosquito Creek series. The dominating rock type is granite or grano-diorite, though a more extensive development of the Nullagine series can be seen in the distance in the north-western part of the station, outside of the area under review.

The topography is essentially of low relief, consisting of large flat, to gently undulating plains, in which wide drainage valleys develop, forming gum-lined creeks with steep banks up to 12ft. or more high in places, and low hilly areas consisting of broken granite knolls or ridges. Some quartzite ridges flanked by granite form conspicuous features, and narrow remnants of the Nullagine series occur as long narrow ridges in the higher parts of the area.

Over much of the plain country the granite forms a rock floor, being covered by a few inches of soil only, revealing its presence in numerous fresh, bare, flat outcrops or prominent fresh, rounded bouldery masses. In some plain areas the soil thickness appears to be greater and gives the impression that the underlying granite may be decomposed for a considerable depth. Several exploratory water bores in this class of country revealed the fact that this was not the case, however, and generally speaking, the flat to undulating plain country carrying only a scattered growth of small eucalypts and either spinifex or other grasses, is underlain at a very shallow depth by comparatively fresh granite.

Alluviated (or "built-up") areas favourable for the accumulation of underground water are remarkably scarce, but several were located a long distance away from existing drainage channels.

The wide drainage basins have unquestionably been developed in the softest part of the granite terrain, for it is mainly in the creek beds and in the immediate vicinity of their banks that any decomposed rocks are found. This has an important bearing on the occurrence of underground water in this area.

Much of the station country lies at an elevation of 1,400 feet and more above sea level, and forms the watershed between the headwaters of the Ord and Fitzroy rivers. The average annual rainfall is about 20in., which is received mostly in the "wet" season, November to April inclusive. The large creeks and their tributaries are carrying the products of normal natural erosion (and artificial erosion caused by thousands of cattle crowded round permanent artificial and natural water supplies) down to the lower country in their beds during floods, and are not building up alluvial flood plains. Even the flood plains of some of the major creeks are rock floors with a thin veneer of soil only.

From the above description, it will be seen that the large areas of comparatively fresh granite, and the absence of alluviated (or "built-up") ground, combine to make the search for underground water somewhat difficult, and narrows the chances of success in the search for it to the prospects associated with certain restricted natural features, which will be discussed later.

The Water Supply Problem.

The problem on this station, as on all stations, is to provide reliable artificial water supplies of sufficient capacity to augment the natural permanent water supplies (mainly large water holes in the main creeks) and to locate them in such positions as to use the maximum area of country with the minimum amount of erosion caused by stock coming into and going out from water.

The amount of erosion caused by cattle when large numbers of them use one water supply has to be seen to be believed. Hundreds of acres are literally turned into dust heaps and all the feed is eaten out for miles around the water point.

Unfortunately, only very rarely is nature so kind as to provide conditions whereby artificial water supplies can be provided from underground water sources exactly where desired.

In the area under review, namely, the south-eastern portion of Moola Bulla Station, a limited number of artificial water supplies in the nature of wells have been provided. These wells are located on the banks of large streams or near the drainage channel in wide, open, shallow head-water basins. They have been sited in positions which observation and experience proves to be the right localities for obtaining water in this class of topography.

Unfortunately, where water is most urgently needed in this part of the station, these conditions are not repeated. If they had been, there would have been no necessity for geological advice in the present search for water, as the present station manager is as well able to detect these prospects as is the writer.

Another important aspect is that an artificial water supply intended for the watering of cattle running in unfenced country must be capable of producing at least 10,000 gallons of water per 24 hours, and it must be able to do this during the six months of the year following the drying up of the natural surface waters after the wet season, and the beginning of the rains in November, and longer if the rains are late.

These are exacting requirements and require exacting geological conditions to meet them. In the writer's experience, no single 6in. bore hole drilled into the rock-types known to occur on this station is likely to have this capacity, irrespective of how favourable the site is. Recourse must be had to the well and drives to produce this quantity of water in metamorphic rocks, and the well must be so situated that the underground reservoir is rapidly recharged each year when the rains come.

A small number of exploration percussion boreholes have been drilled in recent years on sites in the areas where additional water supplies were required, but they either failed to find water or were unable to produce the necessary quantity of water. Some of them have been equipped with windmills, tanks and troughing, only to be abandoned shortly after completion.

The geological characteristics of the country in which these unsuccessful bores were sunk were explained to the manager on the site, and it was clear that useful water supplies could be found in this country under only two sets of conditions, namely—

(a) alongside main creeks;

(b) in higher level "built-up" areas containing a considerable thickness of soil overlying a deeply weathered rock zone.

These higher level "built-up" or alluviated areas are scarce on this station, but one had been located and prospected by a borehole. This hole penetrated 151ft. of soil and decomposed granodiorite before it was stopped in fresh granodiorite. A bailing test at the rate of 400 gallons per hour failed to lower the level of the water when applied for a quarter of an hour. Water was struck at 120ft. and rose slightly in the bore.

This type of potential aquifer (water-bearing rock) can be detected by the absence of outcrops or large quartz grains in the soil, the presence of a light powdery soil and a prolific growth of grass, not spinifex. The gum trees (eucalypts) are considerably larger and more numerous than on country which has only a thin mantle of soil and a shallow zone of decomposition.

Although this is an encouraging water occurrence, its value cannot be gauged until it has been subjected to a continuous pumping test for at least 24 hours. Should this class of aquifer stand up to this test and produce its 10,000 gallons, there will be a strong tendency to equip it as a borehole supply, but the writer has no faith in the 6in. boreholes in this class of country being able to stand up to a six months daily draw of 10,000 gallons per day.

A borehole capable of delivering 10,000 gallons in 24 hours without a very serious fall in the level of the water table is an excellent prospect on which to sink a well and provide additional storage by driving from the bottom of the shaft. The provision of a reliable water supply of adequate quantity is creating an asset of very great value in this country, and the cost of first sinking the bore, then sinking a well on the bore and driving from the bottom of the well and subsequently equipping the well with pump, tanks and troughing, is small compared with the ultimate financial gain connected with increased carrying capacity and the more even distribution of the herd over the property.

Recommendations.

(1) The search for water in the south-eastern part of the Moola Bulla Native Station should be confined to two topographic positions, namely:—

(a) Main drainage channels and wide headwater basins occupied by smaller creeks.

(b) Higher level alluviated or "built-up" areas.

(2) Exploration should be by 6in. percussion boring in the first instance, and on a satisfactory 24-hour pumping test being established, a well should be sunk on the bore and drives extended from the bottom of the well.

(3) Boring should not be continued in fresh rock if the upper soil and decomposed rock have failed to provide a water supply adequate to requirements.

(4) In the peculiar circumstances applying to the East Kimberleys, where it is virtually impossible to get contract borers with their own boring plants, and a lot of exploration is necessary to test the water bearing capacity of a huge area of country, it is highly desirable that the station should have a boring plant of its own. This plant should be operated by wages personnel, under a bonus system of so much per foot for distance drilled. This principle is followed by the South Australian Government with marked success.

(5) An eminently suitable type of boring plant is an all steel, diesel driven unit, mounted on pneumatic tyres as a trailer unit. Such a plant as the Ruston-Bucyrus 22W. well drill should be ideal for the class of country encountered on Moola Bulla Station. This type of drill is in extensive use in South Australia, and has been proved to be particularly suitable for outback conditions. This machine has a drilling range of 16in. diameter holes to a depth of 100ft., down to 6in. diameter holes to a depth of 750ft.

PEAK HILL GOLDFIELDS MANGANESE DEPOSITS.

10th July, 1951.

The Under Secretary for Mines:

In June of this year I inspected the principal manganese occurrences known to the Mines Department in the Peak Hill Gold Field.

2. My investigations were confined principally to ascertaining the mode of occurrence of the deposits, i.e. to determining whether they were lode formations or surface cappings over completely barren rocks.

3. I unhesitatingly proclaim them to be surface cappings over barren rock, and to be formed by the replacement of pisolitic, bauxitic material of an old land surface.

4. The manganese and iron have been provided from adjacent higher country in solution in drainage waters. The rock type carrying the manganese in trace quantities is a hematite-rich sandy shale of the Mosquito Creek Series, found in the higher country adjacent to the deposits.

5. Mining operations (quarrying) have made many exposures of bed rock, and these combined with natural exposures provide convincing evidence of the shallow nature of the deposits.

6. There is absolutely no necessity for any exploratory drilling of these deposits, either by churn or diamond drilling.

7. If further sampling is required this could be best done by digging pits, using a portable compressor.

8. Would you please pass a copy of this minute together with my ore reserve estimates to The Director of the Bureau of Mineral Resources, 485 Bourke Street, Melbourne.

H. A. ELLIS,
Government Geologist.

MANGANESE ORE DEPOSITS—PEAK HILL GOLDFIELD, W.A.

Summary of Estimate of Ore Reserves.

Deposit.	*Tonnage containing 42 per cent. and more of Mn.	†Tonnage containing under 42 per cent. Mn.	Remarks.
	Long tons.	Long tons.	
Northern Deposit, Horseshoe	30,000	62,000	Some guessing and judgment had to be used in this estimate. Analytical data reliable.
Southern Deposit, Horseshoe	215,000	245,000	Estimate reliable : based on sample pits. Analytical data reliable.
M.C. 30P, Mt. Fraser Locality	18,000	18,000	Some guessing and judgment had to be used in this estimate. Analytical data reliable.
Other deposits	....	....	Known to be small and not considered to have any appreciable effect on the total reserve situation.
Totals	263,000	325,000	

* Maximum Mn content probably 55 per cent.

† Minimum Mn content probably about 24 per cent.

PEAK HILL G.F. MANGANESE ORE RESERVES.

By H. A. ELLIS, Government Geologist.

Horseshoe Manganese Deposits.

(1) *The Southern Deposit.* M.C. 24P.

Based on Blatchford's sampling and mapping (G.S.W.A. An. Rep. 1929) and a recent examination of the deposit by the writer (June, 1951), the following is an estimate of ore-reserves for this deposit:—

Original Area of Manganese Ore = 12 acres.

Sampled by 40 sampling pits from 2 to 20 ft. deep.

Average depth 11 feet (the average of 40 sampling pit depths).

Average grade = 39.8% Mn. (determined from analyses of 136 samples).

Estimate of Quantity of Manganese Ore of Average Grade of 39.8 per cent. Mn.

Area = 12 acres = 43,560 × 12 sq. feet.

Average depth = 11 feet.

Volume of ore = 43,560 × 12 × 11 cubic feet.

Tonnage (using 10 cubic feet = 1 long ton) = $\frac{43560 \times 12 \times 11}{10}$ = 574,992 tons.

Less 20% for cracks, cavities, and irregularities in base and top of ore body—

574,992
—114,998

459,994 tons.

or, say: 460,000 tons.

Less what has been mined to date (July 1951). 15,000 tons.

= 445,000 tons.

Estimate of Quantities of Manganese Ore of Various Grades Contained in the Deposit of 445,000 tons of Average Grade of 39.8 per cent. Mn.

In Blatchford's detailed sampling (G.S.W.A. An. Rep. 1929) the ore was divisable into a number of areas (eleven) which could be further placed into three groups in which the average manganese content was 50.7%, 45.7% and 42% respectively. His estimated tonnages for these grades (exclusive of what has been quarried over the last three years; 15,000 tons) are as follows:—

	Tons.
Ore containing 50.7% Mn.	73,500
Ore containing 45.7% Mn.	75,500
Ore containing 42% Min.	66,000
Ore containing 42% to 50.7% Mn. = ...	215,000
Ore containing less than 42% Mn. = ...	460,000–215,000 = 245,000

Analytical Data.

Ore containing 50·7% Mn. contains	73·3%	MnO_2
	6·3%	Fe
	0·98%	SiO_2
Ore containing 45·7% Mn. contains	68·4%	MnO_2
	9·35%	Fe
	1·45%	SiO_2
Ore containing 42% Mn. contains	14·4%	Fe
	2·4%	SiO_2

A complete analysis of a sample from 11 mixed samples is as follows:—

	Per cent.
MnO_2	66.32
MnO	6.04
Fe_2O_3	14.59
SiO_2	0.90
CoO	0.23
NiO	Nil.
BaO	0.62
K_2O	1.97
Na_2O	0.30
CaO	Nil.
MgO	.25
Al_2O_3	2.43
TiO_2	0.12
CO_2	Nil.
P_2O_5	0.17
SO_3	0.25
H_2O above 100°	5.76
H_2O at 100°	0.67
	100.62

On Dry Ore..

Total Mn = 46.90%
Fe = 10.28%
P = 0.074%
S = 0.101%

Analysis by Geological Survey Laboratory 1925.

Typical analyses of three parcels of ore mined in 1948 and assayed by Broken Hill Pty. Ltd. are as follows:—

	Mn.	Fe.	SiO_2.	P.	H_2O.	
895.59 tons;	48.98	8.66	0.21	0.094	0.70	(per cent.)
2,131 tons;	50.40	8.50	2.50	0.08	0.90	(per cent.)
2,238 tons;	47.47	9.86	1.47	0.035	0.50	(per cent.)

The average Mn. content of 12,766 tons of ore shipped during 1948, 1949 and 1950 is 47.47 per cent.

Analyses of ore containing less than 42 per cent. Mn. show Mn. values as low as 24 per cent, and Fe as high as 34 per cent. with SiO_2 up to 2.82 per cent.

(2) The Northern Deposit.

This deposit is situated about one mile north of the Southern Deposit. It has not been sampled in detail and has not been worked. The following estimates of ore reserves and grade are based on Montgomery's plan and analyses (1925) and a personal inspection of the deposit by the writer in June, 1951.

Area of Manganese Ore = length by average width (16 widths) = 1,200 ft. × 171 ft.

Average thickness—5.6 ft. (average of 5 observed thicknesses).

Volume of ore = 1,200 × 171 × 5.6 cubic feet.

Tonnage (using 10 c. ft. = 1 long ton) = $\frac{1,200 \times 171 \times 5.6}{10}$ tons.

= 114,912 tons.

Less 20 per cent. for cracks, cavities and irregularities in base and top of ore body—

114,912 tons
—22,982

91,930 tons

or say: 92,000 tons.

Four samples taken across the surface of the orebody by Montgomery at roughly equal intervals over its length gave the following results:—

(a) 49.99% Mn. over a sample length of 350ft.
(b) 47.01% Mn. over a sample length of 300ft.
(c) 48.32% Mn. over a sample length of 60ft.
(d) 52.40% Mn. over a sample length of 60ft.

This gives a weighted average of 48.89% Mn.

Details of the above analyses are as follows:—

	H_2O—	Mn.	Assay on Dry Ore.			
			MnO_2.	MnO.	Fe.	SiO_2.
(a)	0·60	49·99	75·54	2·91	6·63	0·54
(b)	0·65	47·01	69·94	3·63	8·69	0·85
(c)	0·85	48·32	72·24	3·44	6·12	1·01
(d)	0·74	52·40	78·34	3·75	3·48	0·57

After inspecting the ore body, the writer guesses, in the absence of detailed pit sampling, that approximately one third of the available ore would contain 42% or more of manganese.

The ore reserves can be dissected as follows, based on the above guess:—

42% or more of Mn. .... 30,000 tons
Under 42% Mn. .... 62,000 tons

The Northern ore body has the same structure and mode of occurrence as the Southern ore body, i.e. it is a superficial deposit consisting essentially of hard psilomelane and limonite in varying degrees of purity, and has no possibility whatever of downward continuation.

(3) M.C. 30P., 3¾ miles West of Mt. Fraser.

This deposit is 20 miles S.W. of "Horseshoe" and has been worked during 1949 and 1950 by the Broken Hill Pty. Coy. Ltd.

It has the same structure and mode of occurrence as the "Horseshoe" deposits, and was examined by the writer in June 1951.

Area of Deposit = length × average width (7 widths)
= 535 ft. × 75 ft.
Average thickness = 15 ft. (average of 12 thicknesses)
Volume of Ore 535 × 75 × 15 cubic feet

$$\text{Tonnage (using 10 c. ft. per ton)} = \frac{535 \times 75 \times 15}{10} \text{ tons}$$

= 60,187 tons

Less 20% for cracks, cavities, and irregularities in base and top of ore body—

60,187 tons
—12,037

48,150 tons or say, 48,000 tons.

After a detailed inspection of the deposit the writer guesses that at least one quarter of this tonnage consists of hard liver-brown limonite in bands thick enough to be selectively mined and discarded, leaving a total of

48,000
—12,000

36,000 tons of Manganese ore of varying grade.

The deposit has not been pit sampled, but the grade of selected ore can be gauged from the following assays or ore shipments:—

1139.72 tons containing 54% Mn.
1665 tons containing 55% Mn.
1670 tons containing 53% Mn.
2154 tons containing 46% Mn.
1963 tons containing 52% Mn.

Assays by B.H. Pty. Ltd.

A total of 11,186.47 tons has been mined from this deposit up to the end of 1950.

No other analytical data are available.

This deposit may contain, as a guess:—

42% or more of Mn. .... 18,000 tons
Under 42% of Mn. .... 18,000 tons

(4) Other Deposits.

Several other small deposits are known, but the quantity of ore in them is not sufficient to seriously affect the total ore reserves.

REPORT ON UNDERGROUND WATER SUPPLIES IN THE AREA EAST OF WILUNA, W.A.

Approx. Lat. 26° - 38′ S.
Approx. Long. 120° - 22′ E.

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

Introduction.

Wiluna is situated in the interior of Western Australia, 709 miles by rail North-East from Perth, via Wongan Hills, and 445 miles by rail from the nearest port of Geraldton. The general level of the flat to undulating country in the immediate vicinity of Wiluna is about 1,700 ft. above sea level.

The average annual rainfall over a recorded period of 44 years is 980 points. The climate is arid with high temperatures in the summer months, and severe frosts in the winter time.

From 1933 to 1946 Wiluna was a flourishing gold mining town with a peak population of about 8,000 people, but with the decline of gold-mining, due to the exhaustion of ore in the Wiluna Gold Mine, the population has gradually dwindled to about 400 at the present time. (Aug. 1951).

The dismantling of the treatment plant and buildings belonging to the Wiluna Gold Mining Company is approaching completion, and the Wiluna Rail Head is now used principally for servicing the sheep and cattle stations in the adjoining country.

During the active life of the mine, a period of about 13 years, approximately 1,000,000 gallons of good quality water per day for both domestic and mining requirements was drawn from an area situated about four miles east of the town. The inhabitants were liberally supplied with potable water, and grass lawns, vegetable gardens, and fruit trees (except stone fruit) flourished. Recently, Plaistowe & Co. Ltd., Confectionery and Food Manufacturers, of Perth, demonstrated that peanuts could be successfully grown in the red sandy loam seven miles east of Wiluna under irrigation, using local ground-water.

The railway line from Meekatharra to Wiluna (109 miles) was originally constructed to serve the Wiluna Gold Mine, and with the cessation of gold mining the question has arisen as to what is to happen to the unpayable line between these two centres. It has been suggested by Wiluna Local Authorities that perhaps some use could be made of the copious underground water supplies proved to exist in the country from four to seven miles east of Wiluna in some form of irrigated vegetable or fruit growing, and the writer was instructed to inspect and report on the underground water supply prospects of this area. The inspection was made during the period August 3 to August 9, 1951, inclusive.

Topography and General Geology.

The country surrounding Wiluna is typical of most of the inland portions of the Great Plateau of Western Australia, being characterised by vast areas of flat to undulating terrain, vegetated sand dunes, large salt lake systems, and prominent remnants of the Old Plateau in the form of flat topped ridges and isolated hills.

The vegetation is sparse and consists mainly of mulga (acacia sp.) which flourishes in the flat alluviated drainage areas, and gums, (eucalypt sp.) which line the more prominent incised drainage channels. The maximum difference in elevation between the crests of the residual hills and ridges rising from the general level of the flat to the undulating New Plateau surface is about 500 feet.

The oldest rocks of the area are the greenstones, granites and gneisses of Archaean Age, which were eroded to a peneplain prior to the deposition of horizontally bedded quartzites, shales, and conglomerates of the Nullagine Series of Proterozoic Age. These rocks of the Nullagine Series rest in violent angular unconformity on the highly folded remnants of the greenstones and gneisses, and overlie the eroded granite surfaces also. The subsequent erosion of the old Nullagine rocks has laid bare the still older greenstones, granites and gneisses in a vast flat to undulating New Plateau, and the wide, shallow drainage areas of this New Plateau have been further modified by a cycle of arid erosion of comparatively recent age.

During this cycle of arid erosion, which is still in progress, the tendency is for the drainage systems to actively erode their headwater sections in the remaining higher ground and gradually fill the old depressions and drainage channels formed during a period of higher rainfall. The rock waste deposited under these conditions in the old shallow drainage basins is known as 'fluviatile' sediments, and ranges in grade from fine silt and clay through sand to coarse conglomerate. The fluctuating intensities of rainfall and run off are reflected in the sudden vertical changes in the nature of the sediments deposited in these old drainage systems, and the arid conditions prevailing between successive rains cause a wide-spread deposition of the natural cements, lime and iron oxide, throughout those sediments lying within the influence of evaporation aided by capillarity. Under arid conditions certain clays behave in a peculiar manner when situated in a zone of fluctuating water table, and instead of losing silica, are converted into masses of semi coherent silica grains or opaline quartz (quartz containing up to six per cent. of water in its composition). These beds later become important water bearers.

The Underground Water Area East of Wiluna.

The area which has supplied Wiluna Township and the Wiluna Gold Mine with potable water at the rate of one million gallons a day for 13 years, without permanently lowering the water table, is an old drainage system now filled with fluviatile terrestrial sediments, and forms part of the large Lake Way salt lake catchment area. It has a north-south trend with a width of about five miles in an east-west direction measured along the Lake Violet Station road, commencing at a

point approximately three miles east of Wiluna. The country gradually rises east and west and consists of either granite or greenstone. The northern divide is a series of 'breakaways' in spinifex country about 35 miles north-east of Wiluna along the road to Cunyu Station. The underlying rock is here composed of granite and gneiss. From ground and air reconnaissance, the latter made possible by the courtesy of Mr. M. Finch, a local station owner who flew the writer over the area in an Auster monoplane, it is clear that this wide, flat to undulating drainage area is supplied with the bulk of its water from the two intermittent creeks Negrara Creek and Kukabubba Creek, which drain the higher country occupied by the Nullagine Series north and north-west of Wiluna.

The northern limit of the drainage area is definite at about 35 miles north of Wiluna, but the north-eastern limit was less easy to define with the transport available. The eastern side could be recognised both on the ground and from the air. There is no well marked creek entering from the north-east, but it is probable that a series of flat alluviated drainage areas come in off the granite country in this direction.

The depth of the built-up ground has not been determined in any part of this basin, as is evident from an inspection of the dumps of over 40 wells located in it, and P.W.D. bore log records of the bores sunk at the Peanut Plantation, seven miles east of Wiluna.

The area of built up ground consisting of fluviatile sediments within the catchment area of approximately 547 square miles could not be determined in a reconnaissance survey, but it is considerable. Ground reconnaissance suggests that there is a long low tongue of flat to undulating granitic country extending well down into the basin from the north, dividing the drainage of the Kukabubba and Negrara Creeks, out on the seemingly flat alluviated basin.

South of the Wiluna-Lake Violet Station road, the width of the alluviated basin increases, and for a distance of three miles south of this road, ground water has been found in large quantities, and has been proved suitable for vegetable growing.

The general shape of the catchment area is an immense fan extending 35 miles north from the Wiluna-Lake Violet Station road, with a maximum width or spread of about 35 miles, gradually contracting southwards to about five miles wide and then gradually opening up. Within this fan-shaped area there are large areas of fluviatile sediments occupying old depressions in a now buried terrain, which was itself an old drainage channel. These sediments are the storage ground for the waters poured into them from large creeks such as Negrara and Kukabubba Creeks, and themselves readily absorb rainfall. The absence of any defined incised drainage channel (creek) crossing the Wiluna-Lake Violet Station road within the basin eastwards from Wiluna is significant when it is realised that the drainage from 547 square miles of country has to ultimately reach the Lake Way Salt Lake System. Torrential rains cause extensive sheet flooding of this area, and no doubt there are shallow, wide depressions on this apparently flat part of the basin, which would be in evidence as surface water carriers after exceptionally heavy rains.

The shape in depth and laterally of the alluviated basins is unknown at present, but their water-yielding capacity is known in three localities, viz., at the Town Well Reserve No. 21,142, situated four miles east of the Wiluna P.O., the Wiluna Gold Mine well area situated 1.7 miles south of the Town Well Area, and the Peanut Plantation situated about seven miles east of Wiluna.

The nature of the fluviatile sediments, as revealed from the dumps of the wells, indicates the occurrence of white indurated clays, thick (up to 12ft.) bands of opaline silica with associated friable soft opaline silica full of drussy cavities, ferruginous grits cemented with lime and containing some opaline silica in thin bands, loose sand and small waterworn pebbles of ironstone and quartz.

No reliable information is available about which beds carried most water, and in only one instance is the occurrence of sub-artesian water (pressure water) recorded.

Water level is approximately 12 feet below ground level at most wells, but it is obvious that this water must have a surface gradient which will be from north to south. No data are available about the reduced levels of either water level or ground surface level at the various wells.

The full water yielding capacity of a complete vertical section of the fluviatile sediments is not known, because the deepest well is 47 feet and the deepest bore is 40 feet, and neither wells nor bores have penetrated to true bedrock, which is either granite or greenstone.

Capacity Data.

Assuming an average annual rainfall of 980 points, the catchment area of approximately 547 square miles (350,000 acres) north of the Lake Violet Station road would receive about 76,580 million gallons of rain water per annum. Assuming that only one-third of this quantity of water was absorbed and stored in the fluviatile sediments as underground water, then each year an average of approximately 25,000 million gallons of water would go underground. This quantity of water must be presumed to be moving southwards across the narrower southern end of the basin on an average, each year. This could account for the fact that the continual withdrawal and complete removal from the basin of 365 million gallons of water per year for 13 years made no impression on the level of the water table.

This water was drawn from the Town Well group, and the Mine Well group in approximately equal quantities of 500,000 gallons per day each. The Town Well group consists of 10 wells, the maximum depth being 35 feet, the length five feet and the width four feet. There is no reliable information about the maximum capacity of any of these wells, but an average yield of 50,000 gallons each per day must have been obtained to meet the 500,000 gallons per day which is reliably quoted as the daily consumption for many years. The material in the dumps of these wells is mostly opaline silica, both massive and friable, and locally called "opaline" limestone. No details are available about the manner in which the water enters the wells. Water level stood at about 12 feet below ground level in August, 1951.

The group of 10 wells is distributed over an area 72 chains long east and west by 15 chains wide north and south, but no information is available about any interference of one well with another near by, during pumping operations.

It is clear that this area has not ever been fully exploited, because none of the wells has penetrated to bedrock and from the appearance of the dumps, none of them has any drives at the bottom.

The water from these wells has been used for some 13 years on lawns, vegetable gardens and citrus fruit trees without noticeable injury to plant life.

One analysis of the water from the storage tanks of the town water supply gave 49 grains of total salts per gallon of which nine were sodium chloride and the p.H. reaction was eight.

The Mine Well group is situated about 1.7 miles south of the Town Well group and three and a half miles east of the Wiluna Gold Mine. The wells have been sunk through opaline silica and ferruginous grits to an average depth of 47 feet, with drives 50 feet long east and west at the bottom. Some 18 wells occur in an area 1.4 miles long in an east and west direction and about 30 chains wide in a north and south direction. No detailed information is available about the yields of the individual wells or how the water entered them. Water level in August, 1951, stood at about 12 feet below ground level and the group maintained a steady daily supply of about 500,000 gallons of water for 13 years without permanently lowering the water table.

Mr. H. H. Carroll, general manager of Wiluna Gold Mines for many years, told the writer in August, 1951, that once during the active life of the

mine when the daily draw from these wells was 500,000 gallons per day, the electric pumps had to be lifted four feet on account of the gradual rise in the water table some months after heavy rains had fallen to the north. If the rain fell within the catchment area of the basin, then such a rise could be expected, but there is a legend that the rain fell hundreds of miles to the north, and still affected the basin. This is a good basin, but not quite as good as that.

The Peanut Plantation Area is situated about seven miles east of Wiluna on both sides of the Wiluna-Lake Violet Station road. Here a number of shallow wells have been sunk through ferruginous grits to a water-table 12 feet below ground level. This area is continuous geologically with the Town Well and Mine Well areas, and draws water from the same wide-spread saturated zone of fluviatile sediments. Varying yields have been experienced in the wells here, but as in the other two areas, the potentialities of the aquifer have not been anywhere near fully tested. Some figures are available from a series of bores put down by the Public Works Department on experimental plots during 1949-50 in connection with the Wiluna Peanut Project. They have been made available by the Goldfields Water Supply Branch and appear in Appendix 1.

It will be seen from these details that the maximum depth of any bore was 40ft.-3in. and that yields of up to 3,600 gallons per hour of water containing from 24 to 84 grains of total salts per gallon were obtained without a maximum yield having been determined. It will also be observed that in several instances continuous pumping at the rate of 3,600 gallons per hour for eight hours failed to increase the total salinity of the water or to seriously lower the water table.

Some details are available about the capacity of one well used as a source of irrigation water on the peanut plantation. A 6ft. by 4ft. well 20ft. deep sunk in ferruginous grits, with two 5in. bore holes 10ft. deep sunk in the bottom, was put under pumping test. The well was pumped for 23 hours per day for seven days at the rate of 5,000 gallons per hour. The water level was gradually lowered by pumping at a rate in excess of 5,000 gallons per hour, when it became evident that water was entering the well almost exclusively up the two bore holes in the bottom. The level could not be lowered at rates less than 5,000 gallons an hour, and no variation in this flow was noticed in practically one week of continuous pumping. This water was obviously under pressure, but not sufficient to cause it to flow at the surface. The aquifer must have been some loosely consolidated sand or grit, because it has a phenomenally high rate of yield. The question of whether there is pressure water in the basin elsewhere also arises, and it is not beyond geological possibilities for shallow artesian water to occur in this type of sedimentation.

Characteristics of Fluviatile Basins.

It was not possible in a reconnaissance examination of the Wiluna Basin to even approximately determine the area occupied by fluviatile sediments, but the area in which soil, topographic and vegetation conditions appeared similar to those in the vicinity of the three proved water bearing localities east of Wiluna is large, amounting to many thousands of acres.

The grain size and mineral composition of fluviatile sediments is inherently subject to quick lateral and vertical variation, being likely to be coarser near the principal feeding creeks and along the edges of the basin.

The basement rock is likely to be disposed in wide undulating surfaces, and to be covered by sediments of different water yielding capacities in different parts of the area.

It will be obvious, therefore, that we cannot expect to encounter the same water-productive capacity over the whole of the alluviated area, and that much experimental boring would be necessary to locate areas of maximum yield.

It is also certain that to properly exploit any of these potential high water yielding areas, bores must penetrate to hard bed-rock, which will be either granite or greenstone; probably mostly granite. The salinity of water derived from the sediments low down in the fluviatile sedimentary succession will need careful checking, because it is possible for water of a higher salinity to occur in the beds below a zone of low salinity water.

There may be areas of built-up ground within this basin, on which the soil conditions are similar to known high water-yielding areas, but which could have only a comparatively thin layer of sediments covering underlying bedrock, and on which poor ground-water yields would be obtained.

As previously mentioned, there may be also considerable areas in which pressure water may be found, giving rise to either sub-artesian or even possibly artesian water conditions. These areas can only be found by actual exploration.

Conclusions.

(1) A large depression filled with water-bearing fluviatile sediments exists immediately East of Wiluna.

(2) The catchment area of this basin, North of the Wiluna-Lake Violet Station Road, has an area of approximately 547 square miles or 350,000 acres.

(3) The relative areas of exposed basement rock and built-up (fluviatile) ground within this catchment area are not known, but the area of ground on which soil, vegetation and topographic conditions appear similar to those of known high water yielding areas east of Wiluna amounts to many thousands of acres.

(4) For a period of 13 years, two groups of wells situated approximately four miles east of Wiluna, withdrew continuously a total of 1,000,000 gallons of water per day from the southern end of this basin, without permanently lowering the water table or noticeably increasing the salinity of the water.

(5) The water from this basin was used exclusively on vegetable market gardens, lawns and citrus fruit trees on both residual and transported soils and yielded excellent crops. Peanuts have been successfully grown also, using water from the same source.

(6) The total salinity of the water varies, the maximum recorded being 84 grains per gallon. One analysis of the town water supply in 1935 gave a total salinity of 49 grains per gallon of which nine grains was sodium chloride (salt).

(7) The full water-yielding capacity of any part of the basin has never been tested, and the highest reported yield from any one well was 115,000 gallons per 24 hours for a continuous period of seven days, the water level remaining steady during the test.

(8) Exploration of the basin to bedrock by percussion drilling in the first instance, has excellent prospects of producing large quantities of water in subsequent exploiting wells, suitable for irrigation purposes.

(9) The initial determination of the shape of the bottom of the basin in any selected area, appears to lend itself to solution by geophysical electrical resistivity methods of prospecting.

Recommendations.

(1) In order to use this natural water resource as a possible reviver of a district which has suffered a severe decline in population through the closure of the Wiluna Gold Mine, it is suggested that some steps may be taken to ascertain if it is possible both physically and economically to produce any crops under irrigation using the underground water from the Wiluna Basin.

(2) In view of the excellent prospects of obtaining sufficient quantities of suitable water over perhaps large areas of this basin, consideration may ultimately be given to the establishment of an experimental area by the Agricultural Department. Should this eventuate, then the Geological Survey would be pleased to co-operate in the selection of the area, and in the development and exploitation of the underground water resources.

Appendix to Government Geologist's Report on Wiluna Water Supply.

WILUNA PEANUT PROJECT.

Results of Boring for Water (by Contract).

1949-1950.

No. of Bore.	Rest Level.	Depth of Hole.	Salinity Before Pumping.	End of 1 hr. Pumping.			End of 2 hrs. Pumping.			End of 3 hrs. Pumping.			End of 4 hrs. Pumping.			End of 8 hrs. Pumping.		
				Salinity.	G.P.H.	W.L.	Salinity.	G.P.H.	W.L.	Salinity.	G.P.H.	W.L.	Salinity.	G.P.H.	W.L.	Salinity.	G.P.H.	W.L.
	ft. in.	ft. in.		g.p.g.		ft. in.	g.p.g.		ft. in.	g.p.g.		ft. in.	g.p.g.		ft. in.	g.p.g.		ft. in.
2	....	40 3	76	76	3,600	16 0	76	2,840	18 0	76	2,800	18 0	76	2,840	18 0	....	....	....
3	11 11	36 0	84	84	1,200	24 0	....	....	....	....	....	....	....	....	....	....	....	....
4	10 4	26 0	56	56	3,600	15 6	56	3,750	16 2	....	....	....	56	3,750	16 2	56	3,750	16 2
5	11 8	35 0	72	73	3,600	17 0	....	....	....	....	....	....	74	3,600	17 0	74	3,600	17 0
6	12 6	36 0	72	78	809	23 0	....	....	....	....	....	....	....	....	....	....	....	....
7	11 0	28 0	42	40	3,000	16 0	....	....	....	....	3,000	16 0	....	....	....	44	3,000	16 0
8	12 10	30 0	80	76	2,880	20 0	76	3,050	20 8	76	3,050	20 8	76	3,050	20 8	....	....	....
9	13 0	40 0	68	68	240	21 8	....	....	....	....	....	....	....	....	....	....	....	....
10	11 0	28 0	56	56	1,500	23 0	56	1,500	23 0	56	1,500	23 0	56	1,500	23 0	....	....	....
11	13 7	30 0	84	84	620	25 0	84	620	25 0	....	....	....	....	....	....	....	....	....
13	11 6	30 0	60	....	Pump emptied Bore in 30 seconds.					....	....	....	....	....	....	....	....	....
14	12 5	30 0	84	84	1,320	17 0	84	1,377	18 0	....	....	....	....	1,760	21 6	84	1,980	24 0
15	13 0	30 0	56	48	660	23 6	48	660	23 6	....	....	....	....	....	....	....	....	....
16	10 8	30 0	52	56	3,600	16 3	52	3,600	16 3	....	....	....	52	3,600	16 3	52	3,600	16 3
17	11 6	30 0	80	80	660	23 0	80	700	24 0	....	....	....	....	....	....	....	....	....
18	12 7	30 0	72	72	585	24 0	72	585	25 0	....	....	....	....	....	....	....	....	....
22	10 6	30 0	48	48	906	24 0	48	906	24 0	....	....	....	....	....	....	....	....	....
23	11 3	30 0	64	64	850	24 0	64	850	24 0	....	....	....	....	....	....	....	....	....
25	10 7	30 0	56	56	1,056	10 7	56	1,056	10 7	56	1,056	10 7	....	....	....	....	....	....
25A	....	30 0	60	60	1,250	24 0	60	1,250	24 0	....	....	....	....	....	....	....	....	....
26	10 7	40 0	68	68	900	10 7	68	900	10 7	68	900	10 7	....	....	....	....	....	....
27	9 10	40 0	58	58	950	9 10	58	950	9 10	58	950	9 10	....	....	....	....	....	....
28	....	40 0	44	....	2,700	....	....	....	....	....	....	....	....	....	....	....	....	....
29	....	37 6	68	....	840	....	....	....	....	....	....	....	....	....	....	....	....	....
30	10 7	31 6	24	24	748	25 0	24	748	25 0	24	748	25 0	....	....	....	....	....	....

No details forwarded for Bores shown on Lots 1 and 12.

Note.—Bore yields shown are not necessarily the maximum yield s pumping equipment would not, in all cases, permit of complete test.

REPORT ON NEVILLE'S SCHEELITE PROSPECT P.A. 2476, NOONGAL, YALGOO G.F.

Approximate Latitude, 28° 10" S.
Approximate Longitude 117° 00" E.

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

Location.

P.A. 2476 is situated about 16 miles north-north-east of Yalgoo about three-quarters of a mile west of the Yalgoo-"Carlaminda"-"Meka" Road, in low rugged greenstone hills, and about two miles N.N.W. of the old Noongal Townsite and three-quarters of a mile South of Noongal Rock-Hole. The same ground has been previously held as P.A's. 2315 (1942), 2338 (1943), 2409 (1947) and 2443 (1949), all in the name of Neville.

The locality was examined with the owner, Mr. J. Neville of Yalgoo, on August 23, 1951, with a view to advising him on the best method of further prospecting the occurrence of scheelite The prospect had been examined in 1942 by F. Forman. (An. Rep. G.S. 1942. p. 9.)

Geology.

The country rock consists of slightly schistose, massive greenstones, composed predominantly of fine to medium-grained crystalline ferromagnesian minerals of the hornblende group. The schistosity trends about N.30°W. and dips vertically, and is variable in intensity. Besides imparting a general schistosity of varying degree to the basic rocks, which appear to be lavas and not intrusives, the folding movements have been locally intense, resulting in shearing and foliation of the rocks in short, discontinuous structures, whose strikes and dips cut across the strike and dip of the regional schistosity. It is in these structures that scheelite mineralisation has taken place, with accompanying dynamic and hydrothermal metamorphism. Biotite granite outcrops in the locality, and bands of schistose granitised greenstone up to 4 feet wide extend from the granite contacts for some distance along the direction of regional strike of the schistosity, into the main greenstone mass. These are the "sheared porphyrites" referred to by the prospectors. Pegmatite dykes also occur in the vicinity.

The Principal Scheelite Occurrences.

The main known scheelite deposition is confined to three sheared and foliated structures, within an area about 12 chains long north and south by five chains wide east and west. The strikes of these shears vary from N-W. to N-E. and one has a curving strike swinging from E-W. to N-W. Dips vary from 45° to 70° and are to the west or south. The longest mineralised shear is about 2½ chains long, and the three shears have no linear connection, but are distrubuted in a rough echelon manner. They have been mined as open cuts to a maximum depth of about 10 feet with several shallow underlay shafts not exceeding 40 feet in length.

Lenses of chlorite schist, actinolite schist and vermiculite varying in width from seven feet to six inches occur along the shears, and are the host material for disseminated pale green scheelite grains and crystals and occasional partially crystalline masses of scheelite weighing up to 10lb. The vermiculite lenses always carry the best values.

In one of the shears a large piece of Bismuth Carbonate was found associated with the vermiculate, but this mineral is very rare in the present workings. No quartz has been seen in association with the scheelite and bismutite, and associated opaline silicia and magnesite are rather diagnostic of surface expressions of potentially mineralised zones, Footwall and hanging-wall rocks are frequently medium-grained hornblende rocks with occasional strong developments of massive green actinolite rocks. The rock assemblage and shearing is very similar to that associated with the Young River vermiculite deposits in the southern part of the State, but in that locality no metallic minerals other than magnetite have been found in the vermiculite lenses.

The clayey loam near the shears carries detrital scheelite, and is obviously a source of ore. The area of this material is of small extent, however, but it would be comparatively rich. Scheelite varying in size from a fine powder up to pieces 1 inch by ¼ an inch can be recovered by panning this loam.

Grade of the Deposits.

The mineralisation is extremely irregular, the scheelite being inclined to occur anywhere in a lens of chlorite schist, actinolite schist or vermiculite, in patches or as disseminated grains. The readily available soft ore has been mined to shallow depth only, downward exploration having ceased when the lens of ore narrowed to a few inches.

During 1942-43 approximately 407 tons of ore was mined and treated in a stamp-battery and concentrated on a Wilfley Table for a return of 6692lb. of concentrates, containing an average of 64.5% WO_3. This quantity of ore therefore contained about .73% of scheelite. The present day (Aug. 1951) value of the 6692 lb. of scheelite concentrates of an average grade of 64.5% WO_3 is approximately £6,480 (at £A33 10s. per long ton unit). Roughly, the 407 tons of ore contained the monetary equivalent of £16 per ton, or say an ounce of gold per ton. This comparison is drawn to attract attention to the fact that a gold deposit yielding one ounce to the ton would be vigorously prospected, yet a scheelite deposit of equivalent monetary value has been neglected. It is also very certain that many hundreds of pounds of high quality scheelite were lost as slime by treating this class of ore in a stamp battery, and the grade of the ore treated was probably close to 1% scheelite.

Future Prospects.

This scheelite occurrence has no prospects for large scale development, but the three previously worked shears, although short in length, have a production history (from two of them only) and types of structure which certainly justify at least another 100 feet of shaft sinking on each of them. With tungsten valued at £33 10s. per long ton unit (Aug. 28, 1951) of WO_3 (tungstic oxide) the risk involved in further exploring these scheelite-bearing shears is amply justified. Swelling and pinching in this type of structure is to be expected, and the downward limits of scheelite mineralisation had not been reached in any of the workings.

REPORT ON THE DONNELLY RIVER GRAPHITE DEPOSITS, W.A.

Approx. Lat. 34° 13′ S.
Approx. Long. 115° 55′ E.

By H. A. ELLIS, Geological Survey of W.A.

(Note.—This report should have appeared in the Annual Report Geological Survey for the year 1943 but was omitted in error.)

Locality.

These deposits are situated in hilly, thickly timbered country, on the northern side of a small easterly trending tributary of the Donnelly River, at a distance of approximately 15 miles west of Manjimup by road, in approximate Lat. 34° 13′ S., and approximate Long. 115° 55′ E. They are located on M.C.281H, forming part of Mining Reserve No. 12318 (See Lands Dept. Litho No. 439C/40 Square D.4.).

Manjimup is 197 miles by rail from Perth, and 90 miles by rail from Bunbury, the nearest port.

The deposits were examined on December 1st, 1943.

Topography and Geology.

With the exception of occasional small cleared farms in the broader depressions of the moderately hilly country surrounding the graphite

locality, the whole of the area is covered with thick jarrah and karri forest with dense undergrowth. The soil is the characteristic pisolitic gravelly type at the surface, with no visible outcrops, and it is only on the graphite claim which had been recently burned that any clue could be got as to the nature of the underlying rocks.

It can be gathered from evidence available here that the surrounding country is probably composed of a series of gneisses and schists.

The Graphite Deposits.

It would appear that the graphite was first detected in some ferruginous laterite capping the crest of the low timbered hill immediately north of the swampy creek at the south end of the claim. The impact of metal such as a heel plate of a boot or a horse shoe leaves a shiny mark on graphitic laterite, and this characteristic probably lead to the discovery of the graphite seams.

In 1916 these deposits were examined by the late Mr. H. P. Woodward of the Geological Survey who described them at that time as being of no commercial value on account of the amorphous nature of the graphite (G.S.W.A. file 171/16).

At the time of inspection (December 1st, 1943) nearly all of the old workings were inaccessible or unsafe to enter, and consequently only a limited amount of information as to the nature of the deposits was available.

It would appear however, with a reasonable degree of correctness, that on the southern and south-eastern slopes of the hill at the south end of the lease, and immediately north of the easterly trending swampy creek, a series of micaceous schists with bands of graphitic schist and quartzite underlies the gravelly and yellow clayey soil mantle.

From the distribution of the old workings showing amorphous clayey graphite in the dumps, the graphite-bearing zone strikes N. 70° E. and dips at 37° to the N.W. The only reliable strike and dip occurs in the shaft at the crest of the hill.

The zone as measured is at least 400 feet true thickness, with at least three well defined clayey graphite horizons of unknown thickness occurring one at the top, another some 150 feet below it, and the third near the base of the zone. The state of the workings did not anywhere permit of a true thickness of the seams being measured.

No information was available to indicate for sure the extent of these seams along the direction of strike. The top seam has been cut in a vertical shaft 13 feet deep now partially collapsed, which shows on the S.E. end of the shaft a vertical section consisting of six feet of red concretionary clay, then seven feet of clayey graphitic schist. An underlay shaft has been sunk on the seam for possibly 50 feet to water level, in a direction of N. 20° W. on a dip of 37° from the bottom of the shaft. The seam as exposed in the underlay shaft is about five feet thick with no true bottom showing. The roof consists of what appears to be a decomposed micaceous schist, and the graphite seam contains numerous lenticular patches of sandy material and is drag folded in an intense manner, in some instances.

The material in the dumps of the openings on the other seams appears to be similar to that in the top seam—a typical felspathic clayey graphitic schist showing bedding (or schistosity?) with the graphite present as extremely fine amorphous particles presenting a dull appearance in hand specimens.

Water and Mining Timber.

Ample supplies of jarrah and karri are available on the claim and sufficient water for treatment purposes would probably be available from mining operations. A battery of wells sunk in the swampy creek at the south end of the claim and adjacent to the deposits would also provide treatment water.

Estimate of Ore Reserves.

It is impossible in the present state of development of these deposits to make any estimate of ore reserves, and a considerable amount of prospecting will be necessary before the extent of the graphite bearing seams can be determined.

The deposits appear to be of sedimentary origin, and it can be anticipated that they will have some continuity along the strike and down the dip.

Quality of the Graphite.

A representative sample of the top seam was taken and submitted to the Kalgoorlie School of Mines for treatment.

It is understood that the owners of the lease are conducting experimental work on the material in an oil-floatation unit set up in Perth, and that it is their intention to ultimately erect a treatment plant on the claim.

General Remarks.

The deposits as examined on December 1st, 1943, constituted a "good prospect" only, and owing to lack of information about the extent and quality of the graphite-bearing seams, were certainly not in the condition to warrant the erection of a treatment plant.

If a successful treatment process can be evolved to secure an amorphous graphite concentrate of a good carbon content by oil floatation processes, and if the market requires amorphous graphite at a suitable price, then the deposits would be worth prospecting.

REPORT ON A WOLFRAM DEPOSIT ON P.A. 2472, ABOUT SIX MILES N.E. OF MT. GIBSON, YALGOO GOLDFIELD.

Approximate Lat. 29° 32′ S.

Approximate Long. 117° 00′ E.

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

Locality.

This prospecting area is situated about six miles north-east of Mt. Gibson near the old Bonnie Venture group of gold leases. It is reached by travelling two miles east from the 216 mile peg on the Great Northern Highway, along the Mt. Gibson Station track as far as the old "Harp" Gold Mine, where there is a windmill and tank, and then about 10 miles in a north-north-easterly direction on a winding bush track to some steep hilly country. The ground pegged is on a north-south ridge cut by a west trending deep, dry gully. The inspection was made on October 24, 1951.

Geology.

The country rock is a series of metamorphosed fine and medium grained tuffs of acid composition. They strike N. 20° E., and dip at about 60° to the west. Some of the beds are silicified at the surface, but are much softer underground and weather with a purple tinge. Other beds are hard and fresh on the surface, highly jointed, and will probably continue to be so underground. A series of four quartz reefs varying in width from two inches to two feet and showing a pegmatitic phase in places, have been injected into the steeply dipping meta-sediments along fracture planes having a general strike of N. 70° E. and a dip of from 30° to 60° to the south. These pegmatitic quartz reefs carry disseminated wolfram in association with dark coloured quartz. Occasional concentrations of fine, scaly, rosette shaped lepidolite mica occur at or near the hanging or footwall of the small reefs. No felspar was noticed in the reefs, though exposures were too limited to be able to state that none occurs.

Four wolfram bearing reefs were seen in a distance of about 800 feet, the strongest occuring on the north side of the gully. This reef has been cut by two adit tunnels about 40 feet apart vertically, and driven on for short distances. A winze

some 40 feet deep has been sunk on the reef from the lower adit. The reef varies in width from two inches to two feet, and has soft kaolinised walls. Only occasional specks of wolfram were visible in the quartz, and a grab sample from a dump of about 180 tons of mixed reef and wall rock mined from the upper adit is reported to have assayed .039% WO_3 per ton. A trial parcel of this ore has been carted to the nearest railway siding at Wubin (60 miles) for transport by rail to the Cue State Battery for crushing and concentration in a stamp battery and on a Wilfley table. At the time of writing (Oct.) the return from this crushing is not available.

About 400 feet S. 25° W. from the adit workings several thin quartz veins striking N. 70° E. and dipping from 30° to 60° south have been opened up to a maximum depth of about eight feet on top of the ridge. Their greatest width is about 10 inches and the maximum length over which they had been traced was about 30 feet. The country rock here is a hard silicified, metamorphosed tuff, strongly jointed. Occasional small concentrations of wolfram intergrown with muscovite mica and quartz occur in a matrix of dark coloured quartz, and the predominantly siliceous veins vary rapidly in width both in strike and dip.

It is extremely unlikely that the wolfram content of these "leaders" will pay for their extraction and treatment, involving as it does the mining of up to 30 inches or more of hard footwall rock, the road haulage of 60 miles to rail, and a further rail journey of 333 miles to Cue, and crushing and realisation charges in addition. The present price of wolfram is about £A27 per long ton unit of WO_3. (Oct. 1951).

Production.

The same ground was held during 1942 and 1943 as prospecting area No. 2325, and the following is the official recorded production during those years:—

Period.	Ore Treated.	Concentrates.	WO_3 Content.	Equivalent Long Ton Units.
	(tons)	(lbs.)	(lbs.)	
1942	0.25	51.00	33.15	1.47
1943	13.25	493.00	325.85	14.53
Total	13.50	544.00	359.00	16.00

This ore was hand picked and selected prior to treatment. No production has been recorded to date (Oct. 1951) from the present holding (P.A. 2472).

FINAL PROGRESS REPORT ON A GEOLOGICAL SURVEY OF THE METROPOLITAN AREA.

By J. C. McMath, B.Sc. (Hons. Lond.), F.G.S., M.A.I.M.M., Senior Geologist.

CONTENTS.

Introduction.

Economic pressures arising from World War II emphasised the urgent need for a more comprehensive and precise knowledge of the geological resources of the Metropolitan Area. This survey was initiated in August, 1950, and its terms of reference were purely economic in character.* Two reports upon the southern portion of the Area were made available to interested parties. This southern area, the Armadale Sub-Area, was completed in December, 1950, and the results published in brief in the Annual Progress Report of the Geological Survey for that year. This publication details the objects and modus operandi of the survey. The present report concerns itself with the Bullsbrook and Wanneru Sub-Areas together with the built up portions of the city of Perth and Fremantle.

Some 800 square miles have been mapped to a scale of 20 chains to the inch, prospected, and sampled in broad outline. Some 215 samples were taken and tested for industrial suitability. Where tests warranted, "follow up" boring with hand equipment was carried out wherever possible.

Definition of the Metropolitan Area.

The maximum area authorised for investigation extended from the latitude of Muchea southwards to that of Safety Bay. The eastern boundary was the longitude of Glen Forrest.

For convenience of operation, determined by demand priorities of materials, communications, and proximity to the city, the Area was divided into sub-areas centred about Armadale, Bullsbrook, and Wanneroo. The Bullsbrook and Wanneroo Sub-Areas (including the built up portions of Perth and Fremantle) form the subject of this report and comprise some 800 square miles.

Reference Maps.

Reference maps to the Metropolitan Area as defined by the Survey are:—

(a) *Lands and Surveys Department Lithos:*—
29/80 – 31/80

341A/40, 341B/40, 341C/40, 341D/40.

(b) *Military Maps*, 1 inch = 1 mile:—

Mundaring	Zone 1	No.	309
Yanchep			392
Toodyay			393
Perth			398
Fremantle			404
Kelmscott			405
Rockingham			410
Jarrahdale			411

Sample and Location References.

Such references are, for convenience, given in terms of the military grid. This grid will be incorporated with the published geological map.

Publication of Results of the Survey.

The results will be presented concisely in the following form:—

(a) Contoured Geological Map to a scale of 1 inch to the mile—with an economic summary.

(b) Overlays showing distribution of industrial rocks and minerals, sample locations and broad results, and relevant economic notes. Such overlays will be:—

(i) Clays, loams, shale, kyanite.

(ii) Limestone, lime sands, bog limestone.

(iii) Silica (sands, quartz, diatomite).

(iv) Dimension Stone and Aggregate (other than limestone) including laterite, granitic gneisses, dolerites, etc.

(v) Water—including drainage lines, ground water wells, artesian bores.

(vi) Land Utilisation.

* Annual Progress Report G.S.W.A., 1950.

Personnel.

Six professional officers (including one temporary) have been engaged upon this survey during the period. They were:—

Geologist.	Function.	Period.
J. C. McMath	In Charge	Aug., 1950-Oct., 1951.
N. M. Gray	Field Duties	Aug., 1950-Oct., 1951.
J. Sofoulis	Field Duties	Aug., 1950-Oct., 1951.
L. E. de la Hunty	Field Duties	Aug., 1950-Apr.. 1951.
G. H. Low	Field Duties	Aug., 1950-Oct., 1951.
A. Glance	Field Duties	Aug., 1950-Dec. 1950.

Industrial Rocks and Minerals of the Area.

The principal industrial uses for rocks and minerals which may occur are:—

Clays and Shales—brick, tile, pipe making.

Clays—minor ceramic uses—cement.

Sands—foundry uses, glass, filters, etc.

Diatomaceous earths—filters, insulating shapes, etc.

Gravels—road surfacing, aggregate material.

Limestone—chemical, industrial, and agricultural uses—dimension stone.

Salt—industrial uses.

Refractories other than clays and shales (possible in the Pre-Cambrian rocks).

Igneous and Metamorphic Rocks—dimension stone and aggregate material.

THE BULLSBROOK SUB-AREA.

Location and Communications.

Bullsbrook lies 28 miles north of Perth upon the Midland Railway Line and is adjacent to the Northern Highway. Within the Sub-Area gravel roads give access to the Chittering Valley from East Bullsbrook and Muchea; to Toodyay from Midland Junction (through which centre passes the Eastern Highway); to Gingin via Muchea.

Access to the Perth-Yanchep road (Wanneru Sub-Area) is poor and is confined to a gravel road from West Swan (the Gnangara road) and a sand track from Bullsbrook to the Lake Pinjar road (Neaves Road).

On the Darling Ranges access in some detail may be had by timber tracks, etc., but westward access by track is limited and poor.

Geological Outline.

From east to west the broad geological elements of the Bullsbrook Sub-Area are:—

(a) The Pre-Cambrian rocks of the Darling Range. These include granite-gneisses, epidiorites and two occurrences (Chittering Valley and Bullsbrook respectively) of meta-sedimentary rocks which have been regionally folded and metamorphosed. In the Chittering Valley these meta-sediments are kyanitic.

On their western margin (the Darling Scarp) these Pre-Cambrian rocks are flanked (unconformably) by Mesozoic rocks in the Bullsbrook-Muchea locality and by the Tertiary to Recent sediments of the coastal plain from Bullsbrook southwards to Midland Junction. The Pre-Cambrian Cardup Series were not encountered. Associated with these rocks are residual deposits including laterite.

(b) Confined to the Bullsbrook-Muchea region on the western slopes of the scarp is a foothill piedmont zone consisting of low dipping, well dissected, Mesozoic rocks together with residual and alluvial fan material. Some of the valley heads in this zone are fringed by boulder beds. In general the Mesozoic rocks (sandstones, shales, grits, conglomerates) tend to be ferruginous and lateritised. Approximately a mile east of East Bullsbrook (just off the Chittering Road) a "greensand" horizon has been recorded at a depth of 40 ft. in a well section.

(c) Southwards of Bullsbrook the valleys of the Ellen Brook and Swan with their associated clays, loams, and—in the case of the Ellen Brook—bog limestones form a distinct entity. The Ellen Brook bog limestones are noticeably confined to the west bank of the brook.

(d) Succeeding both (b) and (c) above to the westwards is a zone of vegetated siliceous sand dunes, depressions in which may be swampy and contain sufficient organic matter to support market gardening. This zone continues westwards into the Wanneru Sub-Area.

Outline of Ecomonic Results.

In general the Sub-Area is not well off—either with respect to quantity or quality—for industrial rocks or minerals.

(a) Ceramic and Brick Clays—are virtually confined to the Swan Valley where problems of land values and utilisation are increasing. Elsewhere, transported clays are limited in extent and confined to the Ellen Brook—they are of no economic importance. Residual clays occur upon the Pre-Cambrian rocks but have a very limited development and present accessibility problems—as also do the kyanitic meta-sediments which, at some undetermined future time, may prove an economic source of kyanite. As far as seen, kaolinitic clays appear to be absent—none being noted beneath laterites on the Range.

(b) Foundry Sands—(i) *"Natural Sands"*—these are largely river loams and results of testing, as in Armadale Sub-Area* emphasise the fact that acceptable "natural" sands have a very limited vertical and horizontal distribution.

In any one locality a deposit varies greatly in a short distance—e.g. the Guildford loams at present in use. Limited quantities of "natural" sands can only, then, be located by very close prospecting of loams mapped during the course of the survey.

(ii) *Synthetic Sands.*—Sources of synthetic sands—a silica sand to which a bonding agent such as bentonite is added to produce a foundry sand to specification—are confined to the vegetated siliceous dunes. These sands offer possibilities, either by themselves or after some beneficiation.

(c) Limestones—the sole limestones within the Sub-Area consist of the bog limestones associated with the Ellen Brook. They could have a local and limited agricultural use.

(d) Road Metals and Aggregates—are confined to the Pre-Cambrian rocks (lateritic gravels, granite, "Blue" metal) and the Mesozoic rocks (lateritic gravels). Sand, as builders' sand, occurs against the Darling Scarp at Upper Swan and again in the zone of vegetated siliceous dunes.

(e) Silica—occurs in economic quantity only in the zone of vegetated sand dunes—there is a small but variable iron content.

* Annual Progress Report G.S.W.A., 1950.

THE WANNERU SUB-AREA.

Communications.

Wanneru lies 15 miles north of Perth on the Perth-Yanchep road (bitumen). Within the Sub-Area eastwards access is confined to Neaves Road (sand-track) previously mentioned and the Gnangara—West Swan road. Westwards access, north of Balcatta, to the coast is limited to sand tracks and is not good.

Broad Geological Outline.

The broad geological elements of the Wanneru Sub-Area are from the east to west:—

(i) A zone of vegetated siliceous dunes (the western-most zone of the Bullsbrook Sub-Area) which are bounded on the west by a series of lakes (both permanent and seasonal) and swamps which trend approximately north-south. This zone achieves its maximum width in the south where it fringes the Swan Valley.

(ii) A zone of calcareous sandstones (Coastal Limestone) which extends to, and comprises, the coast line. Its western margin is fringed with both live and fixed calcareous sand dunes. The zone achieves its maximum width in the Yanchep locality and tapers southwards. Major areas of cap-rock are largely confined to the terrain north of Wanneru township. A chain of lakes and swamps (permanent and seasonal) trend north-south in the central position of the zone and extend from Yanchep southwards to Perth.

Outline of Economic Results.

The potentialities with regard to industrial rocks and minerals are limited with regard to variety and quality of material and, unless some form of beneficiation is employed, with regard to quantity.

(a) Foundry Sands—Only "synthetic" sands are available either within the zone of vegetated siliceous dunes (some beneficiation may be possible to give a more even grading) or lake systems (where some grading of material is evident).

(b) Glass Sands—The evenly graded finer sands of the lake systems offer possibilities —Lake Gnangara being a present source of supply.

(c) Limestone (Chemical and Agricultural)— Industrial demand is for a $CaCO_3$ content of 80 per cent. or better. This until beneficiation is practised, imposes a very narrow limit upon available quantities which, in any one locality, are of the order suitable to the local lime-burning industry. From the cement manufacturing aspect, the choice would appear to lie with either:—

(i) Beneficiation of limestone—in which case commensurate reserves of material 70-80 per cent. $CaCO_3$ in grade are available.

(ii) Accepting a lower grade limestone and using a high alumina clay.

The latter would involve beneficiation of the kaolinitic clays to remove free quartz grains. In either case deep exploration of the coastal limestone is necessary before definite reserves can be located or industrial policy formulated. The belt of limestone between the south end of Lake Pinjar and Yanchep (east of the Yanchep Road) appears to offer the most promising prospects for deep exploration—although equal prospects more restricted as to area are located closer to the coast in the locality of Burns Beach and Quinns Rocks.

(d) Lime Sands.—Within the quadrangle mentioned above occur lime sand dunes. These dunes, both "fixed" and "live" parallel the coast and occupy a zone which may have a width of up to a mile. They are, in places, of large dimensions and may show a horizon of secondary enrichment. Some are very high in $CaCO_3$ content (one averaging 89 per cent. over a depth of 5ft.) and merit quantitative investigation—especially if beneficiation be contemplated. They could show large reserves.

(e) Diatomaceous Earths—occur in the chains of lakes and swamp throughout the sub-area. The thickness of the deposits ranges from 2in. to about 5ft. All carry varying quantities of organic matter and quartz sand—the latter (until beneficiation is practised) proving a handicap where an otherwise economic quantity of material exists. To date the main use for the material has been in the production of insulating shapes. In general the characters of the diatoms do not favour uses for filtration—research may overcome this point. The chief present sources of diatomaceous material are from the Gnangara and Badgerup localities. Apart from these localities, the outlook for economic grade and quantity of diatomaceous earths is not promising until some effectual means of removing quartz sand comes forward and lies within the economic production framework of the material.

(f) Aggregate Materials, Dimension Stone.—

(i) Aggregate Materials.—Coastal limestone furnishes the only coarse aggregate material for road construction purposes, whilst the fixed siliceous sand dunes together with the better graded lacustrine sands are the only source of indifferent aggregate for building purposes or cement brick and tile manufacture.

(ii) Dimension stone is available in the coastal limestone and has, just north of Perth been extensively produced from small quarries in the past; it does not, however, appear to compare with the No. 1 grade stone (reference Annual Progress Report, 1950) produced in the Spearwood area south of Perth. It could, however, be of fair utility.

Summary.

Fieldwork in the Bullsbrook and Wanneru sub-areas was commenced in January and finished in August, 1951. Some 800 square miles were mapped on a scale of 20 chains to the inch. Resulting from this work were the following points:—

(i) That clays of economic ceramic or brick making interest were confined to the Swan Valley.

(ii) That, as in the Armadale sub-area, natural foundry sands were limited in quantity, extremely variable in characteristics within any one locality, and significant reserves were not apparent. Of "synthetic" (i.e., silica) sands good potentialities were seen. Some beneficiation with regard to grade to suit a particular type of foundry work might prove an economic possibility.

(iii) That chemical lime prospects, both with regard to limestones and lime sands, was in general better than in the Armadale sub-area, but that large reserves of materials of 90 per cent. of $CaCO_3$ were non-existent, although adequate reserves of 75-80 per cent. grade material are to be had.

(iv) That, in general, aggregate materials (other than sand and limestone) are severely restricted to the pre-Cambrian terrain.

(v) That commercially acceptable diatomaceous materials are very limited in extent, quantity and quality.

In general the resources of the two sub-areas are limited and largely fall below existing industrial standards (where such are to be found). The future of these resources or of a particular field of

use is contingent upon industrial research both into beneficiation methods and technologies of application and the economics thereof.

Acknowledgments.

The writer wishes to express the appreciation of the members of this operation for the co-operation that has been received from official and unofficial bodies and individuals too numerous for specific mention.

NOTES ON THE PROGRESS OF THE RAVENSTHORPE (PHILLIPS RIVER G.F.) GEOLOGICAL SURVEY as at 31/12/51.

By J. C. McMath, B.Sc. (Hons. Lond.), F.G.S., M. Aust. I.M.M., Senior Geologist.

CONTENTS.

GENERAL.

The Area under geological survey comprises some 4,500 square miles of the Phillips River Goldfield (less the lake country to the north-east) centred about the township of Ravensthorpe. Previous regional work of the Geological Survey (circa 1909 by H. Woodward) was limited to a small area lying between Ravensthorpe and Kundip.

The present work has been undertaken in order to—

(i) further elucidate the hitherto imperfectly understood regional geology and

(ii) ascertain, if—and as far as—possible, the relationship of ore mineralisation to regional and local geological structures.

Comprising two phases, the field operations are firstly, regional mapping on 80 chains to one inch and 20 chains to one inch (chiefly in the Ravensthorpe, Eyre, Mt. Barren Ranges and Kundip locality); and secondly, mapping of mining groups on a five chain to one inch. Mapping of the following mining groups is scheduled:—Elverdton, Mt. Mahon, Catlin, Kundip, Hatters Hill, together with certain mineralised pegmatites. The Elverdton Group has been completed.

Survey methods employed consist largely of plane table and telescopic alidade for oriented traverses and resections together with compass and chain traverses.

The party consists of the following:—

J. C. McMath, Senior Geologist, in charge.

N. M. Gray, Geologist 2nd Class—field duties as laid down.

J. Sofoulis, Geologist 2nd Class—field duties as laid down.

Previous official literature is scanty, the principal references being:—

Bull. No. 5 G.S.W.A.—The Phillips River Mining District—T. Blatchford, 1900.

Bull. No. 35. G.S.W.A.—The Gold and Copper Deposits of the Phillips River Goldfield—H. Woodward, 1909.

Mines Dept. Report—The Development of the Phillips River Auriferous and Copper Mines—A. Montgomery and M. Maclaren, 1914.

Apart from a small gold mine operating at Kundip, mining in the district is moribund. Precious metal production from this Goldfield to date (1951) has been:—

Alluvial.	Dollied and Specimen.	Ore Treated.	Gold Therefrom.	Silver.
Fine oz.	Fine oz.	Tons. (2,240 lb.)	Fine oz.	Fine oz.
607·11	818·28	130,485·53	103,285·53	16,020·14

Production for the year 1951 being 63.44 fine ounces of gold from 100 tons of ore.

Total Copper Ore production to date is 95,924.47 long tons of value £589,373. Production for the year 1951 being 4.83 long tons of value £138.

No map is published with these notes by reason of the expense being incompatible with field mapping carried out to date.

GEOLOGICAL NOTES.

1. Physiography.

The following major positive topographic elements noted so far, are:—

(i) The Ravensthorpe Range—sigmoidal in expression with its longer axis lying approximately 20° north of west.

(ii) The isolated coastal ranges of Mt. Barren and Eyre, showing raised beaches. These ranges trend approximately 10°-20° north of east.

(iii) North of the latitude of Mt. Short isolated hills, usually of granitic gneiss, rise above the sand-plain.

(iv) Again about the latitude of Mt. Short a general east-west trending sinuous and embayed "jump-up" line (vernacular) which separates the Old Plateau from the New Plateau.*

The major drainage pattern within the area shows broad valleys with incised meanders. The trend of the major rivers, the Jerdacuttup, Steere, Phillips, West, and Hamersley, is to the south-south-east (the regional trend of the older Pre-Cambrian-Archeozoic structures). Some measure of control appears to be exercised by structures associated with the Mt. Barren-Eyre Range rocks. The rivers are intermittent, consisting for the major part of the year of fresh, brackish or saline pools. These rivers terminate seawards in brackish or salt lakes—the so-called "inlets"—cut off from the sea by substantial and mainly vegetated sand bars of which the Culham Inlet furnishes a typical example. The water of this "inlet" is at a slightly lower level than that of the sea.

In the salina country of the north-east quadrant of the Area the drainage is reminiscent of the Coolgardie and Murchison Goldfields in that, to date, it appears entirely internal.

2. The Rock Types of the Area.

A broad two-fold grouping of the rocks of the Area is possible. This grouping is in no sense final and may well require modification in detail as the work of the Survey progresses. The two major divisions apparent are:—

(i) Post-folding Rocks—these comprise the coastal limestones, laterites, and the conglomerates, mudstones, and sandstones about the Kundip railway cutting. Thin spreads of a dominantly quartzose conglomerate may occasionally occur south of the latitude of Kundip capping the lower ridges. Included in this post folding group of rocks are the granitic-gneisses, magmatic granites, economic pegmatites, and quartz-dolerite dykes.

* Bulletin No. 95, G.S.W.A.: Physiography of W.A. J. T. Jutson, 1950.

(b) Pre-folding Rocks.—Whilst all have been in varying degree metamorphosed (regional) granitised, and intruded by magmatic granites and post-granite porphyry and quartz-dolerite dykes, a fundamental major structural separation can be effected, viz.:—

(i) Regionally folded (average trend 20° west of north) and metamorphosed rocks consisting of Basic Lavas, Ultra-basic rocks, jaspilites. These rocks comprise the Ravensthorpe Ranges and show traces of superimposed structural elements trending in approximately N. 70° E. In the Ravensthorpe-Bandalup Creek region these elements appear as "cross-folding" of a minor order. Hence these rocks have experienced two periods of folding (cf. the Older Greenstones of the Coolgardie and Yilgarn Goldfields). In general the degree of regional metamorphism is low—but local "highs" may occur.

In detail the Basic Lavas comprise fine to medium grained rocks, vesicular and amygdaloidal types, metagabbroidal types, porphyritic rock lavas, and volcanic agglomerates. Rare and very thin meta-sedimentary horizons (of no marked value) were noted. The Ultra-basic rocks comprise both fine grained massive and schistose actinolitic, anthophyllitic and tremolitic types together with rare residuals of bedded dolomites (Cocanarup). These dolomites, however, are usually much metamorphosed. Wide developments of serpentine, magmatic in some instances, of uncertain origin in others, are associated with the Ultra-basic rocks. Of economic interest are the developments of manganiferous talc schists east-south-east of Kundip on the Jerdacuttup River.

The jaspilites of the Ravensthorpe Area dominate the topography but are, individually, of relatively small thickness—the rounded ridges resulting from lamination of jaspilites and schists. The division between Ultra-basic rocks and jaspilites is logical; the mutual relations of these quite arbitrary and entirely lithological; the mutual relations of these sets of rocks being, as far as has been seen, one of conformable transition. There is no evidence to offer upon the relationship between the Basic Lavas and the Ultra-basic rocks. In the field they appear conformable. Structural evidence in the Mt. Short and Kundip localities makes the Basic Lavas the oldest of these pre-folding rocks, followed upwards by Ultra-basic rocks and the jaspilite group.

(ii) Regionally folded (upon the "Cross-fold" axis of N. 70° E.) and slightly metamorphosed conglomerates, shales, grits, quartzites which comprise the rocks of the Mt. Barren and Eyre Ranges. They find, to date, their most northern expression in the latitude of Kundip. They contain no structural elements of north-south trend and are clearly involved in a single folding episode and hence are younger than the rocks of the Ravensthorpe Range. Whilst, as also have the latter rocks, they have been intruded by granites and granitised in varying degree, their regional metamorphism is lower in degree than that of the Ravensthorpe rocks.

Mutual Relations of the Ravensthorpe Range Rocks and Mt. Barren and Eyre Range Rocks.

These rocks are to be seen clearly in juxtaposition some two miles east-north-east of Kundip. The salient facts brought out to date are:—

(i) The singly folded rocks of the Mt. Barren Series consist of shales, grits, quartzites, conglomerates, quartz-breccias (tectonic).

(ii) The above rocks overlie the rocks of the Ravensthorpe Series and strike N. 70° E., dipping southwards at high and varying degrees whilst the Ravensthorpe Series strikes N. 20° W. with dips oscillating about the vertical.

(iii) The regional metamorphism of the Mt. Barren Series is low compared with that of the underlying Ravensthorpe Series.

(iv) Drag-folding and fracture cleavage in the Mt. Barren Series indicates overturning of beds to the north and a low easterly plunge to the major structure.

(v) The northern expression of the junction of the two series takes the form of a sinuous and deeply embayed north facing gentle scarp line. This topographic expression is consistent either with the outcrop of a series dipping flatly southwards or with the line of emergence of a low angle major thrust plane.

(vi) In topographic depressions in the Mt. Barren Series, especially in the beds of major drainage channels, "windows" exposing the underlying Ravensthorpe Series are seen—e.g., the creek four and a half miles south-west of No Tree Hill.

(vii) Whilst no north-south structural components are to date found in the rocks of the Mt. Barren Series, "cross folding" is impressed on the Ravensthorpe Series in varying degree.

There exists, then, a major angular discrepancy between the rocks of the Ravensthorpe Range and those of the Mt. Barren Series. Sufficient work has yet to be carried out to demonstrate unequivocally the true nature of this discrepancy—whether it arises from a normal regional angular unconformity rendered locally complex by "cross-fold" "highs" in the Mt. Barren Series, or whether it arises from low angle overthrusting of the Mt. Barren Series from the southward.

The current view of the author, based upon the related facts and close field acquaintance therewith, inclines heavily on the side of overthrusting, with the dips, brecciated quartzite, suspicions of repetition of strata southwards, the relatively low topographic level development of these rocks northwards of Mt. Barren and the Eyre Ranges suggestive of an imbricate zone on the sole of, or in advance of, a major low angle thrust plane which has carried the Mt. Barren Series northwards over the rocks of the Ravensthorpe Ranges which have acted as a foreland. A firm view at this stage of the work is, however, premature.

Structure of the Ravensthorpe Ranges.

Work has sufficiently advanced to delineate the regional structure of the folded rocks of the Ravensthorpe Range in, and west of, the Kundip-Mt. Short region. East thereof is only known in reconnaissance outline.

Briefly, the structure consists of a north plunging anticlinorial of which Mt. Short forms the nose and the main Ravensthorpe Range the eastern limb. At Kundip there is a suspicion (to be confirmed or otherwise) of the nose of a complimentary synclinorial to the east of the Range. The western limb is traceable southwards, to date, to Cocanarup where it disappears in the granitic gneiss (whose structures parallel this major structure in broad outline). The axial zone trends N. 20° E. and,

south of Ravensthorpe, has been occupied by granites and granitic gneisses. The western margin of the eastern limb has been largely granitised. "Cross-folding" is discernible in the McMahon-Bandalup Creek area.

Classification and Sequence of Rock Types.

The classification and sequence which follows cannot, at this early stage of the survey, be regarded as either complete or final. As work progresses it will, inevitably, be subject to modification.

	Age.	Series.	Description.	Remarks.
Kainozoic.	Recent	....	Soils	Various types—alluvial and eluvial.
	Tertiary to Recent	....	Alluvium and lacustrine deposits	May be older or younger than the laterites—possibly deposits of both ages occur.
	Tertiary	....	Laterites ; Coastal Limestone ; High level conglomerates	(1) Laterites of W.A. generally accepted as of Tertiary age. (2) Conglomerates show some degree of correlation with Mt. Barren raised beaches—could be Miocene.
		? Kundip Series	Basal conglomerates, sandstones, mudstones Great Unconformity.	Have low initial dips—overlie unconformably both Ravensthorpe and Mt. Barren Series. Have been regarded as Nullagine in age by H. A. Ellis and E. de C. Clarke. Are not metamorphosed or intruded.
Late Proterozoic or Lower Cambrian.	Nullagine	? Kundip Series	lithology above	*See* above.
			Igneous Contact Quartz dolerite dykes and quartz-porphyries	Post folding and post granite.
			Igneous Contact Magmatic Granites—economic pegmatites	Period of Au, Cu, Pb, Ag mineralisation together with intrusion of economic pegmatites.
			Igneous Contact Granitic gneisses and allied rocks Period of Earth Movements	Period of granitisation of pre-Folding rocks.
		? Mt. Barren Series	Conglomerates, shales, grits, quartzites	Regionally folded on N. 70°E. axis—time range unknown but could be early Proterozoic or later.
Archeozoic.		Ravensthorpe Series	Great Angular Discrepancy Period of Earth Movement Jaspilites—Ultrabasic Rocks—Basic Lavas	For lithology, *see* elsewhere in notes. Basic Lavas and Ultra-basic rocks lithologically and metamorphically similar to those of Yilgarn and Coolgardie Older Greenstones. The jaspilites may represent a condensed Whitestone sequence. Folding was on approx. N–S axis. "Mt. Barren Cross folding" impressed in varying degree upon these rocks.

Future Work.

Carrying forward mapping programme.

Working out detail of relations between Mt. Barren and Ravensthorpe Series.

Further structural delineation of the area. Correlation, if and as possible, or ore mineralisation with regional and local structures.

Completion of the mining group mapping programme.

ACKNOWLEDGMENTS.

The author wishes to acknowledge help gratefully received from official and unofficial organisations and individuals. In particular he would like to record his appreciation of stimulating and cogent discussion by and advice from the Government Geologist.

REPORT ON WATER SUPPLY AT MURESK AGRICULTURAL COLLEGE, MURESK, W.A.

By J. H. LORD, B.Sc., F.G.S.

The Agricultural College at Muresk, 50 miles east-north-east of Perth between Spencer's Brook and York, was visited in early January 1951 at the request of the principal to advise on the water supply problem of the College.

As the College buildings are connected to the Goldfields Water Supply pipe line, there is no domestic water supply difficulty. Stock water in the paddocks has been drawn from numerous soaks, which, due to a number of below average rainfall seasons, have dried out and created the present problem. All the water obtained from the soaks is suitable for stock, while a well at the garden, although slightly brackish now, is suitable for drinking and for the garden. This well, the only one on the property that produces a continuous supply, is 12ft. deep with water at 7ft. below the surface. There is no salinity problem in any of the known underground supplies yet.

A brief general reconnaissance was made of the property, which consists of granite-gneiss with meta-sedimentary rocks and greenstone intrusions. Much of the property is high rocky country dissected by creeks and gullies which, when carrying water, drain in a general south-westerly direction to the Avon River. The soaks occur in and on the slopes of these gullies.

MODE OF OCCURRENCE OF UNDERGROUND WATER.

The following well-known features are most important when searching for water in this type of country, and should be borne in mind when selecting sites for bores.

In order that underground water may exist there **must be** an effective intake area. If there is a suitable intake area then there must be porous strata (aquifers) to act as a reservoir for the water.

In country such as this with granitic hills and narrow, shallow valleys, the possibility of large underground supplies of underground water is not good. Only in the gullies, where there are patches of sandy alluvium are suitable intake and storage areas likely to exist.

Sites with good prospects of underground water occur immediately upstream from any resistant bar across a gully where suitable alluvium is present. In the brief inspection at Muresk, although resistant bars cross the gullies in places, there did not appear to be any great thickness of alluvium in the gullies.

RECOMMENDATIONS.

There are numerous sites worthy of drilling in the circumstances to ascertain the possibility of obtaining underground water with no guarantee of success but the following sites are suggested, bearing in mind where the greatest need for water exists.

(1) Top Paddock—in the gully near the northern boundary.
(2) Clear Hills Paddock—in the gully near the southern boundary.
(3) Oliver Paddock—where the small gully meets the main creek near the south-west corner.
(4) Flat No. 1 and No. 2—in either gully, slightly upstream from the soakages.
(5) Oval Paddock—west of the sand-pit near the fence.

Further sites upstream from Flat No. 1 would be suitable but the soak in Creek Paddock seems quite adequate. Another possibility is, if the Stone Soak Paddock's soak dries out, at the north-west corner of the paddock. Drilling in each hole should be stopped when solid rock (granite, greenstone, etc.) is encountered.

Little can be done to improve the existing soaks except that some cleaning out may improve the supply. Such attention may benefit the soak in Gully Paddock.

It would be of general interest and benefit if some of the underground supplies were tested for salinity at regular intervals. This would eventually show if the waters were becoming more saline and also illustrate any annual variation in salinity.

REPORT ON THE EXPLORATION OF THE SOUTHERN PORTION OF PROSPECTING AREA 54, COLLIE MINERAL FIELD, W.A.

By J. H. Lord, B.Sc., F.G.S.

CONTENTS.

GENERAL INFORMATION

This report describes further prospecting for coal on P.A. 54, details of which were enumerated previously in "A Report on a Portion of P.A. 54, Collie Mineral Field, W.A." published in the 1949 Annual Report of the Geological Survey of W.A.

This prospecting, which had been suggested in the report quoted above, was to locate and prove the existence and extent of the top, No. 1 coal seam of the Collie Burn horizon on this area.

There is no previous record of any prospecting on this portion of the P.A., but the seam had been traced up to the western boundary as described in the report "Shallow Drilling for Open Cut Coal on a Portion of Mineral Leases 82, 129 and 130, East Collie Burn, Collie Mineral Field, W.A." by the writer in the 1950 Annual Report of the Geological Survey of W.A.

The drilling, which commenced at the beginning of November, 1950, was done by Kent Bros. for Western Collieries Ltd. under the geological supervision of the writer. The programme described was completed on the 2nd May, 1951.

GEOLOGY AND DRILLING RESULTS.

The general geology of this area has been described in the reports mentioned above.

This drilling programme was planned to trace the blind outcrop of the No. 1 seam of the Collie Burn horizon across the P.A. commencing from the western boundary. An occasional hole was drilled further down the dip to test the continuity in that direction. Of the 18 holes drilled, all except two encountered the seam. Hole No. 46 was not taken deep enough owing to an incorrect reduced level being supplied. The position and details of these holes are shown on Plate I and Table 1.

In following this seam it was found that the blind outcrop varies from a depth of 90 feet on the ridges to approximately 45 feet in the gullies. This actually represents a variation in the thickness of the Pliocene lake deposits, which overlie uncomformably the Permian coal measures.

There is no possibility of a large open-cut along this seam, the only possible areas being in the two main gullies, where the extent would be very small.

As previously anticipated, the strike continues to swing in a clockwise direction across the P.A. varying from N. 50° W. on the western side to N. 3° W. towards the east, but on the far eastern side the strike appears to swing back to N. 38° W.

The dip varies from 6 to 10 degrees in a south-westerly to westerly direction from west to east. The dip of the seam flattens to the south-west and the dip calculated between bores Nos. 47, 50 and 51 is 3¾ degrees. The general strike and dip can be seen on the structure contour plan (Plate II). There is no evidence of any serious faulting.

The thickness of the seam away from the weathered blind outcrop varies from 9ft. 6in. to 13ft., with an average thickness of 11ft. 6in. A majority of the bores show the seam to have a soft sandstone roof, which apparently changes to black shale down the dip.

In the hole furthest down the dip, namely bore No. 51, a 6ft. 9in. seam was encountered at a depth of 64 feet. This is the only other seam of economic significance encountered during the drilling. This seam was not investigated further because it would only occupy a small portion of this property.

QUALITY OF THE COAL.

The seam was sampled in all bores, where it was intersected, and a selection analysed by the Western Australian Government Chemical Laboratories.

Although percussion drilling does not provide an entirely satisfactory sample, care was taken to keep the sample as free from foreign matter as possible, and it is considered that a reasonable sample was obtained.

All analyses give fairly consistent results, except the sample from Bore 51 which is the deepest bore. This latter analyses shows an increase in ash content and decrease in calorific value. Occasionally in sampling such as this, one sample may vary greatly from the average, but on the other hand, it may indicate a decrease in the quality of the coal down the dip.

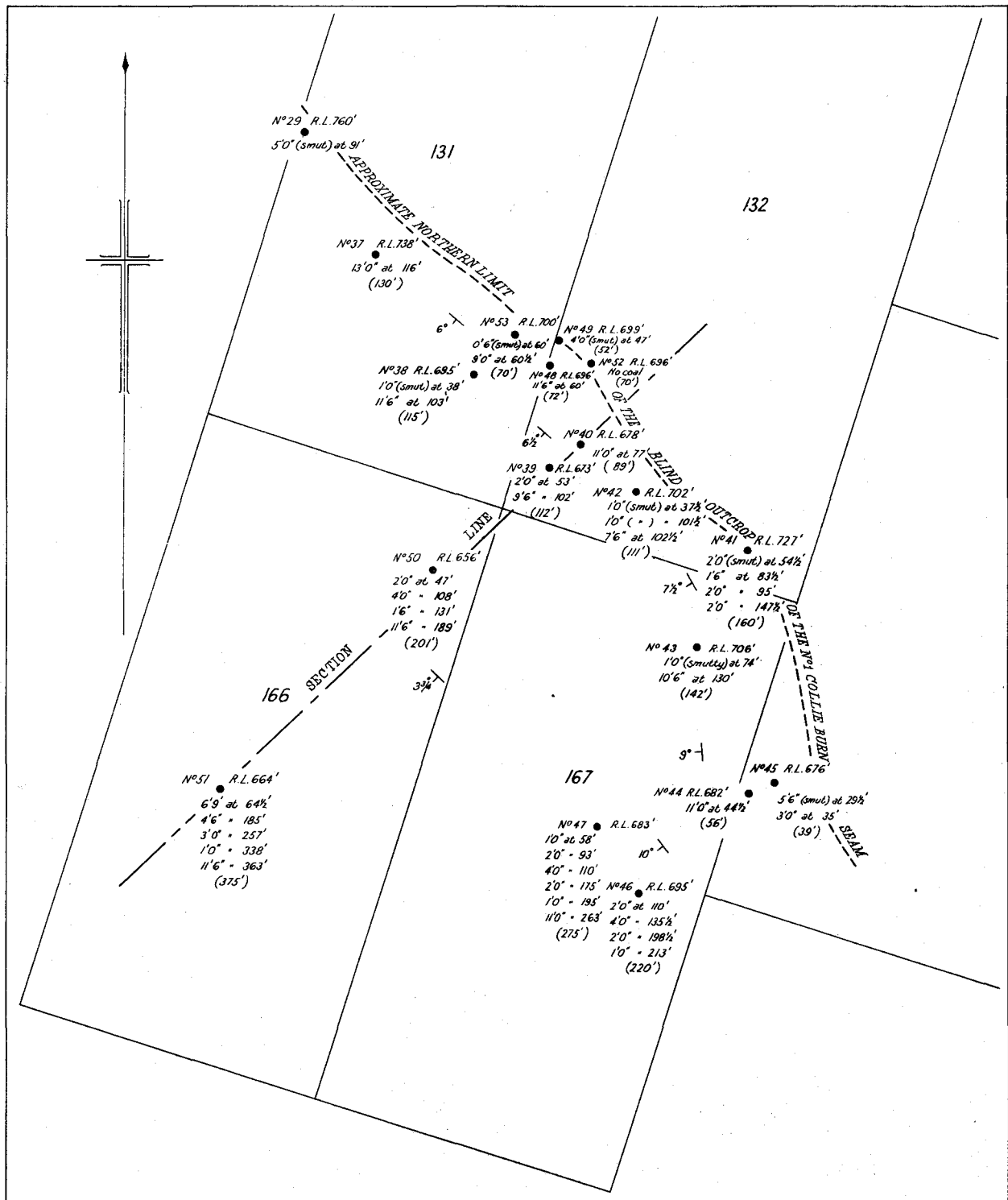
The details of all analyses are shown in Table 2 which gives an average analyses on the 20 per cent. moisture basis of ash 4.4 per cent. and calorific value 9,500 B. Th. U.'s, while the average dry-ash-free calorific value is 12,620 B. Th. U. These values are similar to the values for the seam on the adjoining M.L.'s 82, 129 and 130.

The colour of the ash is pale pinky-grey to fawn, indicating an absence of iron and probably a high ash fusion point.

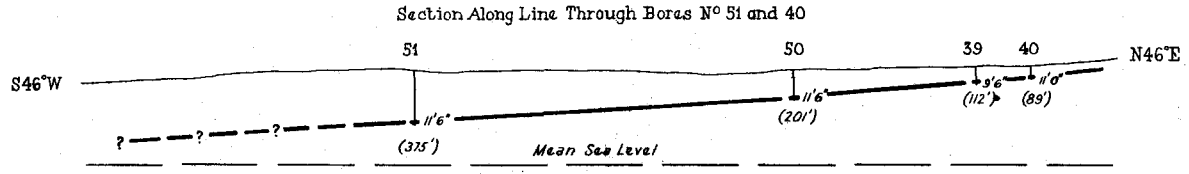
COAL RESERVES.

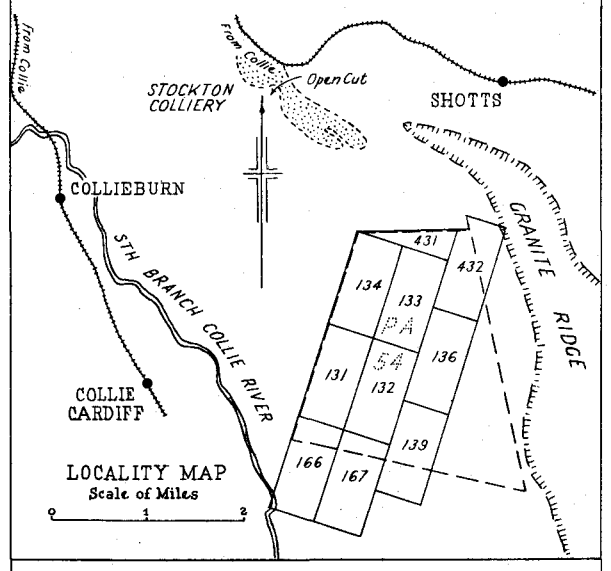
As stated earlier there is no suitable locality on this portion of the P.A. investigated for an open-cut. In consequence, the drilling was planned for colliery purposes and the coal reserves have been calculated accordingly. In the following estimates

PLATE I



Section Along Line Through Bores N° 51 and 40





—REFERENCE TO SIGNS—

Borehole - showing indentification (N°37) reduced level (R.L. 738') significant coal seam intersected (13'0" at 116'), borehole depth (130') — N°37 R.L.738' 13'0" at 116' (130')

Lease boundary

Line of section

Strike and dip of seam from bore data — 9°

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

PLAN AND SECTION
OF
SOUTHERN PORTION
OF
PROSPECTING AREA 54
(C.M.L^s 131, 132, 166 & 167)
COLLIE MINERAL FIELD

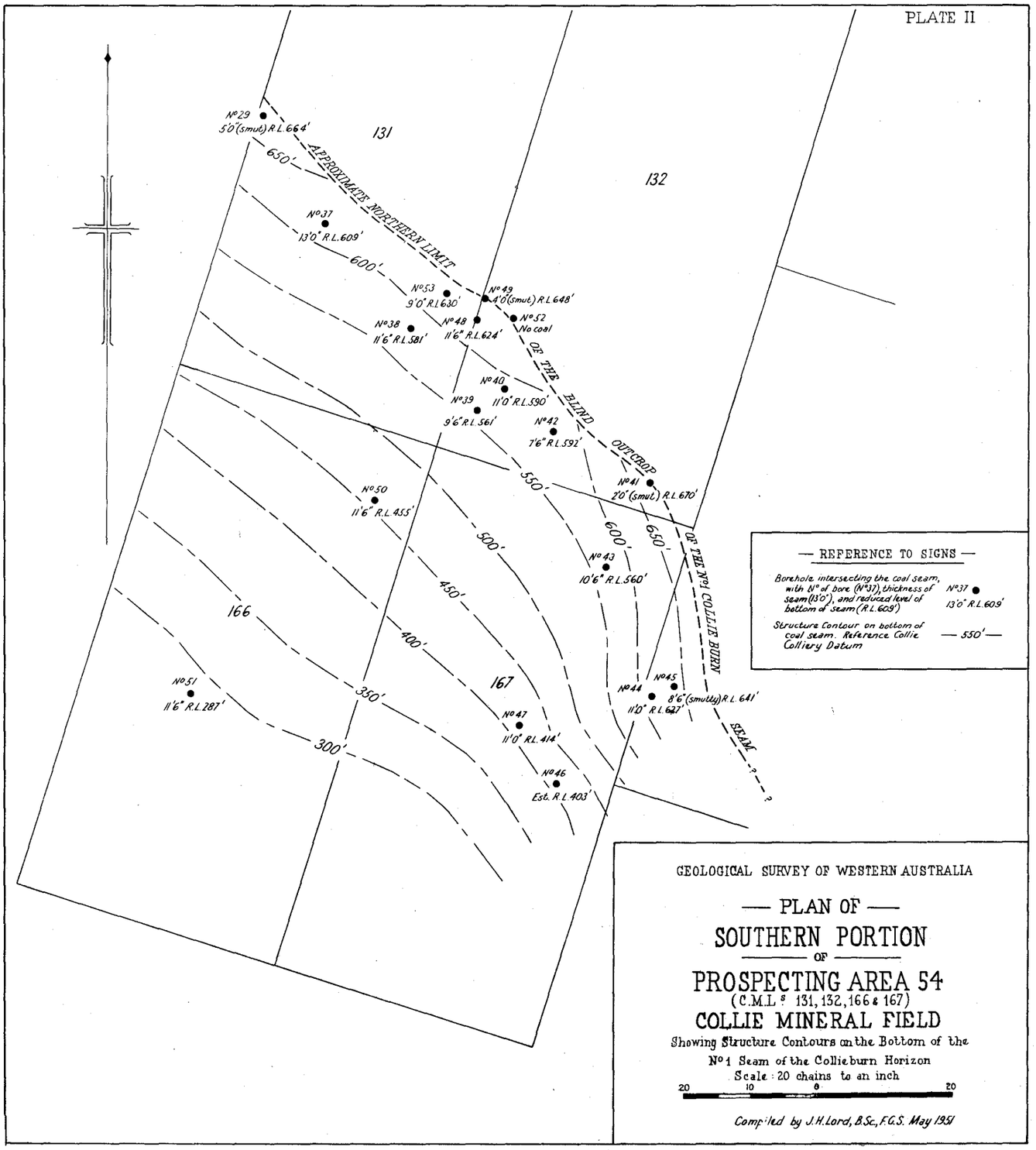
Showing Position of Boreholes with Coal Intersected and some Geology

Scale: 20 chains to an inch

20 0 20

Based on bore logs and surveys supplied by Western Collieries Ltd.
Compiled and correlated by J.H. Lord, B.Sc, F.G.S, May 1951

PLATE II



— REFERENCE TO SIGNS —

Borehole intersecting the coal seam, with No of bore (No37), thickness of seam (13'0"), and reduced level of bottom of seam (R.L 609') — No37 ● 13'0" R.L 609'

Structure Contour on bottom of coal seam. Reference Collie Colliery Datum — 550' —

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

— PLAN OF —

SOUTHERN PORTION

— OF —

PROSPECTING AREA 54

(C.M.L.s 131, 132, 166 & 167)

COLLIE MINERAL FIELD

Showing Structure Contours on the Bottom of the No 1 Seam of the Collieburn Horizon

Scale : 20 chains to an inch

20 10 0 20

Compiled by J.H. Lord, B.Sc., F.G.S. May 1951

it is assumed that the seam averages 11ft. 6in. in thickness and that 30 cubic feet of coal is equivalent to one ton.

The portion of the seam enclosed by the blind outcrop and bores Nos. 29, 51, 46 and 45 is classified as Measured Coal and contains 7 million tons. The remainder of the seam to the southern boundary of leases 166, 167 and 139 is classified as Inferred Coal, because it has only been drilled on the northern side; it is reasonable to assume however, that the seam will occur throughout. This portion contains 6 million tons.

	Tons.
Measured Coal	7,000,000
Inferred Coal	6,000,000
Total Reserves	13,000,000

COSTS.

The charge for this drilling was 12s. 6d. per foot. The total drilling cost was £1,475 12s. 6d. which is 0.05 pence per ton for measured coal or 0.03 pence per ton for total coal located.

No allowance is made for administrative and geological expenses.

CONCLUSION.

On this portion of P.A. 54 occurs the No. 1 seam of the Collie Burn horizon, with a prospect of its extending further south-eastwards on to P.A. 57. The seam averages 11½ feet in thickness and the drilling has proven the existence of 7 million tons of measured coal and 6 million tons of inferred coal.

The coal has an average calorific value of 9,500 B. Th. U.'s/lb. with 4.4 per cent ash on a 20 per cent. moisture basis.

This is considered an admirable site for a colliery.

Table 1.

SUMMARY OF BORE LOGS ON SOUTHERN PORTION OF P.A. 54.

Western Collieries Percussion Bore No.	Reduced Level to M.S.L.	Depth of Seam Intersected.	Thickness of Seam.	Depth of Hole.	Depth to Water.	Remarks.
	Feet.	Feet.	Ft. in.	Feet.	Feet.	
37	738	116	13 0	130	No water	
38	695	103	11 6	115	73	
39	673	102	9 6	112	57	
40	678	77	11 0	89	60	
41	727	54½	2 0	160	85	Smut.
42	702	101½	8 6	111	75	Top 1 ft. is smut.
43	677	130	10 6	142	48	
44	682	44½	11 0	56	No water	
45	676	29½	8 6	39	No water	Top 5½ ft. smut.
46	....	....	....	220	80	Hole stopped before reaching seam.
47	688	263	11 0	275	60	
48	696	60	11 6	72	56	
49	699	47	4 0	52	No water	Smut.
50	655	189	11 6	201	42	
51	662	64½	6 9			
		363	11 6	375	52	
52	696	....	....	70	63	No seam. Locating exact outcrop position for mining purposes.
53	700	60	9 6	70	No water	Top 6 in. smut.
54	....	47½	5 6	54	No water	Smut.

Table 2.

ANALYSES OF COAL FROM BORES ON THE SOUTHERN PORTION OF P.A. 54, COLLIE MINERAL FIELD.

Chem. Lab. No.	Bore 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.	%	
10955	37	116	4 6	20.0	3.95	28.00	48.05	9,505	36.80	12,490	4.95	Grey
10956	....	102½	8 6	20.0	3.20	28.30	48.50	9,615	36.85	12,510	4.0	Grey
10957	39	102	4 6	20.0	3.25	28.85	47.90	9,630	37.55	12,540	4.05	Grey
10958	....	106½	5 0	20.0	3.65	28.55	47.80	9,470	37.40	12,410	4.55	Grey
11308	42	102½	7 6	20.0	3.35	29.25	47.40	9,495	38.10	12,380	4.20	Pale pinky grey
11309	43	130	5 0	20.0	4.20	28.70	47.10	9,530	37.85	12,580	5.25	Pale pinky grey
11310	....	135	5 6	20.0	2.60	30.20	47.20	9,735	39.00	12,610	3.20	Pale pinky grey
2288	47	263	5 6	20.0	4.70	29.65	45.65	9,490	39.50	12,600	5.9	Light fawn
2289	....	268½	5 6	20.0	3.75	31.45	44.80	9,610	41.25	12,600	4.7	Light fawn
3686	51	368	6 0	20.0	8.80	27.95	43.25	9,200	39.30	12,930	11.00	Fawn
....	....	372	5 6	20.0	7.40	27.90	44.70	9,155	38.40	12,600	9.20	Fawn
3263	51	64½	6 9	20.00	7.40	29.25	43.35	9,140	40.25	12,580	9.2	Fawn

PLATE III

To Capel →

FLAT

SWAMP

CLOSED

CLOSED

CLOSED

CLOSED

DRAIN

RESERVE

INDIAN OCEAN

97

102

157

60

CLOSED

— LOCALITY MAP —

— Scale :- 40 chains - 1inch —

Lands Litho 413 8/40

No 1
Test Shaft
0'–15' Limestone
15'–18' Clay
(18')

No 8
0'–1' Overburden
1'–12½' Limestone
12½–15' Clay
(15')

No 1
0'–11' Limestone
11'–16' Clay
(16')

No 2
Test Shaft
0'–15¼' Limestone
15¼–18' Clay
(18')

No 7
0'–3' Overburden
3'–13½ Limestone
13½–17' Clay
(17')

No 2
0'–1' Overburden
1'–20' Limestone
(20')

No 3
Test Shaft
0'–9½' Limestone

No 6
0'–2' Overburden
2'–14' Limestone
14'–20' Clay
(20')

No 3
0'–5' Overburden
5'–13¾' Limestone
13¾–18' Clay
(18')

No 4
Test Shaft
0'–9' Limestone
9'–12' Clay
(12')

No 5
0'–7' Overburden
7'–15' Limestone
15'–19' Clay
(19')

No 4

No 9
Not drilled

0'–12½' Overburden
12½–21' Clay
(21')

No 10
0'–3' Overburden
3'–15½' Limestone
Clay
(15½')

No 12
0'–1' Overburden
1'–15' Limestone
Sand
(15')

No 11
0'–1½' Overburden
1½–13½' Limestone
Clay
(13½')

No 13
0'–½' Overburden
½'–17½' Limestone
17½–20' Sand
(20')

No 14
Not drilled

No 16
Not drilled

No 15
0'–8' Limestone
8'–12' Sand
(12')

No 17
0'–¾' Overburden
¾'–20¾' Limestone
(20¾')

No 18
0'–3' Overburden
3'–16' Limestone
(16')

No 20
0'–6' Overburden
6'–12' Limestone
(12')

No 19
0'–4½' Overburden
4½'–12½' Limestone
12½'–15½' Sand
(15½')

— REFERENCE TO SIGNS —

Borehole showing No (20) thickness and nature of strata encountered, and depth of hole (12')

No 20
0'–6' Overburden
6'–12' Limestone
(12')

Shaft

Borehole in bottom of Shaft

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

— PLAN —
— OF —

PORTION OF STIRLING ESTATE

3 MILES N.W. OF CAPEL
SOUTH WEST DIVISION

Showing Position and result of Bores Drilled, under supervision of Mr. J D. Gillespie, Bunbury Harbour Works.

Scale :- 10 chains to an inch

10 5 0 10 20

June 1951

BED

A NOTE ON PROSPECTING AREAS 55 AND 56, COLLIE MINERAL FIELD, W.A.

By J. H. Lord, B.Sc., F.G.S.

In May, 1950, the Griffin Coal Mining Co. Ltd. discussed with the Geological Survey the future of their mining operations. It was obvious, due to faulting and the proximity of the granite that the future of the Wyvern, Griffin and Phoenix Collieries was definitely limited and, as the company did not hold any leases which were likely to contain other seams, it was suggested that a new area be pegged and prospected.

As a result of the Geophysical and Geological Surveys of the Mineral Field and subsequent drilling, it was recommended to the company that the area to the south of Buckingham's and Muja should be prospected, anticipating that the Ewington and Premier horizons of the north-eastern basin would extend in that direction. The company agreed to the recommendation and was assisted in locating P.A's. 55 and 56, which were pegged on 18th May, 1950.

A purely exploratory drilling programme was laid out for the southern end of P.A. 56, hoping to locate the Ewington horizon first. When the drilling plant was ready in August, 1950, this portion of the area was inaccessible due to the swampy nature of the terrain. A few holes were drilled on the perimeter of the coal basin without disclosing any coal seams of economic importance. In December, 1950, a move on to the swampy portion of the area was made and two of the first three holes intersected a coal seam, with a thickness of 9 to 10 feet, which is thought to belong to the Ewington horizon. This intersection proves the theory of the north-eastern basin put forward in earlier geological work of this Survey.

The company has continued exploratory drilling without the assistance of the Geological Survey and applied to convert the P.A's. into leases in March, 1951.

REPORT ON FURTHER TESTING OF A LIMESTONE DEPOSIT THREE MILES NORTH-WEST OF CAPEL, SOUTH-WEST DIVISION.

By J. H. Lord, B.Sc., F.G.S.

This deposit was reported on previously (Geological Survey of W.A., Annual Report, 1950) as being unsuitable as a flux for the iron industry, due to a high percentage of silica. Later in 1950 the Department of Industrial Development insisted on the deposit being further examined to ascertain if the limestone were suitable for the cement industry.

The Geological Survey set out a grid of proposed bore holes, which were located and drilled by hand drilling methods under the supervision of Mr. J. D. Gillespie, Engineer-in-Charge of Bunbury Harbour Works. The position and results of the bores are shown on Plate III.

The W.A. Government Chemical Laboratories carried out the analytical work.

Sampling Results.

The drillers sampled the limestone encountered, first in two 4ft. sections and then in 2ft. sections, until the floor of the deposit was reached. These samples were all analysed for calcium carbonate and silica and a more detailed analysis made of a composite sample of each hole. Only the composite samples are quoted below because of the poor quality of the limestone. The analytical results of the section samples for each hole are available at the Geological Survey, together with the log of the bores.

The calcium carbonate content is too low and the silica content too high for the deposit to be used as a limestone for cement production as it stands. Any beneficiation process applied to remove the silica would probably increase the magnesium carbonate to a percentage which would be detrimental to the manufacture of cement.

Analyses of Composite Samples from Capel.

Chem. Lab. No.	Locality.	$CaCO_3$.	SiO_2.	$MgCO_3$.	Al_2O_3.*	Fe_2O_3.
		%	%	%	%	%
1109	Shaft 1 and bore	80·96	12·55	2·48	1·01	0·46
1110	Shaft 2 and bore	72·55	20·49	1·74	1·58	0·95
1111	Shaft 4 and bore	76·42	17·55	1·98	2·18	0·95
1112	Bore 1	77·06	15·75	2·60	1·16	0·52
1113	Bore 2	80·05	9·04	2·66	0·77	0·74
1114	Bore 3	75·86	12·51	3·35	0·98	0·69
1115	Bore 4	72·39	21·27	2·24	1·49	0·63
1116	Bore 5	81·66	13·67	0·79	1·10	0·52
1117	Bore 7	71·03	21·89	1·02	1·95	0·66
1118	Bore 8	70·04	22·34	2·31	1·68	0·42
7952–5	Bore 10	74·64	18·54	n.d.	n.d.	n.d.
7956–9	Bore 11	56·61	36·85	n.d.	n.d.	n.d.
7960–2	Bore 12	59·76	31·77	n.d.	n.d.	n.d.
1119	Bore 13	74·57	19·60	1·55	1·19	0·86
1666	Bore 15	76·50	17·25	1·30	3·26	1·02
1120	Bore 17	70·91	24·33	0·54	1·47	1·10
1478	Bore 18	69·68	25·23	0·86	3·12	0·76
1121	Bore 20	62·56	31·88	0·65	3·24	0·96

* Includes TiO_2 and P_2O_5. n.d. = not determined.

Reserves.

The limestone, where intersected by bores, varied from 9 to 20 feet in thickness, with an approximate average of 13ft. The drilling programme blocked out 3½ million cubic yards of limestone with a soil overburden of 3ft. or less. In addition there are at least half a million cubic yards between the western bores and the swamp. Probably this would have to be left in an endeavour to keep the water out of any proposed quarry which would encounter a water problem due to the low terrain of the deposit.

Conclusion.

Due to the poor quality and the location this deposit is not considered suitable for the cement industry under present conditions.

REPORT ON DIAMOND DRILLING AHEAD OF EXISTING COLLIERIES, COLLIE MINERAL FIELD, W.A.—1. PROPRIETARY COLLIERY.

By J. H. Lord, B.Sc., F.G.S.

At the completion of the No. 3 hole of the deep drilling programme for the Collie Mineral Field,* the contract with Australian Drillers Pty. Ltd. was terminated, and drilling ceased until new contractors, McCallum Bros. and Grill, were engaged in January, 1951.

In the meantime, as a result of agitation by the coal mining companies and the Collie Miners' Union, the Government had directed that the deep-drilling programme should be suspended and drilling carried out ahead of faults affecting the operations in the Proprietary, Wyvern and Stockton Collieries.

This report describes the three holes drilled ahead of the fault in the main tunnel of the Proprietary Colliery (see Fig. 1).

DRILLING PROCEDURE.

The drilling plant and rig used were similar to that described in the previous reports of the deep drilling.

At site No. 1 a 45ft. tower was erected for breaking rods in 30ft. lengths, but at sites Nos. 2 and 3 a 65ft. tower was used so that the rods could be broken in 50ft. lengths.

Bentonite mud was used as the drilling fluid, the water for mixing being pumped from the south branch of the Collie River.

In the No. 1 hole a 5ft. cavity was encountered at a depth of 199ft. All efforts to fill the cavity having failed, in order to restore the circulation it was necessary to case down to 210ft. The rods became jammed in this hole at 855ft. and could not be moved. As much of the equipment as possible was "backed-off" leaving in the hole 295ft. of rods, one 15ft. core barrel, one diamond bit and one reaming shell. The casing was withdrawn.

* 1950, Lord, J. H.: Progress Report on Diamond Drilling, Collie Mineral Field, W.A. (3), Bore No. 3. G.S.W.A. Annual Report, 1950.

The No. 2 hole proceeded satisfactorily to its target, and all equipment was withdrawn.

In the No. 3 hole artesian water was encountered producing varying rates of flow up to 3,000 gallons per hour, with a head of approximately 20ft. This problem was overcome successfully by mixing barytes, with the bentonite mud until the density was high enough to hold back the water. The hole was cased to 220ft. due to the water and soft nature of the strata. When the casing was withdrawn the hole apparently collapsed, stopping the flow of water. The rods were jammed at 860ft. but were freed after pumping down 44 gallons of distillate and allowing it to stand overnight.

There was another problem associated with the drilling besides those mentioned above. The pumps had difficulty in pumping the thick mud, either because of the depth or because of the cuttings not settling-out properly and causing excessive wear on the pump parts. The inclusion of a shale shaker in the circuit should help overcome this problem.

While drilling was in progress two 12-hour shifts were worked, and the manner in which the shifts (regardless of number of men employed) and man-shifts were distributed over the various operations is set out in Table I. The figures for hole No. 1 are incomplete owing to the considerable time taken by the new contractors in assembling and sorting the equipment. The time used in setting-up and dismantling the plant again shows that this type of plant is not suitable for these comparatively shallow holes.

Table I.

Time Distribution for Drilling Ahead of the Proprietary Colliery.

Operation.	Hole No. 1. (855 feet).			Hole No. 2. (976 feet.)			Hole No. 3. (1,100 feet.)		
	Shifts.*	Man-Shifts.*	Percentage† of Man-Shifts.	Shifts.	Man-Shifts.	Percentage of Man-Shifts.	Shifts.	Man-Shifts.	Percentage of Man-Shifts.
Drilling	54	118	....	45	98	63	38	76	55
Break-downs, mud-mixing, maintenance, etc.....	15	34	....	10	20	13	10	24	18
Setting-up and dismantling plant	Unrecorded			13	55	24	10	44	21
Fishing for lost tools	16	64	....	*Nil*	....	....	3	8	6
Total	....	....	....	68	173 (232)†	....	61	152 (206)†	....

* All shifts and man-shifts are 12 hours each except for setting up and dismantling.
† All shifts adjusted to 8-hour shifts for percentage purposes.

Table II.

Time Distribution while Drilling, and Core Recovery.

Driller.	Number of Shifts* Drilling.	Total Footage Drilled.	Average Footage per Shift.	Below 100 Feet.		Percentage of Core Recovery for whole Hole.
				Core Recovered (feet).	Percentage Core Recovery.	
Proprietary Hole No. 1.						
McCallum, K.	25	412	16·5	306½	75·5	....
Grill	24	376	15·7	250½	73·5	....
Miscellaneous	5	67	13·4	3½	....	....
Total	54	855	15·8	560½	74·7	68
Proprietary Hole No. 2.						
McCallum, K.	20	366	18·4	245	67·0	....
Grill	24	555	23·2	355	69·5	....
Miscellaneous	1	55	....	....	....	....
Total	45	976	21·7	600	68·5	63
Proprietary Hole No. 3.						
McCallum, K.	17	436	25·6	261	65·2	....
Grill	21	664	31·6	342	57·0	....
Total	38	1,100	29·0	603	60·3	56

* 12-hour shifts.

The best rate of drilling per man-shift (8 hours) overall was in hole No. 3 with 5.3 feet, compared with the best rate of Australian drillers, which was 4.7ft.

Table II is a study of the operations on shifts when drilling took place. In this table the shifts are of 12 hours' duration, but the average rate of drilling for the three holes was 14.8 feet per 8-hour-shift as compared with 19ft. for the three holes drilled by Australian drillers. This difference may be due to the fatigue produced on the operators by the long 12-hour shift, particularly night shift; also the core-recovery was 10 per cent. higher accounting perhaps for the slower drilling rates.

CORE RECOVERY AND LOG.

As shown in Table II the core recovery in No. 1, 2 and 3 holes was 68, 63 and 56 per cent. respectively, giving an average of 62 per cent. for the three holes. This compares more than favourably with the 52 per cent. obtained by Australian drillers for three holes.

Fig. 2 shows the core recovery graph for the three holes.

The strata encountered were typical of the Collie Permain coal measures. A summarised log of each hole showing sediments and coal seams (3in. and thicker) is attached as Appendix I. These logs are shown as columnar sections in Fig. 3.

Complete detailed logs of each hole have been prepared and are available at the Geological Survey.

GEOLOGY.

These holes are situated on the downthrow side of the fault at the bottom of the Proprietary main tunnel, which is probably a continuation of the so-called Wallsend Fault. (See Fig. 1.) The coal seams concerned are those of the Collie horizon, and the holes were located with the object of cutting this horizon twice (No. 1 and No. 2 holes) near the fault, but on the downthrow side, and once (No. 3 hole) at a distance down the dip.

The Nos. 1, 2 and 3 seams of this horizon were intersected in all holes, with the exception of hole No. 1, which was lost before reaching the No. 3 seam. Hole No. 2 was continued to 150ft. below the No. 3 seam to investigate the No. 4 seam which exists in places up to 6ft. in thickness. However, here it is only 2ft. thick.

An enlarged columnar section (Fig. 4) has been prepared, showing the average succession through the coal horizon from the three holes. The correlation of the horizon between the holes is particularly good for the usual variable Collie conditions.

The results of these bores show that the seams of this horizon have been displaced approximately 150ft. by two faults at the bottom of the Proprietary main tunnel, as illustrated in Fig. 5. Some years ago a stone drive was extended beyond the fault at the bottom of the main tunnel, and a coal seam was encountered. This was recognised by Mr. H. Sweeney, who was in charge of operations, as the same seam as extracted in the colliery. This showed that the fault displaced the seam from 50 to 60ft. vertically. Further driving down the dip encountered another fault and considerable inflow of water, which caused the project to be abandoned.

According to the drilling results this second fault must displace downwards some 80 to 90ft. vertically.

Assuming that there are no further faults, the seam in the area enclosed by the three bores dips at 1 in 7.8 ($7\frac{1}{2}$ degrees) in the direction of S. 7° W. As this dip is comparable with the dip in the lower workings of the Proprietary Colliery, the assumption that there are no further major faults in this area appears reasonable.

The object of the drilling was not to prove the extent of the coal ahead of the Proprietary Colliery, but its attitude as described above. However, in doing this the horizon has been proved to exist over a triangular area of approximately 115 acres. The No. 3 seam, which is the seam worked in the Proprietary Colliery, contains a total of over two million tons in this area, but due to the quality and existing methods of working it is doutbful if more than one million tons could be extracted.

No doubt the horizon extends a considerable distance along the strike and down the dip from this triangular area.

QUALITY OF THE COAL.

The detailed analyses carried out on samples submitted to the Government Chemical Laboratories are shown on Table III.

Table III.

Proximate Analyses of the Thicker Seams Intersected while Drilling Ahead of the Proprietary Colliery.

Chem. Lab. No. (1951).	Depth.	Thickness of Sample.	Collie Horizon Seam No. and Total Thickness Analysed.	As Received.					Dry and Ash Free.		Ash Dry Basis.	Colour of Ash.
				Moisture.	Ash.	Vol. Matter.	Fixed Carbon.	Calorific Value.	Vol. Matter.	Calorific Value.		
			Diamond Drill Bore No. 1.									
	Feet.	Ft. in.		%	%	%	%	B.Th.U.	%	B.Th.U.	%	
3262	155	3 5	....	20·00	5·60	28·25	46·15	9,725	37·95	13,070	7·00	Light fawn
5034	562½	2 9	....	20·00	4·80	25·30	49·90	9,940	33·65	13,220	6·00	Pink-brown
7534	802	5 3	No. 1	20·00	8·15	21·35	50·50	9,490	29·70	13,200	10·15	Brown
7535	814½	2 5	No. 2	20·00	13·85	21·30	44·85	....	....	....	....	
7536	817	4 6	9 ft. 6 in.	20·00	17·55	20·75	41·70	....	....	....	....	
7537	821½	2 7		20·00	15·10	20·55	44·35	....	....	....	....	
7535–7537 (Composite)	814½	9 6	No. 2	20·00	15·95	20·90	43·15	8,370	32·65	13,060	19·9	Brown
			Diamond Drill Bore No. 2.									
10724	108¼	1 9	....	20·0	9·00	25·8	45·2	9,180	36·3	13,280	11·3	Light buff
10725	536	1 11	....	20·0	10·5	22·9	46·6	9,130	33·0	13,040	13·1	Light chocolate
11180	713½	2 4	....	20·0	8·05	22·45	49·5	9,530	31·2	13,250	10·05	Salmon
11181	767¾	6 5	No. 1	15·15	12·2	22·4	50·25	9,360	30·85	12,890	14·2	Red-brown
11182	781	5 4	No. 2	12·2	22·15	22·0	43·65	7,830	35·5	11,920	25·1	Red-brown
11183	787½	1 5	9 ft. 6 in.	11·55	29·0	19·7	39·75	7,440	33·15	12,520	32·75	Light red-brown
11184	789	2 9		15·15	10·05	23·30	51·50	9,750	31·15	13,040	11·8	Red-brown
Composite	781	9 6	No. 2	20·0	18·2	....	....	7,680	....	12,400	....	
11715	823½	2 9		14·25	25·25	21·90	38·60	7,500	36·2	12,400	29·4	Brown
11716	827½	2 6	No. 3	15·35	9·55	23·75	51·35	9,880	31·6	13,160	11·3	Dark brown
11903	830	3 8	12 ft. 3 in.	17·65	7·55	24·20	50·60	10,010	32·4	13,390	9·2	Red-brown
11904	833¾	3 4		16·2	10·85	23·55	49·40	9,610	32·3	13,180	12·85	Brown
Composite	823½	12 3	No. 3	20·0	11·9	....	....	9,000	....	13,070	....	
11717	911	2 1	No. 4	17·85	4·50	25·20	52·45	10,400	32·45	13,400	5·5	Red-brown
			Diamond Drill Bore No. 3.									
16776	1,015½	4 8	No. 1	20·00	9·6	20·8	49·6	9,320	29·5	13,230	12·0	Chocolate
16777	1,020¼	1 3	5 ft. 11 in.	20·00	11·5	24·0	44·5	9,080	35·0	13,250	14·4	Chocolate
Composite	1,015½	5 11	No. 1	20·00	10·0	21·45	48·5	9,250	30·6	13,210	....	
16778	1,028½	3 0	No. 2	20·0	15·4	22·6	42·0	8,470	35·0	13,120	19·3	Chocolate
16779	1,031½	3 0	10 ft.	20·0	15·9	20·6	43·5	8,420	32·2	13,150	19·9	Chocolate
16780	1,034½	4 0		20·0	13·2	20·8	46·0	8,850	31·1	13,230	16·5	Chocolate
Composite	1,028½	10 0	No. 2	20·0	14·7	22·1	43·4	8,620	33·8	13,200	....	
16781	1,071½	2 3		20·0	13·1	19·5	47·5	8,920	29·2	13,320	16·4	Chocolate
16782	1,073¾	4 0	No. 1	20·0	8·1	22·1	49·8	9,800	30·7	13,620	10·1	Chocolate
16783	1,077¼	5 0	15 ft.	20·0	8·2	23·3	48·5	9,800	32·4	13,620	10·3	Chocolate
16784	1,082¾	1 3		20·0	15·8	20·4	43·8	8,690	31·7	13,520	19·7	Chocolate
16785	1,084	2 6		20·0	10·5	22·3	47·2	9,350	32·1	13,440	13·1	Chocolate
Composite	1,071½	15 0	No. 3	20·0	9·95	22·0	48·05	9,480	31·4	13,530	....	
Composite	1,073¾	9 0	No. 3	20·0	8·15	22·75	49·1	9,780	31·65	13,620	....	

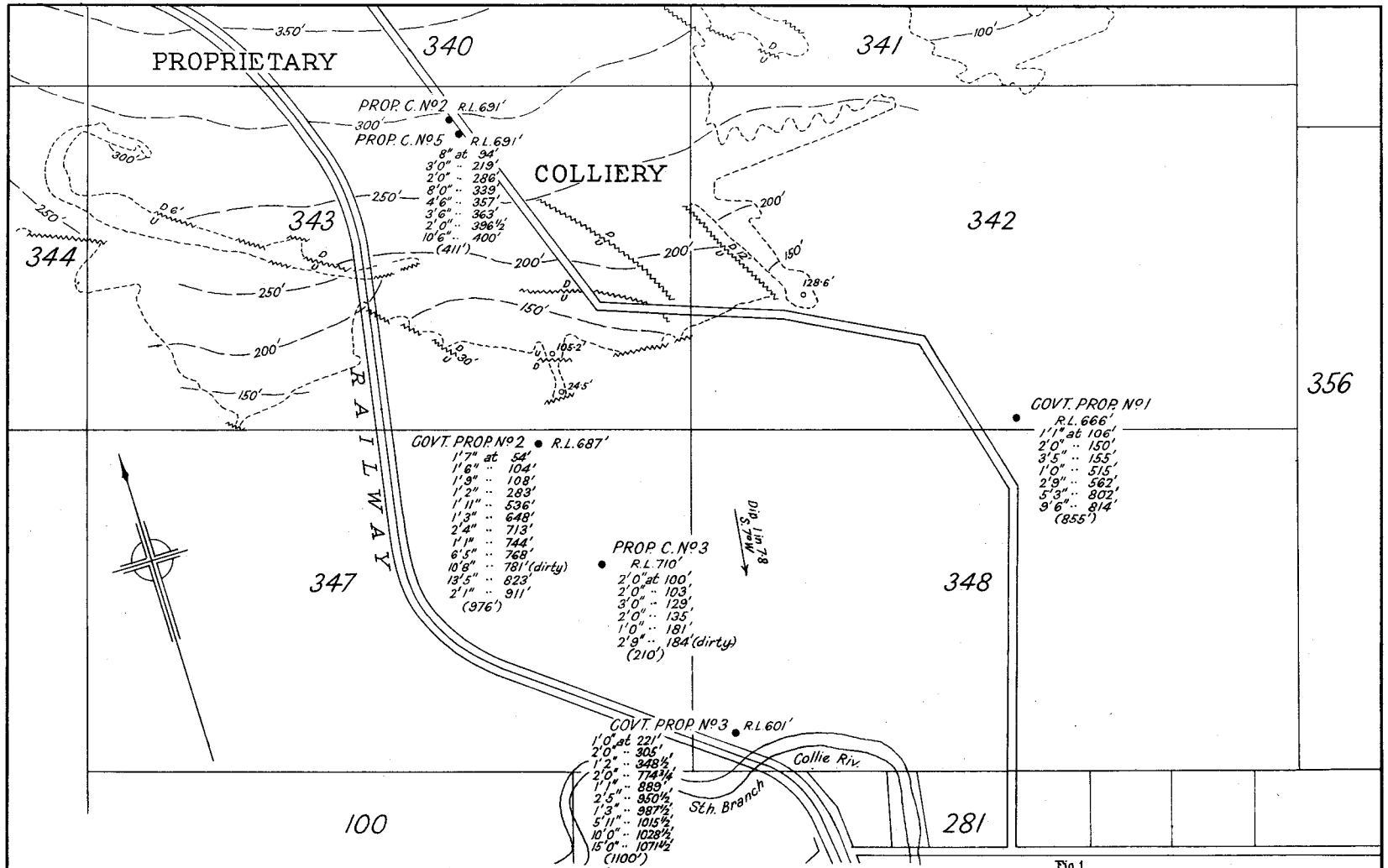


Fig. 1

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

PLAN SHOWING

POSITION & RESULTS

OF

DIAMOND DRILL HOLES AHEAD OF PROPRIETARY COLLIERY

COLLIE MINERAL FIELD

Scale : 20 chains to an inch

20 0 20

Geology, plane table and alidade survey by J.H. Lord, 1951

REFERENCE

Bore Hole – showing identification (Govt. Prop No 1) Reduced level (R.L. 666') Coal seams (1' and thicker) intersected (2'0" at 100') Depth of hole (210').	GOVT. PROP. No 1 ● R.L. 666' 2'0" at 100' (210')
Structure Contours – on No 3 seam in colliery	—200'—
Faults	
Reduced levels in colliery workings	o 105·2'

Fig. 2

PERCENTAGE CORE RECOVERY

Diamond Drilling Ahead of Proprietary Colliery, Collie, W.A.

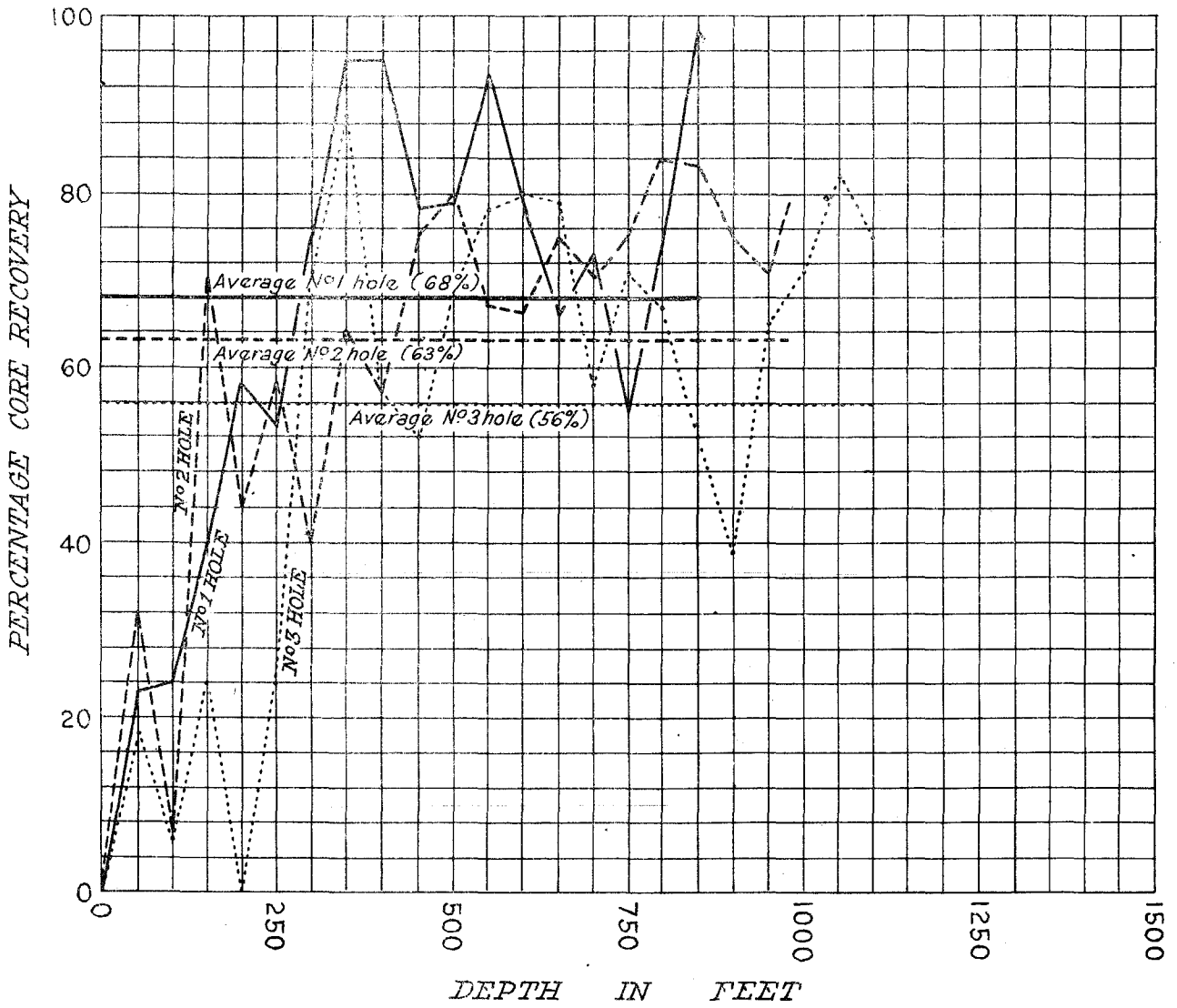


Fig. 3

COLUMNAR SECTIONS
— OF —
GOVERNMENT DIAMOND DRILL HOLES AHEAD OF PROPRIETARY COLLIERY
COLLIE MINERAL FIELD

Drillers: McCallum Bros. & Grill
Supervised and logged by J.H. Lord

Nº 1
— C.M.L. 342 —
Commenced 9·3·51 – Abandoned 31·5·51

GENERALISED DESCRIPTION	DEPTH IN FEET	COLLAR R.L. 666'	THICKNESS OF COAL	REMARKS
Lake Deposits Mainly sandy clays	0 – 50			
			4"	
Grey and black shales with interbedded medium-grained sandstones	100		1'1"	
	150		2'0"	
			3'5"	
			7"	
			10"	
	200			
White medium to coarse-grained sandstones with occasional shales			7"	
	250			
	300		11"	
			10"	
			6"	
	350			
Mainly sandstones medium to coarse-grained with occasional shale band	400		6"	
	450			
	500			
Sandstone with interbedded grey to black shales			1'0"	
	550		9"	
			6"	
			2'9"	
			8"	
	600			
Mainly medium to coarse-grained sandstones Sandstones with occasional shales	650			
	700			
	750		6"	
			9"	
	800		5'3"	COLLIE HORIZON Nº 1 SEAM Sandstone roof shale floor
			9'6"	Nº 2 SEAM Shale roof and floor
	850 855			Hole abandoned

Nº 2
— C.M.L. 347 —
Commenced 16·6·51 – Completed 20·7·51

GENERALISED DESCRIPTION	DEPTH IN FEET	COLLAR R.L. 687'	THICKNESS OF COAL	REMARKS
Lake Deposits	0 – 50			
			4"	
			1'7"	
Grey and black shales with interbedded sandstones	100		1'6"	
			1'3"	
	150		6"	
			4"	
			10"	
			4"	
Sandstones with interbedded shales	200			
	250			
			1'2"	
			5"	
	300		3"	
Mainly white sandstones with occasional shales	350			
	400		8"	
	450			
			6"	
	500			
White sandstones with occasional grey to black shales			9"	
			1'11"	
	550			
	600			
			7"	
	650		1'3"	
			3"	
	700			
			2'4"	
			5"	
Sandstones with occasional shales			7"	
			1'1"	
	750			
			6'5"	COLLIE HORIZON Nº 1 SEAM (MOIRA) Sandstone roof shale floor
			10'8"	Nº 2 SEAM (DIRTY) Shale roof and floor
	800			
			3"	
			13'5"	Nº 3 SEAM Shale roof and floor
	850			
	900			
			2'1"	Nº 4 SEAM ?
	950		6"	
	976			Hole stopped

Nº 3
— C.M.L. 348 —
Commenced 2·8·51 – Completed 10·9·51

GENERALISED DESCRIPTION	DEPTH IN FEET	COLLAR R.L. 601'	THICKNESS OF COAL	REMARKS
Lake Deposits Clays	0			
Grey to black shales and sandstones Soft sand	50			
	100		3"	
	150			
	200		8"	
Mainly black shales with occasional interbedded sandstone			1'0"	
	250		10"	
			10"	
	300		2'0"	
			11"	
	350		1'2"	
			4"	
Medium to very coarse-grained sandstones	400		3"	
			8"	
	450			
	500		7"	
Medium to very coarse-grained sandstones	550			
	600		3"	
Medium to coarse-grained soft sandstones	650			
	700		9"	
			3"	
Mainly medium to coarse-grained sandstones with occasional bed of shale	750		2'0"	
	800			
	850		1'1"	
	900		4"	
Medium to coarse-grained sandstones and interbedded gray shales	950		2'5"	
			7"	
			1'3"	
	1000		5'11"	COLLIE HORIZON Nº 1 SEAM Sandstone roof shale floor
			10'0"	Nº 2 SEAM With shaley bands Shale roof and floor
	1050		7"	
			15'0"	Nº 3 SEAM Shale roof and floor
	1100			Hole stopped

Fig 4

AVERAGE STRATIGRAPHICAL COLUMN
OF THE
COLLIE HORIZON

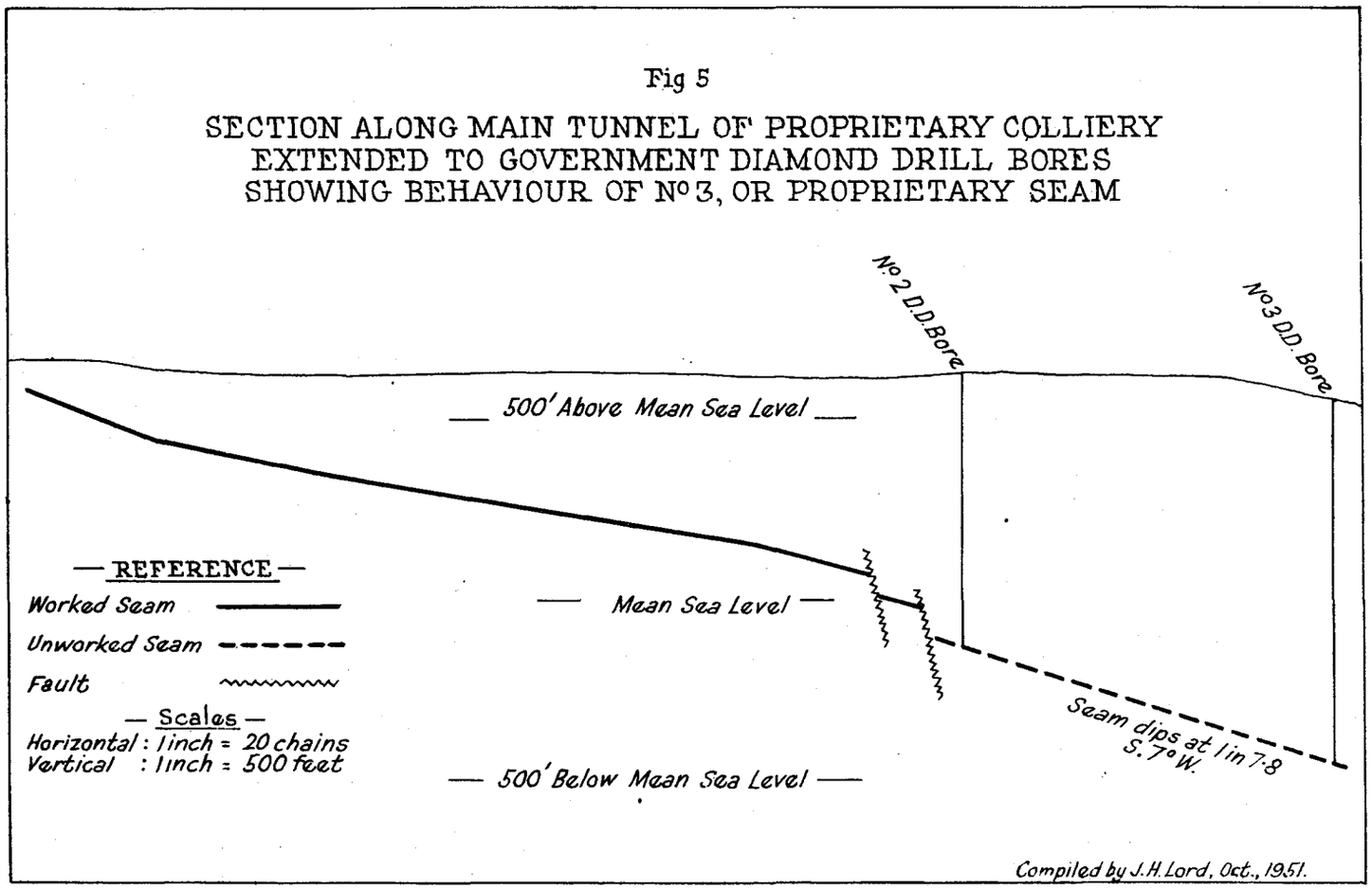
As shown in Bores ahead of Proprietary Colliery

Compiled by J.H. Lord, Oct., 1951

DESCRIPTION OF AVERAGE STRATA	STRATIGRAPHICAL COLUMN Scale: 1 inch = 10 feet	AVERAGE ANALYSIS OF COAL		
		20% MOISTURE BASIS		DRY ASH FREE
		ASH%	CALORIFIC VALUE B.T.U.	CALORIFIC VALUE B.T.U.
Medium to very coarse-grained sandstone with occasional quartz pebbles				
No 1 SEAM (*Moira*) 5' 10"		9·9	9,190	13,100
Floor: Black carbonaceous shale				
Roof: Black carbonaceous shale				
No 2 SEAM (*Dirty*) 10' 1"		16·3	8,200	12,880
With occasional thin shaley bands				
Floor: Black to dark grey carbonaceous shale				
Sandstone fine to medium-grained shaley				
Roof: Grey to black carbonaceous shale				
No 3 SEAM (*Wallsend or Proprietary*) 14' 3"		10·9	9,270	13,390
Floor Black to dark grey carbonaceous shale				
		Best 8 feet of No 3 Seam		
Sandstone medium to coarse-grained		8·1	9,700	13,500

Fig 5

SECTION ALONG MAIN TUNNEL OF PROPRIETARY COLLIERY EXTENDED TO GOVERNMENT DIAMOND DRILL BORES SHOWING BEHAVIOUR OF No 3, OR PROPRIETARY SEAM



Compiled by J. H. Lord, Oct., 1951.

The No. 1 seam, which averages 5 feet 10 inches in thickness, was analysed in each case as one sample. The average of the anaylses for the three holes gives a calorific value of 9,190 B.Th.U.'s with 9.9 per cent. ash on a 20 per cent. moisture basis.

The No. 2 seam was sampled in sections because of the numerous bands of low grade coal and black shale. This seam, known usually as the "dirty seam," contains too much ash to be of economic importance. The average calorific value for this seam (10ft. 1in.) in the three holes is 8,200 B.Th.U.'s with 16.3 per cent. ash on a 20 per cent. moisture basis.

The No. 3 seam is the best seam, and the average analysis for the complete seam (14ft. 3in.) in the three holes gives a calorific value of 9,270 B.Th.U.'s with 10.9 per cent. ash based on 20 per cent. moisture content. However the best 8 feet of the seam has a calorific value of 9,700 B.Th.U.'s with 8.1 per cent. ash on a 20 per cent. moisture basis.

The Chemical Laboratories have carried out Carbonisation and Washing Tests on all the samples, full details of which are on the Geological Survey File 22/51. The following is the Carbonisation Assay of the complete No. 3 seam as encountered in hole No. 3:—

Carbonisation Assay

	Per 100 gm.	Per ton.
Solid Residue	63.5 gm.	12.7 cwt.
Liquor—100°C	20.0 gm.	44.8 gals.
100°C	4.9 gm.	11.0 gals.
Tar	3.5 gm.	7.8 gals.
Gas	7,520 ml.	2,695 c. ft.
	13.1 Therms per ton.	

Analysis.

	%	
CO_2	33.2	
O_2	0.0	
CnHm	2.1	
H_2	21.1	
CO	13.4	
C_2H_6	5.1	
CH_4	23.4	
N_2	1.6	
C.V.	4640 K. Cal/M_3	486 B.T.U/c. ft.

CONCLUSION.

The drilling ahead of the Proprietary Colliery shows that the Collie horizon of coal seams has been displaced some 150 feet by two faults at the bottom of the present workings. The area examined appears to be unaffected by major faulting.

The quality and attitude of the seams is similar to that in the lower workings of the colliery.

The No. 3 seam is the best seam, averaging 14 feet 3 inches in thickness with a calorific value of 9,270 B.Th.U.'s on a 20 per cent. moisture basis. This seam would provide 8 feet of coal with a calorific value of 9,700 B.Th.U.'s and 8.1 per cent. ash on a 20 per cent. moisture basis, if the mining engineers consider it practicable to work this area.

GOVERNMENT DRILLING AHEAD OF COLLIERIES.

Hole: Proprietary No. 1. M.L. 342.

Depth (feet)	Summarised Log.
0 - 60	Lake deposits.
60 - 77	Sediments.
77 - 77⅓	COAL (4in.).
77⅓ - 105¾	Sediments.
105¾ - 106¾	COAL (1ft. 1in.).
106¾ - 150½	Sediments.
150½ - 152½	COAL (2ft. 0in.).
152½ - 155	Sediments.
155 - 158½	COAL (3ft. 5in.).
158½ - 162½	Sediments.
162½ - 163	COAL (7in.).
163 - 182	Sediments.
182 - 183	COAL (10in.).
183 - 232¼	Sediments.
232¼ - 232¾	COAL (7in.).
232¾ - 310	Sediments.
310 - 311	COAL (11in.).
311 - 319½	Sediments.
319½ - 320½	COAL (10in.).
320½ - 334½	Sediments.
334½ - 335	COAL (6in.).
335 - 415	Sediments.
415 - 415½	COAL (6in.).
415½ - 515	Sediments.
515 - 516	COAL (poor quality 12in.).
516 - 553	Sediments.
553 - 553¾	COAL (9in.).
553¾ - 556½	Sediments.
556½ - 557	COAL (6in.).
557 - 562¼	Sediments.
562¼ - 565	COAL (2ft. 9in.).
565 - 570	Sediments.
570 - 570¾	COAL (8in.).
570¾ - 760½	Sediments.
760½ - 761	COAL (6in.).
761 - 768	Sediments.
768 - 768¾	COAL (9in.).
768¾ - 802	Sediments.
802 - 807¼	COAL (5ft. 3in.).
807¼ - 814½	Sediments.
814½ - 824	COAL (9ft. 6in.).
824 - 855	Sediments.

GOVERNMENT DRILLING AHEAD OF COLLIERIES.

Hole: Proprietary No. 2. M.L. 347.

Depth (feet)	Summarised Log.
0 - 50	Lake Deposits.
50 - 53⅜	Sediments.
53⅜ - 54	COAL (4in.).
54 - 54⅓	Sediments.
54⅓ - 56	COAL (1ft. 7in. poor quality).
56 - 104½	Sediments.
104½ - 106	COAL (1ft. 6in. poor quality).
106 - 108¼	Sediments.
108¼ - 110	COAL (1ft. 9in.).
110 - 146½	Sediments.
146½ - 147	COAL (6in.).
147 - 189⅜	Sediments.
189⅜ - 190	COAL (4in.).
190 - 190½	Sediments.
190½ - 191⅓	COAL (10in.).
191⅓ - 194	Sediments.
194 - 194⅓	COAL (4in.).
194⅓ - 283½	Sediments.
283½ - 284⅜	COAL (1ft. 2in. poor quality).
284⅜ - 289½	Sediments.
289½ - 290	COAL (5in.).
290 - 303	Sediments.
303 - 303¼	COAL (3in.).
303¼ - 389⅓	Sediments.
389⅓ - 390	COAL (8in.).
390 - 485½	Sediments.
485½ - 486	COAL (6in.).
486 - 531¼	Sediments.
531¼ - 532	COAL (9in.).
532 - 536	Sediments.
536 - 538	COAL (1ft. 11in.).
538 - 647½	Sediments.
647½ - 648	COAL (7in.).
648 - 649¼	COAL (1ft. 3in.).
649¼ - 667	Sediments.
667 - 667¼	COAL (3in.).
667¼ - 713	Sediments.
713 - 715¼	COAL (2ft. 4in.).
715¼ - 729	Sediments.
729 - 729½	COAL (5in.).
729½ - 730	Sediments.
730 - 730½	COAL (7in.).
730½ - 744	Sediments.
744 - 745	COAL (1ft. 1in.).
745 - 767¾	Sediments.
767¾ - 774¼	COAL (6ft. 5in.).
774¼ - 781	Sediments.
781 - 791⅜	COAL (10ft. 8in.-poor quality with shale bands).
791⅜ - 819¾	Sediments.
819¾ - 820	COAL (3in.).
820 - 823½	Sediments.
823½ - 837	COAL (13ft. 5in.).
837 - 911	Sediments.
911 - 913	COAL (2ft. 1in.).
913 - 952½	Sediments.
952½ - 953	COAL (6in.).
953 - 976	Sediments.

Hole stopped at 976 feet on 20th July, 1951.

Hole: Proprietary No. 3. M.L. 347.

Depth (feet)	Summarised Log.
0 - 25	(approx.) Lake deposits.
25 - 99	Sediments.
99 - 99¼	COAL (3in.).
99¼ - 211½	Sediments.
211½ - 212¼	COAL (8in.-poor quality).
212¼ - 221	Sediments.
221 - 222	COAL (12in.).
222 - 255	Sediments.
255 - 255¾	COAL (10in.).
255¾ - 268	Sediments.
268 - 268¾	COAL (10in.).
268¾ - 305	Sediments.
305 - 307	COAL (2ft. 0in.).
307 - 310	Sediments.
310 - 311	COAL (11in.-poor quality).
311 - 348½	Sediments.
348½ - 349¾	COAL (1ft. 2in.).
349¾ - 355	Sediments.
355 - 355⅓	COAL (4in.).
355⅓ - 397	Sediments.
397 - 397¼	COAL (3in.).
397¼ - 402	Sediments.
402 - 402⅔	COAL (8in.).
402⅔ - 493½	Sediments.
493½ - 494	COAL (7in.).
494 - 611	Sediments.
611 - 611¼	COAL (3in.-poor quality).
611¼ - 710¾	Sediments.
710¾ - 711½	COAL (9in.-poor quality).
711½ - 712¼	Sediments.
712¼ - 712½	COAL (3in.).
712½ - 774¾	Sediments.
774¾ - 776¾	COAL (2ft. 0in.).
776¾ - 889	Sediments.
889 - 890	COAL (1ft. 1in.).
890 - 905	Sediments.
905 - 905⅓	COAL (4in.).
905⅓ - 950½	Sediments.
950½ - 953	COAL (2ft. 5in.).
953 - 972⅔	Sediments.
972⅔ - 973¼	COAL (7in.).
973¼ - 987½	Sediments.
987½ - 988¾	COAL (1ft. 3in.).
988¾ - 1015½	Sediments.
1015½ - 1021½	COAL (5ft. 11in.-No. 1 Seam).
1021½ - 1028½	Sediments.
1028½ - 1038½	COAL (10ft. 0in.-No. 2 Seam).
1038½ - 1068½	Sediments.
1068½ - 1069	COAL (7in.-poor quality).
1069 - 1071½	Sediments.
1071½ - 1086½	COAL (15ft. 0in.-No. 3 Seam).
1086½ - 1100	Sediments.

Hole stopped at 1100 feet 10th September, 1951.

REPORT ON WITTENOOM TOWN WATER SUPPLY.

(Long. 118°22′ E., Lat. 22°15′ S.)

By K. Berliat, D.Sc., M.I.Min.E. (Eng.).

Introduction.

The present population of Wittenoom Town is about 500 and a water supply has been provided for 1,000 people. It is understood, however, that Australian Blue Asbestos Limited are planning to step up their production about two and a half times, and a population of 2,500 to 3,000 will possibly be reached. A very much augmented water supply will therefore be required in future, and the services of the Geological Survey were requested to locate a suitable place or places to undertake boring. Accordingly the writer examined the area from the 29th to 31st March, 1951. He was accompanied by Mr. Hamilton, Engineer for Public Works, North-West Division.

Geology and Topography in Outline.

Wittenoom Town is situated on the alluvial flat of the Fortescue River, close to the northern edge of the Hamersley Ranges. These ranges, which form a highly dissected plateau of about 2,000ft. above sea level, consist principally of ferruginous quartzites, quartzites, and shales, with interbedded horizons of dolomite, sandstone, and conglomerate. The complex is sub-horizontal with minor local folding, and forms part of the Upper Nullagine Series.

Wittenoom Gorge runs roughly in a south-west-north-easterly direction, cutting the general strike of the country at right angles, and opening up into the valley of the Fortescue River at about a mile and a half to the south of Wittenoom Town. The gorge is bounded by steep-sided or vertical cliffs of highly jointed and fissured Nullagine sediments. On its lower course there are short laterals, such as Western Gorge, joining the main creek in deep gorges.

Present Water Supply.

The present water supply is obtained from a pool, six miles south-south-west of Wittenoom Town. The pool, which is fed by springs, lies in Western Gorge, about half a mile above its junction with Wittenoom Gorge. The water is of excellent quality and the present daily supply is about 30,000 gallons. It will be possible, however, to increase the supply from this pool to about 67,000 gallons per day as soon as the new pipe line, now under construction, will be in use.

POSSIBILITIES FOR ADDITIONAL SUPPLIES.

Surface Water.—A traverse was made up Wittenoom Gorge and the writer was surprised at the numerous pools of surface water all along Joffre Creek. On the lower portion of the channel, i.e., from about three miles south-south-west of the present mine workings to the mouth of the gorge, the pools are as a rule of smaller size and do not exceed 10ft. in depth, while on the upper portion deep, permanent pools occur about every half a mile or so. It is estimated that a minimum supply of 200,000 gallons per days could be obtained from these higher pools. This, in addition to the present supply, would be sufficient for a population of 3,000.

The distance from Joffre Falls to Wittenoom Town is about 17 miles. The cost of a pipe line for such a distance over rough country would inevitably be high.

Underground Water.—In the writer's opinion, the most favourable bore sites are on the lowermost portion of Wittenoom Gorge, and a site has been selected right on the bank of Joffre Creek, about two and a half miles south-south-west of Wittenoom Town. The site is on alluvium, underlain by jointed quartzites and sandstones of the Nullagine Series. The water from the bore will have to be pumped over a distance of one and a half miles to the main tank.

If the supply obtained in this bore-hole is only a moderate one it is advisable to sink another bore right in the bed of the creek, about 500 yards further down and diagonally across the trend of the channel. In the very improbable case that the water in the first bore should be saline, a site half a mile higher up in the channel should be tested.

It has been pointed out to the writer that in all these cases the danger of loss of equipment through flood waters could easily be overcome.

It is not recommended to drill in the alluvium of the Fortescue River near Wittenoom Town, as the water is likely to be saline. In case the large Fortescue alluvial flats should be tested for potable water, bore sites should be located very close to the channel, in order to intercept the actual underflow of the river.

REPORT ON UNDERGROUND WATER SUPPLIES—SOUTH AND SOUTH-EAST STIRLINGS—MT. MANYPEAK—NORTH FRANKLAND—SOUTH-WEST DIVISION.

By K. Berliat, D.Sc., M.I.Min.E. (Eng.).

Introduction.

South and South-East Stirlings, Mt. Manypeak, and North Frankland are the names given to three large properties, totalling nearly 600,000 acres, which have been purchased by the War Service Land Settlement Board and will step by step be subdivided into individual farms of approximately 1,000 or 2,000 acres.

Most of the area concerned lies in the saline ground water zone of Western Australia and the provision of an adequate water supply, both for domestic and stock purposes, is therefore a major

problem. Apart from Mt. Manypeak the whole of the country under consideration is underlain at a shallow depth by gneissic granite, and although the annual rainfall is relatively high (in the vicinity of 30 inches), the search for useful underground supplies must be governed by the basic principles that apply generally to the conditions in the wheat belt of Western Australia.

These basic principles may be summarised as follows:—

1. Look for suitable catchment areas in decomposed granite along the crest of ridges and on hilltops.
2. Choose sites on the slopes where there is a concentration of the run-off and pervious soil.
3. Keep away from the main valleys and the lowest parts of the district, as the water beneath these localities will be saline.

The examination was carried out from the 10th to 13th April, 1951, and the writer had the advantage of the company of Mr. Fitzsimmons, of the War Service Land Settlement, for the whole of the traverses.

SOUTH AND SOUTH-EAST STIRLINGS PROJECT.

This area, comprising 350,000 acres, is situated to the south and south-east of the Stirling Range, and is bounded by the Kalgan River and the Pallinup River to the south-west and north-east respectively. For immediate purposes only a small portion on the western edge of the property had to be examined. This portion lies on both sides of the road from Albany to Borden, and its centre is situated in approximately Latitude 34° 30′ S. and approximately Longitude 118° 00′ E. Topographically the country forms part of the broad, flat, sandy plain between the Stirling Range and the Porongorup Range. The average height above sea level is about 900ft.

Not less than 15 bores have been put down in order to test the underground water conditions of the area. In all, except one case, these bores struck heavy salt water which, in most cases is useless even for stock purposes. It may be noted that the sites of these unsuccessful bores are in low-lying portions of the sandplain or in shallow depressions, and it is quite obvious that any further drilling in this type of country is only a waste of time and money.

In the writer's opinion geological conditions necessary to provide underground water of useful quality do not exist in most parts of the area under consideration, and the solution of the water supply problem will depend on sources other than those of subterranean nature.

Only one area is suggested by the writer as worthy of trial. About a mile and three-quarters to the north of the War Service Land Settlement Depot the country is gradually rising, and there is a range of flat topped, and not very heavily timbered hills forming a good catchment. This high ground should be tested and a first site has been selected in accordance with the basic principles mentioned above. Other bores in similar positions may be sunk later on, farther to the westward, along the dissected crest of the ridge.

It may be noted in passing that the only successful bore drilled so far lies in this area.

MT. MANYPEAK PROJECT.

The centre of the 40,000-acre Mt. Manypeak project is situated in approximately Latitude 34° 50′ S. and Longitude 118° 10′ E. With the exception of a small portion in the south-east corner the whole of the property is underlain by the Miocene Plantagenet Beds. These beds, consisting mainly of pervious sandstones, are highly absorbent and form an ideal formation for the storage of underground water. This fact, together with the relatively high annual rainfall of 30 to 35 inches, account for the rich supplies of good water in almost all the bores put down up to date.

It may be safely stated that the further development of the project will not be hampered by the lack of sufficient underground water of useful quality.

There is a tendency for the water, however, to become more saline with increasing depth, and efforts must be made therefore to make use of the top water of good quality.

Favourable locations for new bores are on high level sandstone country above the swamps, and the sites should be selected on cleared grassy country, in order to avoid the transpiration effect of vegetation on the quality of the water.

NORTH FRANKLAND PROJECT.

Traverses in the 200,000-acre North Frankland project have been confined to the Rocky Gully subdivision, the centre of which is situated in approximately Latitude 34° 30′ S. and Longitude 117° 00′ E.

The area, which is underlain by granite gneiss, shows a gentle undulating land surface at an average elevation of about 800ft. above sea level. Considerable dissection of the country causes extreme variations in height of up to 300ft.

Outcrops of solid, impervious, gneissic granite are relatively frequent throughout the area, and surface evidence indicates that these rocks underlie the surface in most places at a relatively shallow depth. These facts obviously prevent efficient catchment of the rain water and its storage underground. Furthermore, the ridges which may act as possible catchments are in many cases a little more heavily timbered than is desirable.

Successful bore sites under such conditions depend very largely upon the configuration of the underlying granite. Surface indications, however, afford no information as to the position of granitic channels and depressions, and it will be necessary therefore to drill more than one hole in some places in order to locate these zones. A light prospecting plant, capable of boring about 200ft. would be most suitable for this purpose.

For immediate needs a water supply is required for seven selected house sites, and although possible boring locations have been indicated, the above considerations apply in each particular case.

In districts such as Rocky Gully, the whole planning must be governed by the problems of water supply, and the sites of houses have to be selected accordingly.

In conclusion it is pointed out that sand soaks are another possible source of water in the Rocky Gully district. Some of these soaks were seen in shallow depressions free from vegetation, and although large, permanent supplies cannot be expected, this type is worth testing in a naturally water poor country.

REPORT ON WATER SUPPLY ON KIMBERLEY CATTLE STATIONS.

By K. Berliat, D.Sc., M.I.Min.E. (Eng.)

INTRODUCTION.

The following report is based upon an examination of 24 cattle stations in the East and West Kimberleys, made by the writer during the period 15th May to 5th August, 1951, with the object of selecting additional sites for bores and wells.

The development of the pastoral industry in the Kimberleys hinges basically upon the provision of adequate and reliable water supplies. Lacking a sufficient number of artificial watering points (bores, wells, excavated tanks, etc.), spread rationally over suitable grazing country, cattle will concentrate along rivers and other permanent natural waters, with the result that large tracts of country become completely eaten out and the forces of soil erosion are given full sway. It is obvious that such conditions are detrimental to the natural increase of cattle, and represent the major cause of high mortality.

In order to halt the development of these unfavourable conditions, which are particularly acute in the East Kimberleys, a scheme for increasing watering points has been approved by the Government. The ultimate aim of this scheme will be to provide a watering point to serve every 28,000 acres of suitable grazing country, with the result that cattle will have a maximum distance of three and a half miles to walk to water.

The writer arrived at Wyndham on the 15th May, and from there travelled up the Ord River as far as Hall's Creek, visiting nearly all the cattle stations in the East Kimberleys. From Hall's Creek the journey followed the road to Fitzroy Crossing and Derby, and finally visits were paid to a few stations situated on the Northern Plateau, north of the King Leopold Ranges.

The writer is greatly indebted to pastoral companies and individual pastoralists for their assistance, co-operation, and unstinted hospitality.

PHYSIOGRAPHY AND CLIMATE.

The pastoral country in the Kimberleys is situated in the physiographic divisions Ord-land and Fitzroy-land (Jutson, 1914, and 1934), the two units corresponding approximately with what is generally known as East Kimberleys, and West Kimberleys.

The East Kimberleys show a marked difference in relief north of Argyle, the hills and ridges representing in all probability the remannts of an old, maturely dissected plateau. To the south, between Argyle and the Antrim Plateau, where the country is under-lain by Cambrian basalts and sediments, the dominant topographical features are low lying, broadly undulating plains, forming excellent grazing land.

The East Kimberleys are drained by the Ord River and its tributaries, the most important of which are the Denham, the Bow, the Panton, and the Elvire Rivers.

The divide between the drainage systems of the East and West Kimberleys is approached in the vicinity of Hall's Creek. The Fitzroy River, and its main tributary, Christmas Creek, follow the regional north-westerly strike of the rocks. They control, together with the Margaret River, the primary drainage of the West Kimberleys.

The outstanding features in the relief of this area are a narrow belt of rugged limestone ranges, comprising the Napier, Oscar, Geikie, and Rough Ranges, in the northeast, and an extensive, comparatively low lying area, with scattered hills and ridges in the southwest.

The rainfall in the Kimberleys is of the summer monsoonal type. The average annual fall in the East and West Kimberleys is in the vicinity of 25 inches, but there are variations from 15 inches (Christmas Creek) to 35 inches (Carlton Hill).

Almost all the rainfall occurs from November to April.

THE ROCK TYPES AND THEIR WATER-BEARING PROPERTIES.

As far as can be ascertained the formations in the area under consideration vary in age from Pre-Cambrian to Recent.

Archean. — These comprise metamorphosed basic lavas, schistose greenstones, metasediments (slates, phyllites, mica schists), and granitic rocks. Their principal occurrences are in the East Kimberleys, where they form the bulk of the country between the Carr Boyd Range in the north and Mt. Dockrell in the south.

Proterozoic.—Nullagine formation. This series is made up essentially of a huge succession of sandstones, grits, quartzites, slates, and shales. The main occurrences are between Wyndham and the Denham River, in the Mt. Ramsay area, and north of the King Leopold Ranges.

Paleozoic.—Volcanic and sedimentary rocks include basalts, limestones, conglomerates, sandstones, and shales. Cambrian basalts and limestones predominate in the Ord River basin, south of Argyle. Ordovician, Devonian and Permian sediments underlie large areas in the West Kimberleys.

Tertiary.—Small remnants of lacustrine, fossiliferous marls and siltstones occur in the White Mountain Range (East Kimberleys).

Recent.—These deposits consist of alluvium (clay, silt, sand, gravel), soil, sand dunes, and laterite.

Considered from a hydrological angle the age of a certain rock type is immaterial. Whether a certain rock acts as an aquifer, i.e. whether it is able to absorb, store, and yield water or not, depends entirely upon its textural and structural features, in other words upon its mode of origin and geological history.

The writer has found that a great deal of misconception of the natural laws, controlling the origin, distribution, and quality of underground water exists, and that in consequence much expensive, useless work has been done.

It is fundamental to understand that underground water is stored in open spaces, existing in certain rock masses below the surface.

Basically these receptacles for water are of two different types:—

(a) Interstices betwen individual rock grains.

(b) Cavities due to fracturing, decomposition, or solution of the rock masses.

It is hopeless to search for water in any formation not offering at least one type of these openings.

The following is a summary of the most common rock types in the Kimberleys, and their water-bearing properties.

Granitic Rocks.

Water occurs in granitic rocks in two different ways, namely, in decayed and decomposed granite near the surface, and in joints and fissures in the deeper granitic formation.

Granite is one of the most easily altered crystalline rocks, and its disintegration products usually cover large areas of granite country. The residuum is as a rule sufficiently porous and disintegrated to afford storage for water. Good yields may be obtained where the residuum reaches a considerable thickness, and where there are favourable topographical conditions. An example for such a case is No. 4 bore on Lyssadell Station, where a good supply is obtained at a depth of 83ft.

Supplies in solid granite depend entirely upon the presence of joints. Prospects of finding a supply are a matter of chance and so poor as to be practically negligible.

Basalt and Associated Rocks.

From a hydrological point of view solid basalt is little better than granite, and much unsuccessful boring has been done in this type of country, especially in the East Kimberleys (Antrim Plateau, Bull Creek bores on Argyle). Boring in basalt is very hazardous, unless the sites are selected with great care. Water may occur in joints, in openings separating successive flows, in vesicular basalt, and layers of interbedded volcanic agglomerates. At Argyle several springs, such as Soda Spring and Napoleon Spring, providing large supplies, emanate through locally eroded areas, where underlying volcanic agglomerates are exposed. Another example where good supplies are obtained from basalt, is No. 13 bore on Gordon Downs. This bore which is between 500 and 600ft. deep, apparently draws its supply from vesicular and/or fragmental basalt at depth.

Phyllites, Mica Schists, Schistose Greenstones.

These rocks are as a whole unfavourable as sources of ground water. Horizontal jointing is exceptional in schists, but they show sometimes a marked development of vertical joints. Water may percolate through these openings and be stored in openings parallel to the schistosity. There is a tendency, however, for all these openings to be closed at a relatively shallow depth, on account of the softness of most schistose rocks.

Good supplies may be obtained in sheared and crushed zones due to major faulting.

Clay, Shale, Slate.

Although pure clay has a high porosity, it is, on account of the minuteness of the interstices, absolutely impervious under ordinary hydrostatic pressure, and forms thus the most hopeless deposit as a source for water supply.

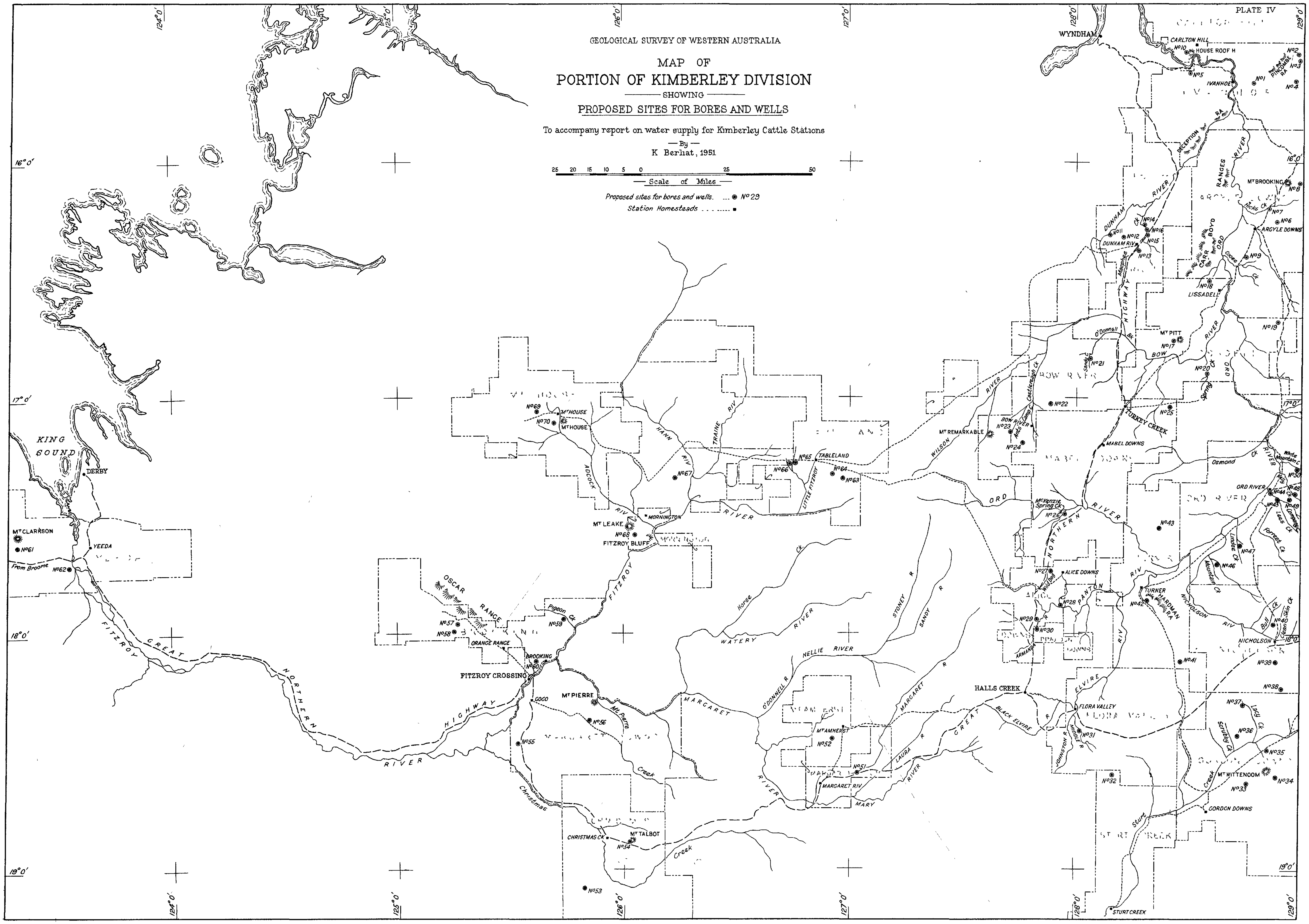


PLATE IV
GEOLOGICAL SURVEY OF WESTERN AUSTRALIA
MAP OF
PORTION OF KIMBERLEY DIVISION
SHOWING
PROPOSED SITES FOR BORES AND WELLS
To accompany report on water supply for Kimberley Cattle Stations
By
K Berliat, 1951
25 20 15 10 5 0 25 50
Scale of Miles
Proposed sites for bores and wells. ... No 29
Station Homesteads ....
KING SOUND
DERBY
YEEDA
Mt CLARKSON
From Broome
FITZROY
GREAT NORTHERN HIGHWAY
RIVER
OSCAR RANGE
ORANGE RANGE
BROOKING
FITZROY CROSSING
GOGO
Mt PIERRE
Mt Pierre Creek
Christmas
CHRISTMAS CK
Mt TALBOT
Creek
Pigeon Ck
Mt LEAKE
FITZROY BLUFF
MORNINGTON
Mt HOUSE
ADCOCK
HANN RIV
TRAINE RIV
TABLELAND
LITTLE FITZROY
RIVER
Horse Ck
WATERY RIVER
STONEY R
SANDY R
NELLIE RIVER
O'DONNELL R
MARGARET
MARGARET R
MARGARET RIV
Mt AMHERST
LAURA R
MARY RIVER
HALLS CREEK
BLACK ELVIRE
ELVIRE
FLORA VALLEY
JOHNSTON R
MIDDLE R
STURT CREEK
Sturt Creek
GORDON DOWNS
Mt WITTENOOM
Scrubby Ck
Lady Ck
NICHOLSON
NICHOLSON RIV
TURNER
HARDMAN RA
PANTON RIV
ALICE DOWNS
ARMANDA
McKENZIE Spring Ck
NORTHERN RIVER
ORD
ORD RIVER
Osmond
Mountain Ck
Bull Ck
Forrest Ck
Mt REMARKABLE
BOW RIVER
WILSON RIVER
MABEL DOWNS
TURKEY CREEK
Mt PITT
BOW RIVER
Spring Ck
DUNHAM RIVER
DUNHAM RIV
HIGHWAY
LISSADELL
CARR BOYD RANGES
ARGYLE DOWNS
Mt BROOKING
DECEPTION RA
WYNDHAM
CARLTON HILL
HOUSE ROOF H
IVANHOE
RIVER
No 1 No 2 No 3 No 4 No 5 No 6 No 7 No 8 No 9 No 10 No 11 No 12 No 13 No 14 No 15 No 16 No 17 No 18 No 19 No 20 No 21 No 22 No 23 No 24 No 25 No 26 No 27 No 28 No 29 No 30 No 31 No 32 No 33 No 34 No 35 No 36 No 37 No 38 No 39 No 41 No 42 No 43 No 44 No 45 No 46 No 47 No 48 No 49 No 50 No 51 No 52 No 53 No 54 No 55 No 56 No 57 No 58 No 59 No 60 No 61 No 62 No 63 No 64 No 65 No 66 No 67 No 68 No 69 No 70
16°0' 17°0' 18°0' 19°0'
124°0' 125°0' 126°0' 127°0' 128°0' 129°0'

Shales and slates are formed by the induration of clay and clayey mixtures, and offer as a whole very unfavourable underground water conditions. Useful water may be stored in joints and fissures, and along bedding planes.

Several bores on Glenroy Station may serve as typical examples for this type of supply.

Sand, Gravel, Sandstone, Conglomerate, Quartzite.

The value of these rock types as aquifers depends on the size of grain, the degree of assortment, and the degree of cementation.

The size of grain is immaterial as far as porosity is concerned. All other things being equal a sand has about the same porosity as a gravel. The permeability however, i.e., the capacity of conducting and yielding water, of a fine sand with very small interstices compares unfavourably with that of a coarse sand or a gravel.

The amount of variation in size of grain or the degree of assortment is of fundamental importance with regard to porosity. Well sorted deposits, consisting of uniform size of grain have high porosity, poorly sorted deposits, composed of a mixture of grains, have low porosity.

Cementation and resulting consolidation affect the deposit in that they close the interstices between the individual grains. A moderate amount of cementation, however, may improve a sand by making it more coherent and less likely to run into a well or bore.

Coarse, clean, well sorted gravel is an excellent formation to yield water. Sand and loosely cemented sandstones rank next. In indurated sandstones, firmly cemented conglomerates and quartzites all the original interstices have been closed, and joints afford the only storage room for water.

Limestone and Related Rocks.

The degree to which a limestone acts as an aquifer depends mainly on the extent to which it has been subjected to the solvent action of percolating waters. Old limestones are generally compact and impervious, but large supplies can be obtained from solution cavities, formed along joints and bedding planes by percolating waters charged with carbon dioxide.

Although the search for water in a creviced formation naturally involves a large element of chance, the instances of failure in the Paleozoic limestones of the Kimberleys are extremely low. The Cambrian limestones of the Argyle and Rosewood basins yield excellent supplies in a number of bores. Typical examples are the Newry Gate bore on Argyle, and Number 1, 2 and 3 bores on Lyssadell. The depth of these bores varies from 103 to 681ft. and supplies range from 800 to 1,500 gallons per hour.

TOPOGRAPHICAL AND STRUCTURAL INFLUENCES ON GROUND WATER.

The very important influence of the topography on ground water conditions lies in the fact that it governs the disposal of the run-off portion of the rainfall and the probable salinity of the ground water. Attention must be paid to the extent of local catchment areas, and to the nature of the channels through which the run-off must pass.

The structural conditions bearing upon the distribution of ground water are especially the type and degree of jointing and the occurrence of faulting. Faults may act as subterranean dams, or as conduits and containers for ground water. Folding, especially in limestone country, may lead to fracturing and jointing of the strata involved, and thus afford storage room for ground water. An impounding effect on percolating waters, similar to certain faults, may also be brought about by intrusive dykes. This is particularly important where a dyke crosses a water channel or a valley.

SITES FOR BORES AND WELLS SELECTED ON KIMBERLEY CATTLE STATIONS.

In the following pages a summary description is given of the sites selected on the various cattle stations. The approximate position of these sites is marked on the accompanying map.

These sites will cover the needs for immediate improvements. Apart from that other suitable areas for underground water have been indicated; they may be considered for further development.

It has been pointed out to pastoralists that many of the sites selected are a proposition for wells with horizontal drives, rather than for bores, and some sites are exclusively a well proposition. This applies particularly to stations like Mabel Downs and Alice Downs, the grazing country of which is largely underlain by greenstones and metasediments. Here, in the absence of other sources valuable supplies may be obtained in wells, especially along creeks. The same applies to various sites selected in the Nullagine formation and in decomposed granite. It is obvious that potentially water-bearing formations of this type are in a great many cases unable to yield the large supplies required on cattle stations from small diameter bore holes.

No. 1. Ivanhoe Station.—Site in Devonian Cockatoo Sandstones, near the faulted contact with Cambrian basalt (black soil). Dip of the sandstones 10 deg. S.E.

No. 2. Ivanhoe Station.—Site in thick sandy alluvium, on the bank of the Keep River. Alluvium underlain by Cockatoo Sandstones, dipping 8 deg. S.E.

No. 3. Ivanhoe Station.—This alternative site is three to four miles south of No. 2, in Keep River alluvium. A range of bare hills and ridges near the Northern Territory border forms an excellent catchment area.

From the standpoint of the pastoralist No. 2 site is preferable, as No. 3 is only three miles north-north-west from Milligan Billabong (Northern Territory).

No. 4. Ivanhoe Station.—Site in fractured limestones of the Devonian Burt Range Series.

No. 5. Ivanhoe Station.—Site on the bank of Clean Skin Creek. Large development of sandy alluvium, underlain by jointed quartzites of the Nullagine formation.

No. 6. Argyle Station.—Site in jointed limestones of the Cambrian Negri Series, dipping 10 deg. W., towards the centre of the Argyle basin.

No. 7. Argyle Station.—Limestones of the Negri Series. The site is near the banks of Hicks Creek, just outside the reach of the flood waters.

No. 8. Argyle Station.—Site in fault zone between Mt. Brooking Series (Permian) and basalt (Cambrian). The hills near Donkey Gap form a good local catchment area.

No. 9. Argyle Station.—Site selected to draw water from the Girvanella limestone (Negri Series) at depth.

No. 10. Carlton Hill Station. Highly jointed quartzites and sandstones (Nullagine). Site in a gully, concentrating the run-off from a large catchment area.

No. 11. Dunham River Station.—Site on the eastern bank of the Dunham River. Alluvium, underlain by jointed Nullagine sandstones.

No. 12. Dunham River Station.—Site in low lying area, with good local catchment. Nullagine formation.

No. 13. Dunham River Station.—Site at the foot of a highly decomposed granite ridge.

No. 14. Dunham River Station.—Site on the bank of Macphee Creek, just above a conspicuous valley constriction, brought about by the appearance of hard, massive sandstones and conglomerates in the Nullagine Series.

No. 15. Dunham River Station.—Site in thick, red, sandy alluvium on the bank of Macphee Creek.

No. 16. Dunham River Station.—Similar, alternative site on the bank of Macphee Creek.

No. 17. Lissadell Station.—Jointed and fractured quartzites and ferruginous sandstones (Nullagine). Site near the foot of Mt. Pitt, forming excellent catchment.

No. 18. Lissadell Station.—Site in red, ferruginous sandstones, interbedded with white, sandy shales (Mt. Brooking Series?).

No. 19. Lissadell Station.—Site in limestones of the Negri Series. A very conspicuous "limestone wall" forms the boundary between basalt and Negri Series.

No. 20. Lissadell Station.—Site near the bank of Spring Creek, in jointed Cambrian basaltic rocks.

No. 21. Bow River Station.—Site at a distance of 30 yards from the eastern bank of Sandy Creek. Sandstones, sandy shales and jointed quartzites are outcropping in the creek bed. Dip 40 degr. E.

No. 22. Bow River Station.—Site close to a creek between two ridges formed by fractured granite. There is a considerable thickness of decomposed granite on the slopes, and on the floor of the valley.

No. 23. Bow River Station.—Site in alluvium and decomposed granite, about 1 chain from the bed of "Ant Camp" creek. Good local catchments.

No. 24. Bow River Station.—Site above a conspicuous and continuous acid dyke. The dyke appears in a depression, which is drained by a gully. The country above the dyke is gradually rising, and is underlain by decomposed granite.

No. 25. Mabel Downs Station.—Site close to the bank of a creek in "Moonlight Valley." Sandy shales and slates with well developed cleavage planes and vertical joints.

No. 26. Mabel Downs Station.—Site in alluvium on the bank of McKenzie Spring Creek.

No. 27. Alice Downs Station.—Site in alluvium on the bank of Togo Creek.

No. 28. Alice Downs Station.—Site in alluvium on the bank of the Panton River.

No. 29. Alice Downs Station.—Site in alluvium on the bank of Emu Creek.

No. 30. Ding Dong Downs Station.—Site in thick, sandy alluvium on the bank of the Armanda River.

No. 31. Flora Valley Station.—Site one chain from Middle Creek. Alluvium, underlain by sandstones and jointed quartzites (Nullagine).

No. 32. Sturt Creek Station.—Site in sandstones and jointed quartzites of the Nullagine formation, near the contact with Cambrian basalt.

The Nullagine Series weathers to a red, sandy soil, carrying a rich vegetation (white gum), while the basalt produces a heavy, black soil, devoid of all vegetation.

No. 33. Gordon Downs Station.—Site as No. 32.

No. 34. Gordon Downs Station.—Site in a heavily timbered, low lying area between two marked ridges, forming ideal catchment. Nullagine formation.

No. 35. Gordon Downs Station.—Site in thickly timbered, red, sandy soil, derived from underlying Nullagine sandstones.

No. 36. Gordon Downs Station.—Site as No. 32.

No. 37. Gordon Downs Station.—Site in thick alluvium of Lazy Creek, not far above a well marked valley constriction, caused by hard, gritty sandstones and compact conglomerates (Nullagine). Good catchment area.

No. 38. Nicholson Station.—Site close to Alice Creek. Exposures of grey sandstones, sandy shales, and limestones.

No. 39. Nicholson Station.—Site as No. 35.

No. 40. Nicholson Station.—Site on the bank of Pear Tree Creek, in decomposed and jointed basalt, amygdaloidal and vesicular basalt.

No. 41. Turner River Station.—Site as No. 32.

No. 42. Turner River Station.—Site four chains from the bank of the Turner River. Alluvium, underlain by limestones of the Negri Series.

No. 43. Turner River Station.—Site in sandstones of the Mt. Elder Series (Cambrian).

No. 44. Ord River Station.—Site on the bank of Forrest Creek. Negri Series: Limestones, sandy shales.

No. 45. Ord River Station.—Site two chains from Forrest Creek, just below the junction of Forrest Creek and Company Creek. Jointed limestones, dipping 8-10 degr. N. Negri Series.

No. 46. Ord River Station.—Site in limestones of the Negri Series.

No. 47. Ord River Station.—Site close to Linacre (Lindee) Creek. Negri Series.

No. 48. Ord River Station.—Site in a zone of springs on the eastern bank of Kelly Creek. Limestones, dipping 5 degr. N.W. Negri Series.

No. 49. Ord River Station.—Site near Company Creek. Geological conditions similar to those at No. 48.

No. 50. Ord River Station.—Site in faulted and fractured limestones, close to White Mountain Creek. Negri Series.

No. 51. Margaret River Station.—Site about one chain from the southern bank of the Margaret River. Nullagine formation.

No. 52. Mt. Amherst Station.—Site in Nullagine Series, above a well defined valley constriction.

No. 53. Christmas Creek Station.—Two bores have been put down at a distance of about 20 miles S.S.W. of Christmas Creek Homestead. Both of them struck saline water at shallow depths. From the bore sites, which are situated in a depression, the country gradually rises westwards, to form a broad plateau, underlain by sandstones of probably Permian age. Site No. 53 has been selected high up the slope, about half a mile to the west of the salt bores. In case the water should still be saline, an alternative site, near the top of the plateau has been indicated.

No. 54. Christmas Creek Station.—Site in ferruginous Permian sandstones.

No. 55. Margaret Downs Station.—Site near "Sugarbag Billabong," close to the bank of Nipper Creek. Ferruginous sandstones and grits of Permian age (Liveringa/Noonkanbah formation).

No. 56. Margaret Downs Station.—Site in Devonian Pillara limestones.

No. 57. Brooking Springs Station.—Site on the southern bank of 12-Mile Creek, in Bugle Gap limestones (Devonian).

No. 58. Brooking Springs Station.—Alternative site two and a half to three miles south of No. 57. Geological conditions are analogous.

No. 59. Brooking Springs Station.—Site in undifferentiated Devonian limestones, close to Pigeon Creek.

No. 60. Brooking Springs Station.—Site in Bugle Gap limestones (Devonian).

No. 61. Yeeda Station.—Site in ferruginous sandstones and grits (Permian).

No. 62. Yeeda Station.—As No. 61.

No. 63. Tableland Station.—Site in a zone of springs, emanating from decomposed and jointed basalt and vesicular basalt.

No. 64-66. Tableland Station.—Sites in ferruginous sandstones, grits and jointed quartzites of Nullagine age.

No. 67-68. Mornington Station.—As No. 64-66.

No. 69. Mt. House Station.—Site in red ferruginous sandstones.

No. 70. Mt. House Station. Site in greenish sandy shales, near the bank of a creek.

In conclusion reference is made to the paucity of information regarding most of the boreholes that have been drilled in the past. It is urged that a full and proper record should be kept of all future boring operations. For each borehole or well, whether successful or not, this record should give full particulars concerning:

1. The exact position.
2. The altitude above sea level and above surrounding country.
3. The log of the borehole with samples of rocks penetrated.
4. The total depth.
5. The depth at which each water was struck.
6. The thickness and the yield of each aquifer.
7. The quality of the water.

REPORT ON LOCATION OF BORE SITES FOR WATER AT LAKE ALLANOOKA.

By K. Berliat, D.Sc., M.I.Min.E. (Eng.)

INTRODUCTION.

The Geological Survey has been requested to assist in the location of two exploratory water bores in the sand plain adjacent to Lake Allanooka.

Lake Allanooka is situated in approximately Latitude 29°0′ S. and approximately Longitude 115°0′ E. The locality is easily accessible by car or truck from the small township of Walkaway, 20 miles by road from Geraldton. The distance from Walkaway to Lake Allanooka is 24 miles.

Lake Allanooka occupies a small portion near the northern edge of an oval shaped basin of say six or eight square miles, the longer axis of which points roughly north and south. The depression is surrounded on all sides by high level sand plain country. The difference in elevation between the top of the sand plain and the floor of the basin is about 400ft. along the northern and north-western rim, but is considerably less on the south and south-east. The basin has no surface outlet but the possibility of subterranean drainage to the west cannot be discarded a priori.

The water level in the lake is subject to fluctuations, but it is stated that the lake never goes entirely dry. The water is of good quality, having a content of about 47 grains per gallon. A marked increase is noticeable towards the end of the dry season. The area receives an average annual rainfall varying from 16 to 18 inches.

The country rocks are predominantly quartzitic or feldspatic grits, and white, yellow or red sandstones, with some intercalations of sandy shales and clays. The formation shows a slight regional dip to the west, and is regarded tentatively as Jurassic.

Porous rock types and suitable topographic conditions render the area potentially water-bearing. The crux of the matter will be to ascertain the salinity of the ground water, and therefore the principles governing the relations between fresh and salt water were given special attention. No. 1 site has been selected in comparatively low lying country, while No. 2 site is 150ft. vertical distance higher up the slope.

It is of interest to note that the general conditions at Lake Allanooka exhibit a marked similarity to those existing in the Wicherina basin (27 miles by road east of Geraldton), from which Geraldton draws its water supply.

Irwin Springs—Ground Water Possibilities.

The Irwin Springs are located in the valley of Springy Creek, a tributary of the Irwin River, one mile east of Irwin homestead, and 14 miles by road from Dongara. They issue in a low, waterlogged tract, about one chain south of the main road from Geraldton to Perth. There are two vents, and pumping tests on one of them, carried out recently by the Public Works Department, showed a yield of 1,700 gallons per hour. The springs have therefore been considered as a possible source of supply for Dongara and Denison.

The Irwin Springs belong to the class "Gravity Springs" or "Filtration Springs" (U.S. Geol. Surv., Water Supply Paper 494). The country rocks consist predominantly of porous Jurassic sandstones, underlying both the high level sand plains to the north and the ridges to the south. The configuration of the topographic surface, being related to that of the water table, brings about an outcrop of the latter in the zone of seepage.

The opinion is expressed that testing of the area has very good chances of success. It is stated that the bore put down by the Midland Railway Company, two or three chains away from the springs, yields an unlimited supply.

REPORT ON LAVERTON SCHEELITE PROSPECT P.A. 2548T, P.A. 2554T, P.A. 2555T, LAVERTON, MT. MARGARET GOLDFIELD.

Approx. Lat. 28°05′ S.

Approx. Long. 122°15′ E.

By K. Berliat, D.Sc., M.I.Min.E. (Eng.)

Location.

The prospecting areas for scheelite are situated 45 miles by road north of Laverton, and about half a mile east of the road from this township to Erlistoun.

Geology.

The country rocks in the immediate vicinity of the deposit consist of schistose greenstones, granitised schistose greenstones, and intrusive quartz dykes. The granitised greenstone schists with the undigested remnants are highly sheared and foliated. They have an average strike of N.10°W. and an average dip of 78°E.

The Scheelite Occurrences.

Scheelite mineralisation shows a definite association with quartz, and is confined to a linear zone between granitised greenstones and a narrow band of unaltered greenstone schists. Mineralisation along this line is not continuous, but patchy and extremely irregular. At the time of inspection (November 1951) six productive quartz lenses occurring over a maximum distance of 1,320ft., have been worked. They vary in thickness from 2ft. 6in. to 8in. and exhibit a maximum length of 100ft. (extreme south end of P.A 2548T.).

In some instances mineralisation has taken place in granitised greenstones, adjoining to quartz lenses. In this case the rock is veined with a network of parallel or anastomosing stringers and veinlets of quartz, and the mineral occurs in patches or as disseminated grains.

Prospects of the Deposit.

Up to the date of examination prospecting and mining activities have been confined to P.A. 2548T. A first parcel of nine tons of ore from trenches and shallow shafts (maximum depth 25ft.) has been crushed at the State battery at Coolgardie and yielded a total of 565lb. of concentrates.

Heavy soil covering on the adjoining prospecting areas to the north and south (P.A. 2555T, and P.A. 2554T) makes any observations impossible. It may be safely stated, however, that, even if mineralisation extends in these directions, it will also be patchy and irregular in occurrence.

In conclusion I have no doubt in saying that the deposit has no prospects for large scale development, but with the present demand and the high price for tungsten further development of the show as a "prospector's proposition" is justified.

REPORT ON COPPER PROSPECT P.A. 2242, NORSEMAN, DUNDAS G.F.

Approx. Lat. 32°05′ S.; Approx. Long. 121°40′ E.

By K. Berliat, D.Sc., M.I.Min.E. (Eng.).

Location.

The copper occurrences are situated about seven and three-quarter miles by road north-north-west of Norseman, and about three-quarters of a mile west of the main road from Norseman to Coolgardie. P.A. 2242, applied for by Messrs. T. F. Egan and C. Mitchell, lies on Native Reserve No. 22465 (19,745 ac.), and on this account an objection to the application has been lodged by the Commissioner of Native Affairs. Under these circumstances the Warden has required a geological report on the find, before granting any title on the ground.

General Geology.

Medium to fine grained basalts are outcropping on the western half and to the west of P.A. 2242. Adjoining the basalt to the east is a narrow belt (about 100ft.) of metamorphosed sediments, consisting mainly of banded ironstones and graphitic schists. The average strike of the sediments is a few degrees to the east of north and the dip is high and to the west (average 72°).

Bounding the sediments to the east, and evidently intruding them, are coarse grained gabbroid rocks, forming a low ridge. A quartz "blow" occurs near the north-eastern corner of the prospecting area.

The Copper Occurrences.

Interformational copper mineralisation, evidently associated with the intrusion of the basic magma, has taken place in the altered sediments. The ore-carrying matrix is a more or less siliceous ironstone. It contains malachite and small quantities of azurite.

The lode, whose trend is coincident with the strike of the country rocks, has been opened up by three narrow costeans, having a maximum depth of two feet. The two southern costeans, which are very close together, are at a distance of about 125ft. from the northern costean. As seen in these costeans copper mineralisation occurs over a width varying from four to five feet.

Such surface evidence as is available indicates that mineralisation has taken place in a small lenticular area only, and that the lode does not extend very far beyond its presently known limits.

Two specimens of particularly rich appearance have been forwarded to the Government Chemical Laboratories for assays for copper and gold.

The specimen collected from the north costean assayed 10.35 per cent. copper, while that from the south costean assayed 10.62 per cent. copper.

There is no gold in either of the samples.

Conclusion.

The conclusions to be arrived at from the evidence available are:—

1. The extent of copper mineralisation is limited and too small to be of commercial value.

2. The deposit as a whole is of low grade character.

REPORT ON A GOLD FIND ON P.A. 6543, COOLGARDIE.

By K. Berliat, D.Sc., M.I.Min.E. (Eng.).

Location and General Information.

P.A. 6543 is situated in the Camel Paddock, some four miles north-east of Coolgardie Town, and just over a mile north-north-west of the 4-mile peg on the Coolgardie-Kalgoorlie road. The place is easily accessible by a bush track, branching off from the main road at a distance of about 150 yards after the 4-mile peg.

A rich gold find has been made recently on this P.A. by Messrs. M. Brown and W. Hart. At the time of the examination there was one shaft, totalling 30ft. in vertical depth. Two 7cwt. parcels of ore, treated on the 20th and 27th November, 1951, yielded 890 oz. and 509 oz. of gold respectively.

General Geology.

The country in the vicinity of the find is of low relief and there are no natural outcrops. Regional mapping has shown that the area is on the eastern limb of the major Coolgardie structure and lies on a minor cross-fold axis. The country rocks, as exposed in the shaft, consist of ultrabasic, schistose greenstones. The strike of the schistosity varies from S. 70° E. to east and west and the dips are vertical.

Within the greenstones, and coincident with their strike and dip, there is a zone of highly sheared rocks, consisting of talc schists, chlorite schists, and micaceous schists, together with ultrabasic decomposition products showing all the transitions from an unaltered schist to a hard, compact, jasperoid ironstone. It is in this shear zone, which varies in thickness from half an inch to six inches, that gold mineralisation has taken place.

The gold values occur in shoots or patches. The richest patches, yielding almost the total of the gold obtained so far, were encountered at a depth of 18 to 23ft., and very rich ore is worked at present at the bottom of the shaft*.

Mineralisation.

Investigations carried out by the Geological Survey of Western Australia in both the Yilgarn and Coolgardie goldfields have demonstrated the fact that—given a suitable host rock—gold mineralisation is controlled by structural conditions. The occurrences in the Camel Paddock are no exception to this principle. Tight regional folding, together with cross-folding were the cause of high fracturing and shearing in the ultrabasic schists, and especially in their least competent members, the talc and chlorite schists. The ore-bearing solutions or vapours have been able to use these easily penetrable zones in the original formation for their passage, and the precipitation of gold has been made possible by the high iron content of the host rock.

The patchy occurrence of the gold values in the lode seems to indicate that a considerable amount of secondary enrichment has taken place, and therefore a decrease in values may be expected at depth. At this stage lateral prospecting on higher levels may prove to be successful.

* According to a newspaper report (*The West Australian*, 19th December, 1951) a 6¼ cwt. parcel of this ore yielded 600 oz. 2 dwt. of gold.

REPORT ON G.M.L. 462, LOC. 53, HAMPTON PLAINS, COOLGARDIE, COOLGARDIE G.F.

By K. Berliat, D.Sc., M.I.Min.E. (Eng.).

General.

The 24 acre lease, held by Messrs. G. P. and A. G. Frank, is situated approximately 18 miles by road E.S.E. of Coolgardie townsite, and approximately seven miles E.N.E. from the 11 mile peg on the main road from Coolgardie to Norseman and Esperance. At the time of the examination (13th December, 1951) there were two shafts, 240 feet apart in a north-south direction. The vertical depth of the southern shaft was about 12 feet, while the northern shaft totalled 25 feet.

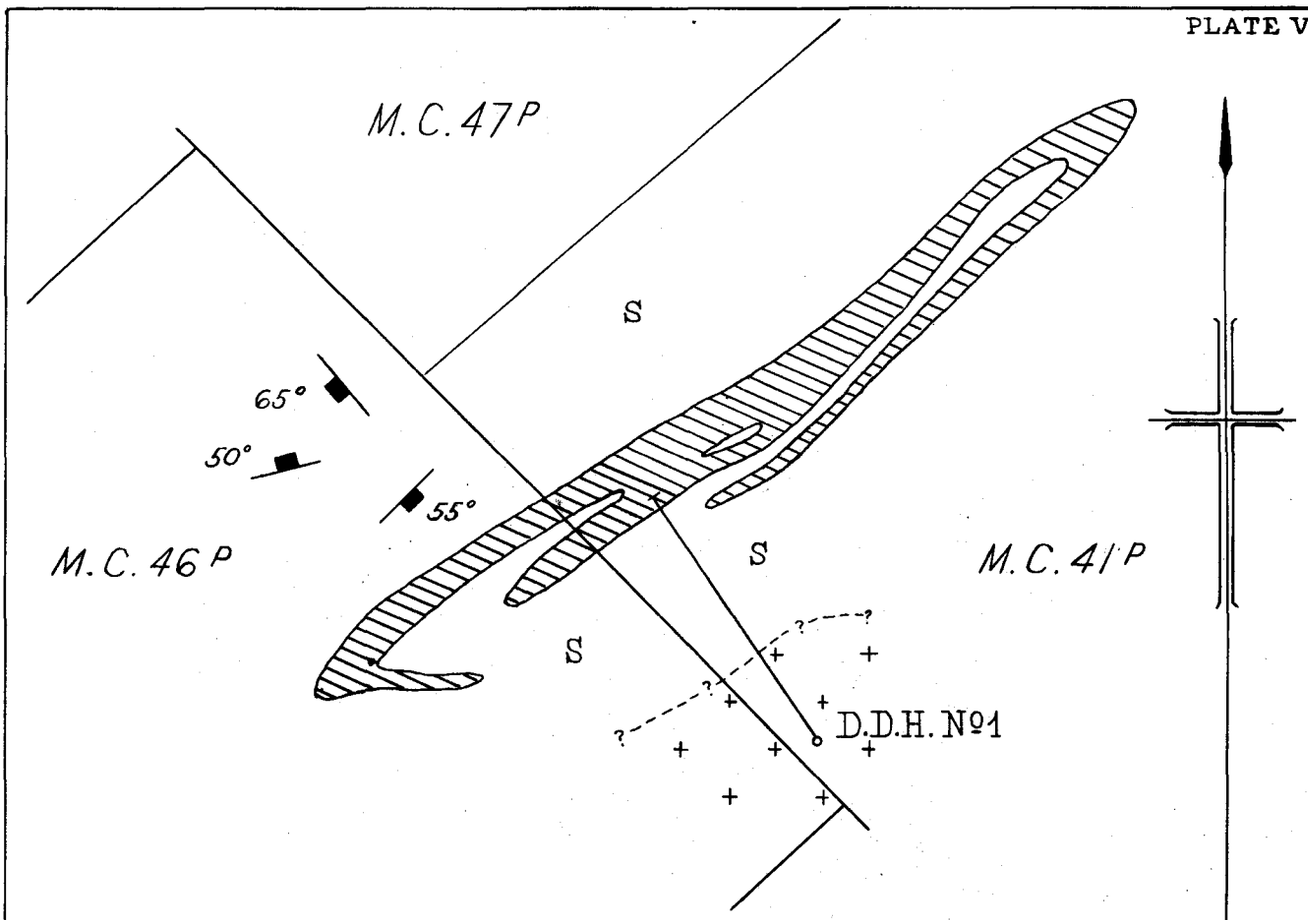
A first parcel of 3 cwt. of ore, treated at the Coolgardie State Battery (27th November, 1951) yielded 139 oz. of gold. The bulk of the values (about 120 oz.) was obtained from a small portion at the bottom of the north shaft.

General Geology.

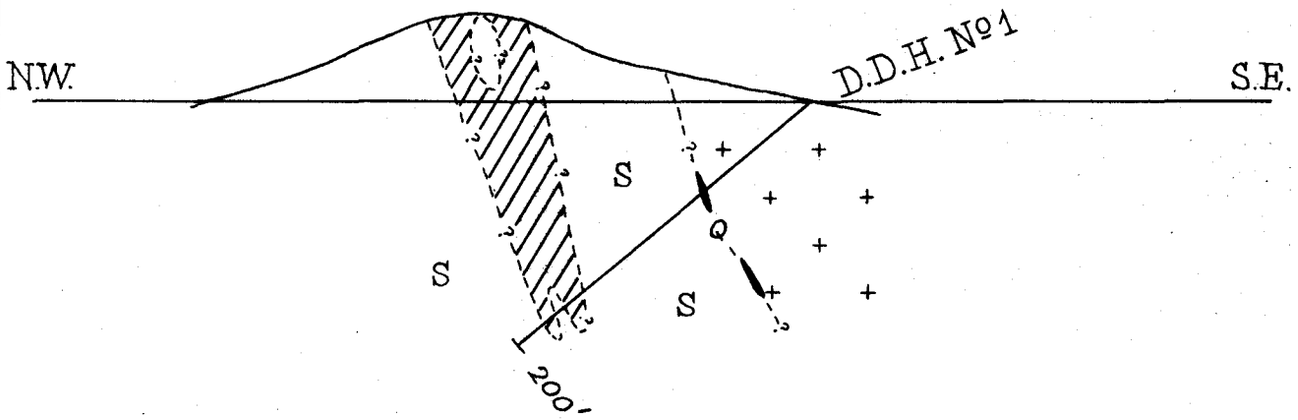
The lease is located in an area of ultrabasic schistose greenstones, predominantly actinolite and tremolite schists, which strike S.20°E., and dip steeply (average 78°) E.N.E. The series is strongly foliated and sheared and has been intruded by quartz reefs.

The Gold Occurrences.

The rich patch of gold in the north shaft occurs in altered greenstone schists, containing chlorite, talc and nontronite as predominating minerals. The values are associated with an interformational band of graphitic schists. The thickness of this "leader" averages 18 inches and is conformable in



— PLAN —



— SECTION THROUGH D.D.H. Nº1 —

Intersection of Chromite	145' V.D.
Azimuth of Borehole	N36°W
Angle of Depression	40°

— REFERENCE TO SIGNS —

Gr/Gn	+ + +
Chromite Ore-body	▨
Quartz	Q
Serpentine	S

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

COOBINA — CHROMITE DEPOSITS

D.D.H. Nº1

Scale :— 100 feet to 1 inch

Geology by L.E. de la Hunty, B.Sc. Nov. 1951.

strike and dip with the country rocks. The gold is found in the hanging wall, adjacent or very close to the graphitic layer. A gradual increase in values was noticeable from the surface to the bottom of the shaft.

There is no indication so far of the presence of the graphitic horizon in the south shaft, where the values occur in actinolite- tremolite schists. Up to the date of the examination 6 oz. of gold have been obtained from this shaft.

The writer has been informed by Mr. G. P. Frank, that prospecting by normal loaming methods revealed the presence of gold over a total length of 600 feet. This figure includes the distance between the shafts and additional distances of about 180 feet to the north and south.

Conclusions.

Further work will have to be done before the extent of the discovery can be gauged. Secondary enrichment is evidenced by the uneven distribution of the high values. This means that the latter cannot be expected to continue with depth.

Further prospecting with the object of determining the lateral extent of the ore shoot within the zone of oxidation is recommended.

REPORT ON DIAMOND DRILLING FOR CHROMITE AT COOBINA—NORTH-WEST LAND DIVISION, Approx. Lat. 23°31′ S., Approx. Long. 120°19′ E.

By L. E. de la Hunty, BSc.

INTRODUCTION.

The deposit is situated 258 road miles north of Meekatharra and about three miles west of the Great Northern Highway. It outcrops on the south-east corner of the Hamersley-Ophthalmia Plateau which is bounded by very steep slopes.

Money for the diamond drilling of this deposit was made available by the Commonwealth Government and drill sites were laid out by Mr. R. S. Matheson of the Bureau of Mineral Resources.

Supervision of the drilling was undertaken by the State Mines Department and the writer was sent to do this work—arriving at Coobina on November 1st.

Inspection of the proposed drill-sites revealed them to be absolutely inaccessible to a motor vehicle until such time as a road was made up to the top of the plateau. DDH No. 1 was sited as the only possible alternative hole and drilling operations commenced on November 3rd.

On completion of this hole (25 Nov., to a depth of 200 ft.) drilling was suspended, pending—(i) The construction of a road to the top of the plateau. (ii) Purchase of a lighter drilling plant.

Under these conditions sites Nos. 1, 2, 3, 4, 5, 8, as selected by R. S. Matheson, should be accessible for drilling. Sites Nos. 6 and 7 are inaccessible without expensive road making.

DDH No. 1

Location—

300ft. S.46°E. of West corner peg of M.C. 41P.
Azimuth of Hole N.36°W.
Angle of Depression 40°.

Size of Core—AX.

Water Used—Average of 200 gallons per day.

Results—(See Log)

0ft.—50ft.	Gr/gn.
50ft.—52½ft.	Quartz.
52½ft.—156½ft.	Serpentine.
156½ft.—180ft.	Chromite with bands of serpentine.
180ft.—200ft.	Serpentine.

Vertical depth of intersection of ore body below outcrop = 145 ft. (Hanging wall intersection).

Dip of Hanging Wall—approx. 75°.

COOBINA CHROMITE.

DDH No. 1. 300 ft. S 46°E of W. corner peg of MC 41P.
Azimuth of Hole N 36°W.
Angle of Depression 40°.

Pull. From. (Feet.)	Pull. To. (Feet.)	Total Core Recovered. (Inches.)	Detailed Description.
0	1	12	Loam soil and rubble.
1	3	5	Red gneissic granite boulders on hill slope giving way to a fractured gr/gn with traces of epidote and some serpentinous material.
3	4	2	
4	6	2½	
6	8	7	The country rock is much fractured.
8	10	5	
10	12	8	
12	21	13	
21	23	18	
23	25	9½	
25	28	13	
28	30½	4	
30½	32½	3	
32½	34½	4	Same gr/gn but rather more amphibole in the core.
34½	38	10	
38	41	5½	
41	42	7	
42	50	28½	26 in. gr/gn ; 2½ in. greenish quartz.
50	51	1½	Quartz.
51	52½	4	Quartz.
52½	70	21	3 in. Quartz.
70	74	35	18 in. Green serpentine containing chromite and shot through with veinlets and thin stringers (1/16 in. — 1/8 in.) of calcite. At 80 ft., there are small calcite vugs also faults and fault breccia recemented with calcite.
74	85	55	
85	96½	48	Serpentine with calcite and chromite. (Drillers say machine did not core from 92 ft. to 96 ft.—perhaps calcite.)
96½	100	19	Serpentine with chromite.
100	104⅔	51	Serpentine with chromite and calcite veinlets.
104⅔	115	101	do. do. do.
115	118	7	Green serpentine with chromite and calcite.
118	121½	31	30 in. Serpentine with chromite and calcite. 1 in. Chromite with serpentine.
121½	124½	15	13 in. Jointed serpentine with chromite. 2 in. Pale green bare serpentine.
124½	133	15½	(Started losing water at 124 ft. due to joints and calcite.) 2 in. Serpentine with chromite and calcite. 3½ in. Calcite with lumps of chromite. 10 in. Serpentine with chromite.
133	135	9	2 in. Serpentine with chromite. 1 in. Quartz. 6 in. Serpentine with chromite.
135	143	30	22 in. Serpentine with chromite. 1 in. Chromite. 7 in. Serpentine with chromite. Small amount of (?) chrysotile in sludge.
143	149¼	59	Serpentine with 1 in. stringers of chromite.
149¼	151	18	Serpentine with chromite, veinlets of calcite with chrysotile and some pyrite at 150 ft.
151	156½	36	Serpentine with bands of CHROMITE and some calcite. Disseminated Ore.

COOBINA CHROMITE—*continued.*

Pull. From.	Pull. To.	Total Core Recovered.	Detailed Description.
(Feet.)		(Inches.)	
156½	157	*Nil*	? Calcite.
157	163¾	27	16 in. Chromite. 1 in. Calcite—may represent 3 ft. of calcite. 10 in. Chromite.
163¾	172⅛	23	Chromite with serpentine and some calcite.
172⅛	175¾	32	24 in. Chromite. 8 in. Pale green bare serpentine.
175¾	177⅝	24	11 in. Pale green bare serpentine. 13 in. Chromite.
177⅝	179¼	16½	1 in. Chromite. 15½ in. Serpentine.
179¼	189½	111	Serpentine with scattered chromite and some calcite.
189½	200	43	do. do. do.
Total Core		989½	

Notes on Core Recovery:

1. Overall percentage core recovery = 41.2%.

2. This low percentage recovery is no doubt due to the broken country and soft seams met with.

3. Extreme care was taken as can be seen by the lengths of the various runs.

4. The first 70ft. of drilling proved very rough on bits (one particular bit only lasting 2½ft.).

Sampling.

The core was sampled in 5ft. lengths from 151½ft. to 182ft. The samples were analysed by the Government Chemical Laboratories.

Results of Assays—

Sample No.	Bore Depth.	Chromic Oxide, Cr_2O_3 Per Cent.
GS/C1	151½ft.—157ft.	15.40
GS/C2	157ft.—162ft.	42.67
GS/C3	162ft.—167ft.	35.09
GS/C4	167ft.—172ft.	26.89
GS/C5	172ft.—177ft.	25.60
GS/C6	177ft.—182ft.	10.61

Samples GS/C1 and GS/C6 are classed as "disseminated ore" while GS/C2-5 are representative of the ore body. Over this 20ft. the average grade is 32.56 per cent. Although this 20ft. is the length in the bore, it differs very little from true width of the ore body.

CONCLUSIONS.

1. This chromite lens persists to a vertical depth of at least 150ft. (See accompanying plan and section).

2. Grade at this depth is lower due to patches of serpentine in the ore-body. Average grade at the surface is about 47 per cent., Cr_2O_3. Grade at 150ft. is 32.56 per cent., Cr_2O_3.

3. True width of ore-body at 150ft. is approximately 20ft.

4. Dip of ore-body—75° to south east.

5. Since the intersection with the ore-body was less than 200ft. from the southern extremity of the lens, this hole seems to prove that there is every likelihood that the larger lenses, at least, will persist to a vertical depth of 150ft.

REPORT ON PEGMATITE AT SPARGOVILLE, COOLGARDIE G.F.

Approx. Lat. 31° 14′ S.; Approx. Long. 121° 28′ E.

By L. E. de la Hunty, B.Sc.

Introduction.

The area mapped is about one mile south of Spargoville and about 30 chains west of the Coolgardie-Esperance road. M.C. 9 and P.A. 6449 cover the area.

The reason for mapping was to determine the structure of the pegmatite and to recommend further prospecting and development.

Valuable assistance was given the writer by Mr. A. S. Giles, the owner of the claim. He has had considerable experience with pegmatites and was able to supply a lot of information about the deposit. He also carried the staff.

Method of Survey.

The survey was made on a scale of 100ft. to an inch—using plane table and telescopic alidade.

The pegmatite was mapped strictly on outcrop only. Where the boundaries were difficult to distinguish—due to boulders on the slope of the hill—a "doubtful or assumed" boundary was marked. Occurrences of the minerals Columbite, Beryl, Tourmaline, etc., are shown.

Sections were drawn (10ft. to an inch) through the only two places where a true measurement of the dip of the hanging wall could be made.

General Geology.

The area is one of Pre-Cambrian greenstones, banded quartz iron formations (Q.Fe.) and pegmatite with quartz lenses. Soil cover obscures much of the geology.

The greenstones consist of a coarse grained amphibolite (anthophyllite), a medium grained massive rock and a highly schistose greenstone. No attempt was made to differentiate these when mapping.

Interbedded with these greenstones is the banded quartz iron formation (Q.Fe.) which forms a prominent ridge to the west of that formed by the pegmatite. Some dragfolding was seen to occur in the Q.Fe. but this may have been due to slumping in the original sediments before metamorphism. The Q.Fe. includes hematite quartzite, quartzite, chert, and a fine hematite schist (on its western edge).

The pegmatite is intrusive in a direction generally parallel with the schistosity of the country rock but changes in direction of at least 40° can be seen. It seems the greenstone may be folded—giving curved lines of weakness—but no evidence of this could be obtained from the exposures. Many of the outcrops of schist on hill slopes gave different readings of strike and dip but these were not considered reliable.

The Pegmatite.

The pegmatite is very coarse in character and consists of the potash felspar Microcline, the soda felspar Albite, Quartz, Muscovite, and accessory minerals—Tourmaline, Columbite and Beryl.

Columbite is the main economic mineral but marketable quantities of beryl are also won.

Zoning is most marked on the hanging wall of the pegmatite body (see sections).

Section AB shows a 5ft. thickness of albite on the hanging wall—in two zones. The first 2ft. is made up of albite and microcline felspars with tourmaline (2ft. long) as an accessory. This zone is bare of columbite.

The albite is the "curly" variety and is distinguishable from the microcline by its curly fracture. The microcline cleaves easily along well developed cleavage planes.

From 2-5ft. the felspar is mostly albite—the other minerals being muscovite (2in. to 3in. plates) and columbite. The columbite occurs in this zone in arrowheads and in rather a poorly developed crystal form. However, very little albite is intergrown with the columbite.

PLATE VI

Pegmatite and beryl floaters

N20°E 85°

Coarse-grained amphibolite

Greenstone

Fine-grained greenstone

OLD WORKINGS 3' N10°E 75°

N5°E 85°

Q

Boulders and rubble

Boulders of jaspilite greenstone, felspar etc.

C.M.L. 5448

Coarse-grained greenstone

Sparge's No 14

OLD WORKINGS 2' N10°E

Floaters of beryl and columbite

Greenstone and jaspilite rubble

Schistose greenstone

N15°E 40°

N10°E

Greenstone boulders

Greenstone

Beryl workings

P.A. 6449

Large mica (muscovite) flakes

Beryl

T

Tourmaline scattered through pegmatite

Boulders of jaspilite

Schistose greenstone

Boulders of pegmatite greenstone, jaspilite

Greenstone

Greenstone rubble No outcrops

Thin bands of muscovite

N20°W 80°

Dragfolds

Boulders of pegmatite greenstone, jaspilite

Greenstone with soil cover

Thin bands of muscovite

Patches of magnesite

N10°E 60° N55°W 80°

Microcline, mica some albite

Large tourmaline crystals with albite and microcline

Columbite in albite

Microcline falspar some albite

Greenstone rubble

Greenstone and magnesite

Magnesite and greenstone boulders

Amphibolite

M.C. 9

Greenstone rubble

Greenstone and magnesite

Greenstone rubble

Schistose greenstone

Elluvial workings

Columbite workings

Old costaan

Beryl

Columbite

N20°W 80°

SEE ENLARGEMENT

Fine-grained greenstone

N5°E Schistose greenstone

N20°E 80°

Albite and microcline some biotite

Columbite

Beryl (Aquamarine)

Amphibolite

Greenstone and magnesite

Coarse-grained amphibolite

Greenstone boulders and pebbles with magnesite and quartz pebbles

Greenstone

Columbite

Beryl

Albite and microcline

Greenstone

Amphibolite

Fine-grained greenstone

LEGEND

Alluvium and soil cover	
Pegmatite	
Greenstone	
Qfe (Banded quartz iron formation)	
Quartz	Q
Beryl	•
Columbite	○
Tourmaline	ΔT

REFERENCE TO SIGNS

Observed geological boundary	.....
Approximate geological boundary	- - - - - - -
Doubtful or assumed boundary	--?---?--
Strike and dip of schistosity	N20°W 80°
Strike of vertical schistosity	N5°E
Strike and dip of bedding	N10°E 70°
Strike of vertical bedding	N10°E
Strike and dip of jointing	N10°E 60°
Workings (with depth)	2'
Non-perennial drainage	
Outcrops	+ + +
Form lines	— — —

Note :- Heights are given with respect to an assumed datum of 70'-N. corner peg M.C.9

GEOLOGICAL SURVEY OF WESTERN AUSTRALIA

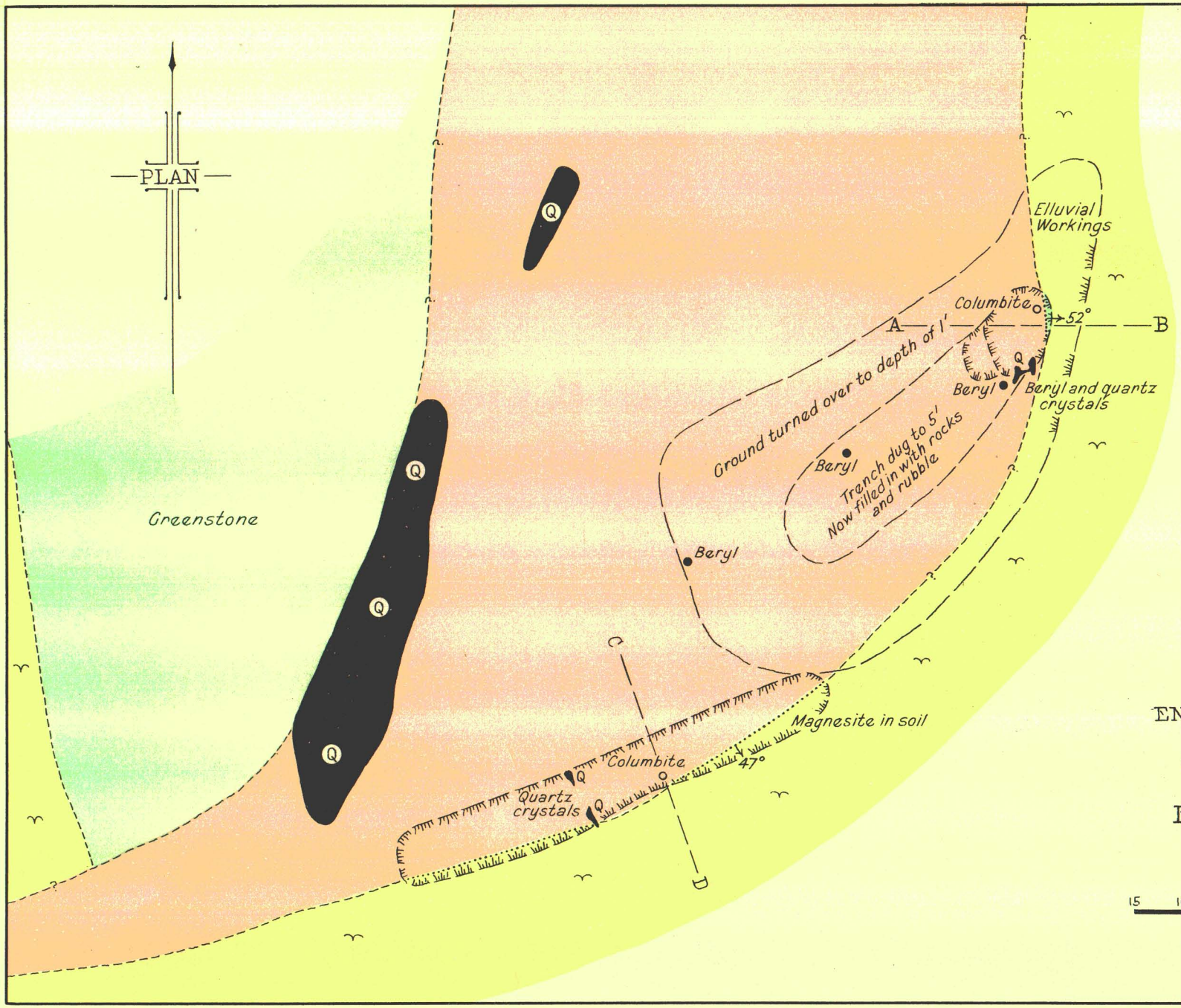
GEOLOGICAL MAP
— OF —
M.C. 9 AND P.A. 6449
— SPARGOVILLE —

COOLGARDIE DIST. — COOLGARDIE G.F.

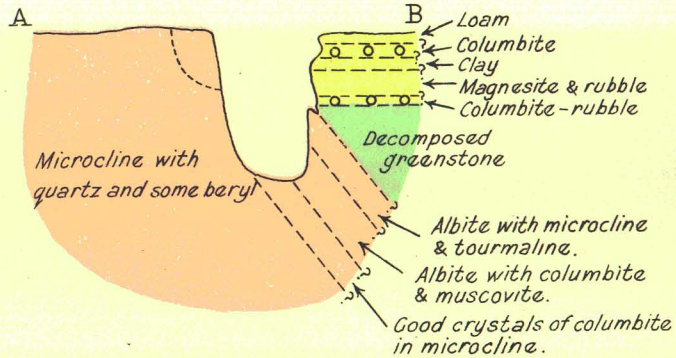
Scale of Feet

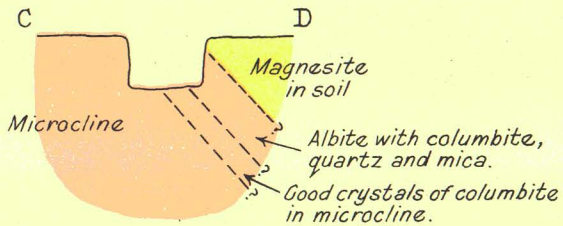
200 100 0 100 200 300

Geology, plane table and telescopic alidade survey by L. de la Hunty, Dec., 1951.



CROSS SECTIONS





ENLARGED PLAN AND SECTIONS
— OF —
COLUMBITE WORKINGS
— NEAR —
EAST CORNER OF M.C. 9
— SPARGOVILLE —

— Scale of Feet —

15 10 5 0 15 30

Survey and geology by L. de la Hunty, Dec., 1951

Up to 3ft. from the albite zone (i.e. 5ft.-8ft. from the hanging wall), good crystals of columbite of 1½lb. to 2lb. weight have been found in the microcline.

One of the characteristics of these columbite crystals is their well developed crystalline form. However, intergrowths of albite are a common feature in these crystals. This indicates that albitising solutions must have been responsible for the introduction of the columbite.

The pegmatite from 8ft. to the footwall is composed mainly of microcline with a little albite and with lenses of milky quartz.

Section CD shows a similar zoning to that of AB—except that the first 2ft. with microcline and tourmaline is "missing."

West of this line of section, the pegmatite narrows down to a width of 10ft. and less, and zoning is not marked. The pegmatite here is composed of both microcline and albite with a number of quartz lenses (? cores). Other minerals occurring are beryl (aquamarines, mostly small) some columbite and tourmaline. Biotite occurs in thin bands of fine flakes on the footwall.

North of the columbite workings, albite felspar occurs with microcline on the surface, sloping to the east. This indicates that the surface may be (more or less) the hanging wall of a flatly dipping tabular pegmatite.

One notable feature of the main dyke is that there is practically no mineralisation apparent on the footwall. The only work done on the footwall side of the outcrop has been prospecting for eluvial minerals. This was singularly unsuccessful.

Thin bands of fine mica were observed at the contact of the pegmatite with the greenstone island at the north corner peg of MC 9. These bands, together with the mica bands already noted to the south west, are the only indications that any assimilation of the country rock, by the pegmatite solutions, took place.

Columbite.

Columbite is a member of the isomorphous columbite—tantalite series (Fe, Mn) (Nb, Ta)$_2$O$_6$. The series passes by insensible gradations from normal columbite, the nearly pure niobate, to normal tantalite, the nearly pure tantalate.

The columbite mined on MC 9 has a high percentage of niobium and little or no manganese. Analyses of two parcels shipped to London in June and July, 1951, showed Nb_2O_5 percentages of 68.50% and 65.52% respectively. Details:—

3 Drums Columbite/Tantalite, 7 cwts. 3 qrs. 2 lb.

Assay:	Nb_2O_5	68.50%	76.15%
	Ta_2O_5	7.65%	
	TiO_2	.70%	
	SnO_2	.40%	

Price per unit, 317s. 6d., English currency.

8 Drums Columbite, 1 ton 1 cwt. 2 qrs. 14 lb.

Assay:	Nb_2O_5	65.52%	73.00%
	Ta_2O_5	7.48%	

Price per unit, 265s., English currency.

Note.—Units are: 1% per long ton = 1 unit.

The columbite on MC 9 is won from two sources:—

(a) Lode.—Occurs on the hanging wall in the albite zones and adjacent microcline. It does not persist as a band along the strike but occurs rather as patches within the zones. The maximum width over which it has been seen to occur is 6 ft. Further columbite is probably hidden under soil cover to the north of the present workings.

(b) Eluvial.—Eluvial columbite has proved quite a good proposition where it has been worked—adjacent to the lode.

Prospecting for alluvial columbite downstream from the columbite workings proved unsuccessful. This is probably due to the high S.G. of columbite coupled with the low velocity of the stream.

Other Minerals.

Beryl.—(a) Lode: Occurs near some quartz masses but not all of them. It is often associated with the clear variety of quartz and is difficult to distinguish from the quartz. Both the clear and green varieties (aquamarine) of beryl have been found—mostly in small crystals (up to 3in. long). Odd crystals weighing several pounds have also been mined.

(b) Eluvial.—Floaters of beryl have been picked up in small quantities.

Quartz.—A few clear crystals of quartz have been found (near section line CD) and clear quartz veins occur. However, the dominant type is the bare milky variety.

Mica.—The mica is mainly muscovite and is too small and impure to have any commercial value.

Tourmaline.—Has no economic value. It is of the common black variety and is likely to be confused with columbite at first glance. However, it has a much lower S.G. and crystallises in a very characteristic form—making determination fairly simple.

Albite.—The soda felspar is an aid in prospecting for columbite but has little commercial value.

Microcline.—This felspar (potash variety) is very clean and should be worth shipment when sufficient quantities are mined out.

Recommendations for Development.

(a) Cut a series of trenches, 50ft. apart, across the approximate position of the hanging wall of the pegmatite—from the columbite workings northwards; i.e., across a line drawn from the present deep pit through the south corner peg of PA 6449.

Trenches dug east from this line should expose the hanging wall and will give a good idea of the amount of eluvial columbite in the overlying soil.

It is possible that the hanging wall may be up to 50 feet east of the present solid line of outcrop, and have a soil cover of up to 10 feet.

(b) If these trenches indicate good prospects, the hanging wall should be exposed along such length as appears promising.

(c) Since the columbite is patchy, within and adjacent to the albite zone, winzing, rather than driving, seems the best method of development at depth.

Index to Geological Survey Annual Progress Report for 1951.

Division V.

School of Mines, Western Australia.

The Under Secretary for Mines.

I have the honour to submit for the information of the Hon. the Minister for Mines my report on the School of Mines for the year 1951.

KALGOORLIE.

Enrolments.

The total number of enrolments received during the year was 388—a decrease of two by comparison with the previous year. The total number of Eastern Goldfields High School boys taking sub-junior or junior geology increased from 20 in 1950 to 49 in 1951. The number of normal School of Mines students therefore decreased by 31. Table I gives the individual and class enrolments for 1949, 1950, and 1951; and Table II gives the enrolments in the various classes for 1951.

TABLE I.

Enrolments—1949, 1950, 1951.

Year	First Term.		Second Term.		Third Term.	
	Individual.	Class.	Individual.	Class.	Individual.	Class.
1949	344	1,077	307	958	258	841
1950	361	907	320	771	309	671
1951	368	794	321	652	281	550

During the year rather more students than usual discontinued their studies. Only 51 per cent. of the possible attendances were made at the Annual Examinations—for 1950 the corresponding figure was 61. This will be referred to again in a later section of the report (Table III).

TABLE II.

Class Enrolments, 1951.

Subject.	1st Term.	2nd Term.	3rd Term.
Preparatory Chemistry	24	17	11
Chemistry IA	13	11	8
Chemistry IB	8	8	8
Analytical Chemistry I	7	5	5
Analytical Chemistry II	10	6	5
Applied Chemistry	3	3	3
Metallurgy I	—	—	—
Metallurgy II	6	6	5
Assaying	14	14	14
Mineral Dressing	7	7	4
Metallurgy and Mineral Dressing	14	14	13
Metallography	5	6	6
Preparatory Mathematics	36	27	22
Mathematics IA	45	38	30
Mathematics IB	—	—	—
Mathematics IIA	39	38	35
Mathematics IIB	7	7	5
Applied Mathematics	19	13	12
Preparatory Physics	20	14	11
Physics IA	19	19	17
Physics IB	17	16	16
Trade Mathematics I	39	19	11
Trade Mathematics II	—	—	1
Preparatory Engineering Drawing	29	19	10
Engineering Drawing I	28	23	19
Engineering Drawing and Design IIA	21	17	14
Engineering Drawing and Design IIB	1	—	—
Engineering Drawing and Design IIC	4	3	3
Engineering Drawing and Design IID	3	2	1
Survey Drawing II	3	4	5
Mechanical Engineering I	11	10	10
Mechanical Engineering II	—	—	—
Practical Electricity	23	11	7
Electrical Engineering I	17	15	13
Electrical Engineering II	5	5	5
Internal Combustion Engines	16	8	8
Workshop Practice I	18	11	8
Workshop Practice II	20	10	7
Workshop Practice III	9	9	5
Welding I	27	25	21
Welding II	8	8	8
Engine Driving	—	—	—
Structural Engineering I	12	11	9
Structural Engineering II	4	4	3
Hydraulics	8	7	7
Machine Design	7	6	6
Materials of Construction	6	5	5
Preparatory Geology	15	14	11
Geology IA	12	12	12
Geology IB	15	14	13
Geology IIA	6	5	4
Geology IIB	3	3	3
Geology III	—	—	—
Mining I	8	8	7
Mining II	11	9	8
Mining IIA	1	—	—
Mining IIB and C	—	2	2
Mining III	4	4	1
Surveying I	7	5	5
Surveying II	12	11	10
Surveying IIA	—	—	—
Preparatory English	7	4	3
Technical English	15	15	13
Junior Geology	11	11	10
Sub-Junior Geology	35	34	32
Total	794	652	550

The total enrolment was made up as follows:—

1.	Students paying class fees (21 years of age or over)		
	Full-time	6	
	Part-time	91	
		—	97
2.	C.R.T.S. students, Class fees paid by C.R.T.S.		
	Full-time	2	
	Part-time	40	
		—	42
3.	Students paying only a registration fee (5s.), or students who are exempt from fees, including Eastern Goldfields High School pupils taking geology		
	Full-time	3	
	Part-time	174	
		—	177
4.	Students who are returned servicemen, and who are exempt from fees (General Regulation 5). Not enrolled under C.R.T.S.		
	Full-time	—	
	Part-time	72	
		—	72
		TOTAL	388

Revenue.

Revenue amounting to £568 16s. 1d. was received from students enrolled under groups 1, 2 and 3 (part), from fees received for diplomas and certificates, and from the sale of books. Many students enrolled under group 3 were not required to pay the registration fee of 5s. Fees received for work done in the Metallurgical Laboratory and paid into a Trust Fund amounted to £189 4s. 6d.

Courses of Study.

The courses of study available remained as for 1950. One new subject, Workshop Practice III, was commenced.

Annual and Supplementary Examinations.

The Annual Examinations were held from Monday, 29th October to Tuesday, 13th November, inclusive, and the Supplementary Examinations on Monday, 4th February, 1952; on Wednesday, 6th February, 1952, and on Friday, 8th February, 1952.

For the Annual Examinations 434 entries for individual subjects were received, which is 51 per cent of the total class enrolments. This figure is lower than the corresponding figure for 1950, which was 61 per cent. Of those who entered for these examinations, 79 per cent passed. The total number of supplementary examinations granted was 37. Thirty three entries were received for these examinations and 20 students passed. The percentage of passes at the supplementary examinations was 60, which is eight per cent. lower than in the previous year. The percentage of those who passed at the Annual Examinations or at the Supplementary Examinations is 84. The total number of subjects in which the number of students who sat for the Annual Examination was less than 50 per cent, was 19—an increase of nine by comparison with 1950. A summary of the examination results for the period 1946 to 1951 inclusive, is given in Table III.

Scholarships and Prizes.

Although the Mines Department Scholarships have been made more attractive in recent years, no entries for these were received during 1951, nor were any students holding the Scholarships from previous years.

TABLE III.

Summary of Examination Results, 1946-1951.

	1946	1947	1948	1949	1950	1951
Class enrolments=A	1,331	1,834	1,498	1,129	946	833
Number of entries for annual examination=B	880	1,196	1,097	750	579	434
B/A per cent.	66	64	73	66	61	51
Number of students passing at annual examinations, as a per cent. of A	58	53	55	49	48	41
Number of students passing at annual examinations, as a per cent. of B	88	81	76	74	78	79
Number of students passing at annual and supplementary examinations as a per cent. of A	60	55	57	52	50	44
Number of students passing at annual and supplementary examinations as a per cent. of B	90	84	79	78	81	84

Diplomas and Certificates.

The following Diplomas and Certificates were issued during 1951:—

Associateship Course in Metallurgy	2
Associateship Course in Mining	2
Associateship Course in Engineering	4
Associateship Course in Mining Geology	3
Total	11
Assayer's Certificate	3
Surveyor's Certificate	9
Engineering Draughtsman's Certificate	2
Electrical Engineer's Certificate	—
Mechanical Engineer's Certificate	—
Engine Operation and Maintenance Certificate	—
Geologist's Certificate	1
Total	15

Commonwealth Reconstruction Training Scheme.

Trainees under the Scheme still attended the School. Details are as follows:—

	1950.	1951.
Full-time	9	2
Part-time	54	40

The two full-time trainees both completed a good year's work, and both exhausted the period of training available to them under C.R.T.S. Neither student has completed his course, but both intend to continue studies. Many part-time C.R.T.S. students have almost exhausted the funds available to them, and their numbers will decrease rapidly during the next year or so.

Classes for High School Pupils.

Classes in geology for High School pupils were continued. During 1951 classes both in sub-junior geology and in junior geology were held. This arrangement worked satisfactorily during the year. The number of students enrolled was as follows:—

	1950.	1951.
Sub-junior geology	20	37
Junior geology	—	12

Of the 12 pupils enrolled for junior geology 9 passed this subject at the Junior Certificate Examination and one left during the year. These classes will continue during 1952.

Services to the Public.

During 1951 the School continued to provide a number of services other than its teaching activities to the public.

The work done in the Metallurgical Laboratory will be referred to in more detail in a later section of this report. During the year 47 samples were received for investigation. In addition to the work done on these samples the Senior Research Metallurgist continued to give advice when this was required.

During the year 345 samples were received from prospectors and others for assay or determination —a decrease of 39 by comparison with 1950. The number of samples submitted for assay for metals other than gold was 42—an increase of 28. The number of samples submitted for gold assay was 139. Other samples were for determination. All assays were done in the Metallurgical Laboratory, and all determinations were made by Mr. Cleverly, the lecturer in charge of geology.

As in previous years the Director acted as Local Secretary for the University of Western Australia for the University Annual Examinations and for the Junior and Leaving Examinations. Supervision and accommodation were also provided for other examining bodies.

Various professional bodies continued to meet at the School.

During the year parties of boys from the various schools in Kalgoorlie visited the School of Mines.

Buildings.

No new buildings were added during the year. The School buildings are generally in satisfactory condition. Reference will be made in a later section of this report (Requirements of the School) to additional buildings under consideration.

Visit of Director to Eastern States.

From 28th July to 26th August the Director visited various Technical Colleges, Schools of Mines, and Universities in South Australia, in Victoria and in New South Wales. Visits were also made to various scientific and technical organisations, and to various firms and works. A short preliminary report has been submitted, and a more detailed report will be prepared. At all places visited very generous assistance was received from members of the staffs, and information was made freely available.

During the visit the following general impressions were gained:—

1. During the past few years all teaching institutions have extended and developed their activities. Many courses and departments have been re-organised or are being re-organised at the present time. Much new equipment has been added and in Adelaide many new buildings have been constructed both at the School of Mines and Industries and at the University.

2. In Adelaide there is close co-operation between the School of Mines and Industries and the University, particularly for courses in mining and in metallurgy.

3. The Mines Department of South Australia is very strong, and particularly well organised on the technical side. Very good facilities for geological work, for drilling, and for metallurgical work are available. All appear to be very well co-ordinated.

4. The Department of Economic Geology at Adelaide University appears to offer good opportunities to students for post graduate training.

5. All Universities and many Technical Colleges have very extensive laboratories and general facilities for training in engineering.

6. The N.S.W. University of Technology and Sydney Technical College are expanding very rapidly, and large sums of money are available for equipment and for staff. Very good facilities appear to be available generally in New South Wales for technical education.

7. One of the highlights of the trip was the visit to Newcastle Technical College, with its very fine buildings and equipment.

8. Mining at Broken Hill appears to be in a very strong position, and the general appearance of mines, especially Zinc Corporation and New Broken Hill Consolidated is very impressive.

9. There is a growing tendency for students to be given time off to attend classes at technical schools, and many courses are planned to allow for this. At Broken Hill there is a definite agreement under which students attend in the day time an equivalent number of hours to those attended at night, provided that the time off for day study cannot exceed six hours per week. The course in metalliferous mining at Broken Hill extends over five years, and provides for 12 hours study each week during the School year.

Requirements of the School.

The principal requirements of the School were referred to in the Annual Report for 1950. Progress is recorded in the following paragraphs.

Re-organisation of the electrical installations in the School was completed during the year, all lighting was improved, and additional power points were provided. The lighting throughout the School is now good except in the workshop and all electrical installations are in good condition. Arrangements for the transfer of the School to A.C. supply were completed, and this transfer was made in February, 1952.

Further improvements were made in the workshop, and two new machines were added—an additional milling machine and a tool and cutter grinder. Improvements to the workshop were slowed down towards the end of the year because we were unable to obtain a fitter and turner to replace Mr. Collins, who was promoted to the Staff. The workshop is now well equipped for all ordinary work, and any further improvements should provide for precision equipment to enable tool room procedure to be taught.

All the equipment originally ordered for the electrical laboratory has now been received and is being installed. Some additional equipment was ordered during the year.

During the year a tender was accepted for the fume cupboards and exhaust system in the chemical laboratories, but no further progress has been made with this work because of the difficulty of obtaining certain fibrolite ducting. It is hoped that this will be overcome during 1952, and this very essential work completed.

Approval was given during the year for alterations to the office to provide a strong room and to provide additional space.

During the year plans were prepared for a library, but the building of this was deferred.

The requirements listed in last year's Annual Report therefore still remain outstanding, and are as follows:—

(i) A mineral dressing laboratory for the use of students.

(ii) New fume cupboards, with mechanical ventilation, for the chemical laboratories.

(iii) A central library, and a full-time library staff.

(iv) Improved office accommodation.

In addition to the above consideration must be given during the next few years to the provision of additional laboratories for the Engineering Department, and to the provision of additional space for the Mining Department.

Advisory Committee.

During the year the Committee met on eight occasions. For portion of the year Mr. J. E. Manners was away from Kalgoorlie, and Mr. E. B. Mundle was appointed to replace him. Attendances at the meetings were as follows:—

Mr. J. H. Verran	7
Mr. J. E. Manners (possible 5)	4
Mr. E. B. Mundle (possible 3)	2
Mr. C. H. Warman	6
Mr. J. A. Maloney	5
Mr. W. R. Mathews	2
Mr. R. A. Hobson	8

A further grant of £2,000 was received for the Apparatus and Equipment Trust Fund—£1,000 from the Chamber of Mines and £1,000 from the Mines Department. Equipment estimated to cost £1,348

has been ordered. Much of this equipment is still outstanding, and the actual cost will be more than the estimated cost.

Plans for the proposed library have been prepared, but no funds were available during the year.

Metallurgical Research Laboratory.

During the year the Laboratory Staff, consisting of two research metallurgists, two laboratory technicians, and one laboratory assistant, working under the technical direction of the Senior Research Metallurgist, was kept fully occupied with metallurgical investigations into problems associated with the mining industry.

Forty-five reports were issued during the year, and details are to be found in Appendix 1. The work done is summarized below:—

1. Fourteen reports were concerned with metallurgical investigations into methods of treatment of gold ores and tailings. Several of the ores investigated were complex, and the investigations were quite extensive. One large-scale pilot plant test covering grinding, thickening, cyanidation, and filtering was carried out continuously over a period of six days.

2. Two investigations into a gold-pyrrhotite ore for the production of an iron sulphide concentrate suitable for sulphuric acid manufacture without reduction of gold recovery.

3. Two investigations into the beneficiation of Western Australian coastal limestone.

4. Two pilot plant investigations into the recovery of scheelite.

5. One extensive investigation into the recovery of a saleable lead and zinc concentrate from a complex lead-zinc-copper ore.

6. An investigation of gold-copper tailings for the recovery of gold and copper.

7. A series of mortar compression failure tests to determine the characteristics of various local sands.

8. Twenty-two reports covering analyses or assay only and not involving any metallurgical test work. These reports do not include assays or chemical analyses made for prospectors under the free assay regulations.

In addition to the work referred to above, 197 free assays or analyses were made for prospectors.

For the above investigations 652 individual metallurgical tests were completed and 4,392 chemical analyses and assays were made.

During the year a considerable number of enquiries from various people engaged in the mining industry were answered by the Laboratory staff.

The pilot scale investigations were handicapped by lack of equipment. Much of the equipment required has been ordered, but delivery has been delayed for various reasons. During the year also consideration has been given to much needed alterations to the building, and plans are now under consideration. Additional equipment and improved buildings would improve the service which the Laboratory can give to the industry.

NORSEMAN.

Enrolments.

The total number of enrolments received during the year was 52 — a decrease of three by comparison with 1950. In addition to these students 40 pupils of the State School and of the Convent were enrolled for sub-junior or for junior science subjects. The numbers enrolled in 1949, 1950 and 1951 are given in Table IV—State School or Convent children are not included.

TABLE IV.

Enrolments—1949, 1950, 1951.

Year.	First Term.		Second Term.		Third Term.	
	Individual.	Class.	Individual.	Class.	Individual.	Class.
1949	71	139	65	128	57	113
1950	50	97	46	89	41	75
1951	49	112	39	90	31	72

Revenue.

The revenue received was £37 5s. 6d. As in previous years many students were under 21, and did not pay class fees. Others were returned servicemen and were exempt from class fees.

Subjects Taught.

Twenty-one School of Mines subjects were taught at Norseman during 1951. As in previous years classes in Workshop Practice and in Welding were held in workshops of the Central Norseman Gold Mines, and thanks are due to that Company for making their workshops available.

Annual and Supplementary Examinations.

The entries received for the Annual Examinations were 61 per cent. of the total class enrolments, and of those who entered, 88 per cent. were successful. Three students were granted supplementary examinations, and one entry was received for these examinations. A summary of examination results for the years 1946 to 1951 inclusive is given in Table V.

These results are considered to be satisfactory, and are rather better than the corresponding results at Kalgoorlie.

Scholarships and Prizes.

The Reg. Dowson Scholarships for 1951 were awarded to J. K. Hall and R. W. Pettit. The two students, E. J. Lea and R. K. Harris, who were awarded these Scholarships at the end of 1950 both completed a satisfactory year's work in 1951.

Building.

As more equipment is provided at Norseman so the building is becoming more and more congested. Plans have been prepared for increased accommodation, but, unfortunately, funds could not be made available during 1951, and construction of the building had to be deferred. Numbers have remained steady at Norseman, and with the increased mining activity, numbers should increase during the next few years. Provision should be made for increased accommodation at Norseman during 1952.

Advisory Committee.

The Advisory Committee continued to meet under the chairmanship of Mr. Dutton, and the thanks of the School are due to members of the Committee who gave of their time to assist the School.

Classes for School Children.

The classes in sub-junior and junior science subjects for State School and for Convent children were continued in 1951. Classes were held in Chemistry, Physics, Geology and Drawing, and the total number of children so enrolled was 40. During the year the Director of Education decided that the Education Department would itself teach any science required at the State School in 1952, and accordingly no arrangements were made to continue with these subjects at the School of Mines.

TABLE V.

Summary of Examination Results, 1946-1951.

	1946	1947	1948	1949	1950	1951
Class enrolments=A	80	54	130	130	78	112
Number of entries for annual examinations=B	57	47	107	81	47	68
B/A per cent.	71	87	82	62	60	61
Number of students passing at annual examinations, as a per cent. of A	51	72	59	47	55	53
Number of students passing at annual examinations, as a per cent. of B	72	83	81	77	91	88
Number of students passing at annual and supplementary examinations as a per cent. of A	51	72	68	50	56	54
Number of students passing at annual and supplementary examinations as a per cent. of B	71	83	85	81	93	89

ACKNOWLEDGMENTS.

In conclusion I would like to thank the Registrar, Mr. Lumb; the Registrar at Norseman, Mr. Taylor; and the Senior Research Metallurgist for supplying information for this report. Appreciation is also due to all members of the Staff both at Kalgoorlie and at Norseman, who have conscientously endeavoured to assist students throughout the year. Throughout the year Staff Conferences with Lecturers in charge of Departments have been held regularly, and my thanks are due to them for assistance and co-operation at all times. Finally, thanks are due to members of the Advisory Committees at Kalgoorlie and at Norseman.

R. A. HOBSON,
Director, School of Mines.

APPENDIX 1.

KALGOORLIE METALLURGICAL LABORATORY.

By C. H. S. MEHARRY, A.W.A.SM. (Mining and Met.), M. Aust. I.M.M., Senior Research Metallurgist.

INTRODUCTION.

A total of 45 reports of investigations were issued during 1951 involving 652 individual metallurgical tests and 4392 chemical determinations and assays. Included in the above total are 197 assays and chemical determinations carried out under the free assays for prospectors regulations.

The following gives a brief description of the more interesting reports and a table is included showing the complete list of investigations, locality of sample, ore type, and scope of test work.

Any person wishing to obtain copies of these reports may do so by applying to the

Senior Information Officer,
Information Service,
C.S.I.R.O.,
314 Albert Street,
East Melbourne, Victoria.

where they will be available six months after date of issue, except in special cases where a longer time is granted.

GOLD ORES AND PRODUCTS.

Fourteen reports were issued detailing test work carried out on the determination of methods of treatment of gold ores and products. A brief description of the more comprehensive reports is given below.

Report 461.

Three samples of gold ore containing some lead and copper sulphides were received from Tarcoola, South Australia, with a request to determine a simple method of treatment to recover the gold and other metals.

Tests showed that a good recovery of gold could be obtained by fine grinding, straking and agitation cyanidation. The small amount of lead present in the ore was difficult to recover by gravity concentration due to the extremely friable nature of the galena. The small tonnage of ore available would hardly warrant flotation particularly as the ore contained iron sulphides thus necessitating differential flotation. An interesting feature of the cyanidation work was the fact that reprecipitation of gold occurred after 12 hours agitation.

Report 476.

An oxidised gold ore from Kundip, W.A., gave excellent gold recoveries by amalgamation and cyanidation after grinding to minus 40 mesh I.M.M., but the ground material proved very difficult to filter or leach. A satisfactory answer to the problem was obtained by adding finely ground activated charcoal to the cyanide pulp and flotation of the charcoal. The gold precipitated on the charcoal which could be burned and the ash smelted to recover the gold.

Report 486.

A hematite-gold ore from Tennant Creek, Northern Territory, containing much coarse gold was the subject of this report, and a series of straking and amalgamation tests at various meshes of grind were carried out. The results of these tests clearly showed the advantage of straking this type of gold ore at several stages during size reduction.

A test using a diaphragm jig instead of strakes in the coarser sizes showed promise.

Cyanidation of the strake tailings presented no difficulties.

Report 498.

A 120 hour continuous grinding, cyanidation and filtration test using the laboratory pilot plant was carried out on an oxidised gold ore from Bullfinch, W.A. The purpose of the test was to detect any cover blinding of the filter and to confirm laboratory batch tests. No measurable cover blinding occurred during the test and the batch tests were confirmed.

Report 505.

Tests to determine a method of treatment of a quartz-gold ore from Yundamindera, W.A.

Satisfactory extraction of gold was obtained by straking and amalgamation after fine grinding. This ore contained much coarse free gold and the advantage of step straking during grinding was clearly shown.

Cyanidation of the strake tailings presented no difficulties.

Report 509.

A method of accurately sampling the gold contents of churn drill borings was developed in this report.

A series of tests showed that by screening out the plus ¼th inch material and tabling the minus ¼th inch material the gold recovered by amalgamation of the table concentrate gave a relatively accurate measure of the gold contents of the borings. The assay values of the slime, sand tailing, table middling and amalgamation tailing were found to be relatively constant and only periodical assays would be necessary on these products.

Assay values of dip samples of the borings showed no relation to the true gold values of the borings.

Report 518.

Detailed tests to improve gold recovery by cyanidation and amalgamation at Broad Arrow, W.A. The ore treated contains some pyrrhotite and copper minerals, and the practice of storing the amalgamation tailings in dams for long periods gives rise to considerable decomposition of sulphides. The acid salts formed by this decomposition have a serious effect on reagent consumption and give rise to much copper in the bullion.

The test showed that the freshly ground ore gave lower lime and cyanide consumption than the same material after months of storing.

Regrinding of the stored tailings gave increased extraction by amalgamation.

It was recommended to the owners that the amalgamation tailings be leached as soon as possible after crushing and that cyanide strengths be kept as low as possible to reduce the tendency of the copper to dissolve.

SULPHUR PRODUCTION.

Reports 489 and 507.

These two reports detail test work carried out on Hill 50 Gold Mines ore in an attempt to produce an iron sulphide concentrate suitable for sulphuric acid manufacture, without seriously affecting the gold recovery.

The major iron sulphide mineral in the ore is pyrrhotite and to enable post cyanidation flotation tests to be carried out under the best conditions a research metallurgist from the laboratory carried out tests at the mine.

The post cyanidation flotation tests were not satisfactory in that a poor sulphur recovery was obtained and arrangements were made for an ore sample to be sent to the laboratory.

Post cyanidation flotation tests on this sample gave similar results to the results of the tests on the mine.

Excellent sulphur and gold recoveries were obtained by flotation after fine grinding and amalgamation. The pyrrhotite concentrate was then cyanided by agitation and good recovery of gold obtained.

The recovery of gold by "straight" cyanidation and the recovery of gold by flotation followed by cyanidation of the concentrate were substantially the same. An interesting fact was that the cyanide and lime consumption per ton of ore was much lower with the cyanidation of the concentrates only, than with the cyanidation of the ore.

Report 507.

At the request of the management of the Hill 50 Mine a further ore sample was investigated. This sample gave similar results to the sample received for Report 487 except that the final residue from "straight" cyanidation and the calculated tailing from flotation plus cyanidation of the concentrate although approximately the same gold value were much higher than that for the ore of Report 489.

COPPER-GOLD RECOVERY.

Report 478.

An investigation to recover copper and gold from a tailings dump at Widgiemooltha.

Grinding, amalgamation and flotation tests showed that a good recovery of both copper and gold could be made. In order to make a saleable copper concentrate it was necessary to condition with lime and cyanide to depress barren pyrite before flotation.

LIMESTONE BENEFICIATION.

Two reports (487 and 503) were issued on test work carried out on the beneficiation of Western Australian coastal limestone.

Report 487.

Flotation concentrates assaying approximately 90 per cent. $CaCO_3$ were produced from ground limestone of a grade of approximately 70 per cent. $CaCO_3$ with a recovery of about 90 per cent. of the $CaCO_3$.

Report 503.

The samples supplied for this investigation were much lower grade (about 50 per cent. $CaCO_3$) but a satisfactory recovery and grade were obtained by grinding, rejecting the coarse material, mainly silica, and flotation of the fine material.

LEAD-ZINC RECOVERY.

Report 497.

A lead-zinc ore from the Protheroe Lead Mine, Northampton field, Western Australia, was the subject of this report.

The object of the investigation was to produce a saleable lead concentrate from the tailings from the gravity concentrating plant.

Bulk flotation after grinding, depressing the pyrite present with lime, gave a relatively low-grade lead concentrate owing to contamination with zinc sulphide.

Differential flotation, after grinding, using lime, zinc sulphate and cyanide to depress the pyrite and sphalerite gave a reasonable recovery of lead in a high-grade concentrate. Flotation of the lead flotation tailing yielded a saleable zinc concentrate.

A feature of the sample investigated was the activity of the sphalerite during flotation and difficulty was experienced in depressing this mineral while floating the galena.

WOLFRAM RECOVERY.

Report 508.

A bulk gravity concentrating test using rolls crushing to minus ½in. followed by jigging and tabling gave excellent recovery of scheelite from half a ton of ore from Comet Vale, Western Australia.

Report 512.

Details of an attempt to use crushing in rolls to 10 mesh and tabling as a means of accurately sampling low-grade scheelite ores.

The attempt was not successful due to the fineness of dissemination of the scheelite and the presence of considerable pyrite in the ore tested.

LIME-MORTAR TESTS.

Report 484.

This report gives the results of tests to determine the failure by compression of lime, portland cement, sand mortars made up in varying proportions and using a number of local sands.

The tests show the advantage of slaking the lime seven days before use and the effect of coarse sand in reducing shrinkage.

It was found that a mortar made up in the proportions of one of cement, two of lime and six of sand gave a compressive strength of 380 lb. per square inch at seven days and 470 lb. per square inch at 28 days.

CHEMICAL ANALYSES AND ASSAYS.

Twenty-two reports were issued, giving the results of analyses and assays carried out for various interests. The table included in this appendix gives the main details.

One hundred and ninety-seven assays and chemical determinations were made during the year under the free assays for prospectors regulations.

INQUIRIES.

An increased number of inquiries dealing with the technical problems of people engaged in the mining industry were handled by the laboratory staff during the year.

Table I.

Kalgoorlie Metallurgical Laboratory—Summary of Year's Work (1951).

Report No.	Owner.	State.	Locality.	Ore Type.	Type of Investigation.	Date available for publication.	No. of Metallurgical Tests.
461	Standard Mining Co.	S.A.	Tarcoola	Gold-Lead	Method of Treatment	4–1–52	134
466	Seddon, H.	W.A.	Burbidge	Iron	Sizing and Analysis	21–8–51	1
470	Parker, O. J.	Qld.	Irvinebank	Tin	Sampling-Analysis	1–11–51	....
472	Beard, P. D.	W.A.	Kundip	Copper - Gold Tailings	Method of Treatment	17–3–52	17
476	Johnson Bros.	W.A.	Kundip	Gold Tailings	Method of Treatment	1–11–51	31
477	Murray Bros.	W.A.	Lakeside	Gold	Method of Treatment	7–9–51	....
478	Mines Dept. of W.A.	W.A.	Paris Group	Gold-Copper	Method of Treatment	8–8–51	19
479	Webster, T.	W.A.	Westonia	Gold	Treatment of Tailings	22–11–51	4
480	Hronsky, V.	W.A.	Yornup	Iron-Manganese	Analysis only	15–8–51	....

Table 1—*continued.*

Report No.	Owner.	State.	Locality.	Ore Type.	Type of Investigation.	Date available for publication.	No. of Metallurgical Tests.
481	McLeod, D.	W.A.	Marble Bar	Wolfram	Analysis only	17–7–51	....
482	Lindsay & Smith	W.A.	Daveyhurst	Gold	Method of Treatment	15–9–51	3
483	Broken Hill Pty., Ltd.	W.A.	Kalgoorlie	Gold-Copper	Analysis only	2–11–51	....
484	Kalgoorlie Power Corp.	W.A.	Kalgoorlie	....	Mortar Failure Tests	21–2–52	15
486	Aust. Development N.L.	N.T.	Tennant Creek	Gold	Method of Treatment	28–3–52	24
487	Parry & Elmquist, Ltd.	W.A.	Cockburn Sound Area	Limestone	Beneficiation	10–5–52	27
489	Dept. of Industrial Development of W.A.	W.A.	Hill 50 Gold Mine, Mt. Magnet	Sulphur-Gold	Sulphur Beneficiation	28–11–51	86
490	Macaboy, H.	W.A.	Kalgoorlie	Gold	Assays only	5–11–51	....
491	Haoma Syndicate	W.A.	Mt. Monger	Gold	Treatment of Tailings	28–11–51	27
492	Byne, E.	W.A.	Northampton Area	Lead	Analysis only	6–12–51	....
493	Cancelled						
494	Allen & Brimage....	W.A.	Yunndaga	Gold	Assays only	1–11–51	....
496	Hicks, H. C.	W.A.	Spargoville	Sulphur	Analysis only	23–11–51	....
497	Anglo-Westralian Pty., Ltd.	W.A.	Nabawa	Lead-Zinc	Method of Treatment	27–5–52	30
498	Western Mining Corp.	W.A.	Bullfinch	Gold	Pilot Plant Test	18–6–52	1
499	Alford, V.	W.A.	Coolgardie	Gold	Amalgamation Tests	27–2–51	1
500	Broken Hill Pty., Ltd.	W.A.	Higginsville	Wolfram	Analysis only	12–12–51	....
501	Ibbotson, R.	W.A.	Uaroo	Lead	Analysis only	30–7–52	....
502	Lake View & Star, Ltd.	W.A.	Fimiston	Gold	Assays only	11–1–52	....
503	Parry & Elmquist, Ltd.	W.A.	Cockburn Sound Area	Limestone	Beneficiation	23–8–52	12
504	Croesus Pty., Ltd.	W.A.	Fimiston	Sulphur-Gold	Analysis only	17–2–52	....
505	Linden Gold Mines	W.A.	Yundamindera	Gold	Method of Treatment	2–7–52	18
507	Hill 50 Gold Mine	W.A.	Mt. Magnet	Sulphur-Gold	Sulphur Beneficiation	11–6–52	102
508	Evans, D. J.	W.A.	Comet Vale	Wolfram	Scheelite Beneficiation	22–4–52	1
509	Western Mining Corp.	W.A.	Norseman	Gold	Sampling of churn drill borings	10–4–52	10
510	Mines Dept. of W.A.	W.A.	Ora Banda	Wolfram	Analysis only	27–2–52	....
511	Broken Hill Pty., Ltd.	W.A.	Coobina	Chromite and Scheelite	Analysis only	27–3–52	....
512	Broken Hill Pty., Ltd.	W.A.	Kalgoorlie	Wolfram	Beneficiation	4–7–52	6
513	Mines Dept. of W.A.	W.A.	Darlot	Gold	Assays only	22–4–52	....
515	Cancelled						
516	Bruce & Merton	W.A.	Coolgardie	Gold	Treatment Tests	6–5–52	3
517	Golden Horseshoe (New), Ltd.	W.A.	Fimiston	....	Analysis of Gold Room Slime	2–7–52	....
518	Rowan & Morrison	W.A.	Broad Arrow	Gold	Treatment of Tailings	7–7–52	31
519	Burrows, W.	W.A.	Peak Hill	Gold	Assays only	6–5–52	....
520	Dunnet, E. C.	W.A.	Prairie Downs, via Meekatharra	Copper	Analysis only	8–5–52	....
522	Western Mining Corp.	W.A.	Bullfinch	Wolfram	Analysis only	16–5–52	....
524	Mines Dept. of W.A.	W.A.	Norseman	Copper	Analysis only	2–7–52	....
525	Mines Dept. of W.A. Free Assays School of Mines	W.A.	Norseman	Gold	Assays only	7–7–52	....
	The following Investigations were pending or incomplete at 31st December, 1951.						
448	A. Vickery Syndicate	W.A.	Lawlers	Gold	Treatment of Tailings	....	....
488	A. Vickery Syndicate	W.A.	Lakeside via Fimiston	Gold	Treatment of Tailings	....	28
485	Goldfields Tin Syndicate	W.A.	Greenbushes	Tin	Sizing Tests and Analyses	....	4
495	A. Vickery Syndicate	W.A.	Southern Cross	Gold-Wolfram	Recovery Tests	....	17
506	Rogers, D. C.	W.A.	Ragged Hills via Marble Bar	Lead-Zinc	Method of Treatment	....	....
514	Vacuum Oil Co.	W.A.	....	Detergent	Determination of frothing characteristics	....	....
521	Western Mining Corp.	W.A.	Bullfinch	Wolfram-Gold	Scheelite Beneficiation	....	....
523	Anglo-Westralian Pty. Ltd.	W.A.	Nabawa	Lead-Zinc	Method of Treatment	....	....
526	Wolfram Hill, N.L.	N.T.	Pine Creek	Copper-Wolfram	Method of Treatment	....	....
527	Western Mining Corp.	W.A.	Bullfinch	Wolfram	Analysis only	....	....
528	Reynolds, L.	W.A.	Kunnanalling	....	Tests on Mortar Sand	....	....
							652

Table II.

KALGOORLIE METALLURGICAL LABORATORY.

Chemical Analyses and Gold Assays Completed during 1951.

Report.	Owner.	No. of Metallurgical Tests.	Elements, etc. Determined.																											
			Aluminium.	Antimony.	Arsenic.	Calcium.	Chloride.	Chromium.	Copper.	Cyanogen.	Ferro-cyanide.	Gold.	Iron.	Lead.	Magnesium.	Manganese.	Nickel.	Phosphorus.	Silicon and Acid Insolubles.	Silver.	Sulphur.	Tellerium.	Thiocyanate.	Thiosulphate.	Tin.	Wolfram.	Water.	Zinc.	TOTALS.
461	Standard Mining Co.	134	....	....	....	....	....	....	....	....	....	396	....	16	....	....	....	....	....	16	....	....	....	....	....	....	....	....	428
466	Seddon, H.	1	....	....	2	....	....	....	....	....	....	....	2	....	....	....	....	2	2	....	4	....	....	....	....	....	....	....	....	12
470	Parker, O. J.	....	....	....	....	....	....	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	30	....	....	....	34
472	Beard, P. D.	17	....	....	....	....	....	....	22	....	....	96	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	118
476	Johnson Bros.	31	....	....	....	....	....	....	....	....	....	54	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	54
477	Murray Bros.	....	....	....	....	....	....	....	....	....	....	34	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	34
478	Mines Department of W.A.	19	....	....	4	....	....	....	123	....	....	62	....	....	....	....	....	....	....	....	25	....	....	....	....	....	....	....	214
479	Webster, T.	4	....	....	....	....	....	....	....	....	....	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12
480	Hronsky, V.	....	....	....	....	....	....	....	....	....	....	1	1	....	....	1	....	....	1	1	....	....	....	....	....	....	....	....	5
481	McLeod, D.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1
482	Linsday & Smith	3	....	....	....	....	....	....	....	....	....	16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	16
483	Broken Hill Pty., Ltd.	....	....	....	....	....	....	....	4	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8
484	Kalgoorlie Power Corp.	15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
486	Aust. Development, N.L.	24	....	....	....	....	....	....	....	....	....	48	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	50
487	Parry & Elmquist, Ltd.	27	8	....	....	133	2	....	....	....	....	....	61	....	36	....	....	....	133	....	2	....	....	....	....	....	....	2	377
489	Dept. of Industrial Development of W.A.	86	....	....	2	....	....	....	....	....	....	70	....	....	....	....	....	....	....	....	101	....	....	....	....	3	....	....	176
490	Macoboy, H.	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
491	Haoma Syndicate	27	....	....	....	....	....	....	....	....	....	172	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	172
492	Byne, E.	....	....	....	....	....	....	....	....	....	....	....	....	15	....	....	....	....	....	4	....	....	....	....	....	....	....	....	19
493	Cancelled	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
494	Allen & Brimage	....	....	....	....	....	....	....	....	....	....	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12
496	Hicks, H. C.	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	4
497	Anglo-Westralian Pty., Ltd.	30	....	....	....	....	....	....	4	....	....	2	....	103	....	....	....	....	....	4	....	....	....	....	....	....	....	57	170
498	Western Mining Corp.	1	....	....	....	2	2	....	2	2	2	....	2	2	2	....	....	....	....	....	4	....	2	2	....	....	....	2	26
499	Alford, V.	1	....	....	....	....	....	....	....	....	....	10	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10
500	Broken Hill Pty., Ltd.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	2
501	Ibbotson, R.	....	....	....	....	....	....	....	2	....	....	....	....	35	....	....	....	....	....	38	....	....	....	....	....	....	....	....	75
502	Lake View & Star, Ltd.	....	....	....	....	....	....	....	....	....	....	16	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	16
503	Parry & Elmquist, Ltd.	12	2	....	....	102	....	....	....	....	....	....	25	....	24	....	....	....	102	....	....	....	....	....	....	....	....	....	255
504	Croesus Pty., Ltd.	....	4	4	4	4	....	....	4	....	....	4	4	....	4	....	....	....	4	4	8	4	....	....	....	....	....	....	52
505	Linden Gold Mines	18	....	....	....	....	....	....	....	....	....	106	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	106
507	Hill 50 Gold Mine	102	....	....	....	....	....	....	....	....	....	392	....	....	....	....	....	....	....	....	217	....	....	....	....	....	....	....	609
508	Evans, D. J.	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	....	....	6
509	Western Mining Corp.	10	....	....	....	....	....	....	....	....	....	135	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	135
510	Mines Dept. of W.A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	....	....	4
511	Broken Hill Pty., Ltd.	....	....	....	....	....	....	6	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	14
512	Broken Hill Pty., Ltd.	6	....	....	....	....	....	....	....	....	....	26	....	....	....	....	....	....	....	....	....	....	....	....	....	14	....	....	40
513	Mines Dept. of W.A.	....	....	....	....	....	....	....	....	....	....	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12
515	Cancelled	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
516	Bruce & Merton	3	....	....	....	....	....	....	....	....	....	30	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	30
517	Golden Horseshoe (New), Ltd.	....	....	....	....	....	....	....	2	....	....	2	2	2	....	....	....	....	2	....	....	....	....	....	....	....	....	2	12
518	Rowan & Morrison	31	....	....	....	....	....	....	12	....	....	116	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	128
519	Burrows, W.	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
520	Dunnet, E. C.	....	....	....	....	....	....	....	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
522	Western Mining Corp.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	3
524	Mines Dept. of W.A.	....	....	....	....	....	....	....	8	....	....	8	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	16
525	Mines Dept. of W.A.	....	....	....	....	....	....	....	....	....	....	34	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	34
....	Free Assays	....	....	....	....	....	....	....	26	....	....	159	....	....	....	3	1	....	....	2	3	....	....	....	1	2	....	....	197
....	School of Mines	....	....	12	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4	....	....	28
	The following investigations were pending or incomplete at 31st December, 1951.																												
448	A. Vickery Syndicate	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
488	A. Vickery Syndicate	28	....	....	....	....	....	....	....	....	....	318	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	318
485	Goldfields Tin Syndicate	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	62	....	....	....	62
495	A. Vickery Syndicate	17	....	....	....	....	....	....	....	....	....	224	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	224
506	Rogers, D. C.	....	....	....	....	....	....	....	2	....	....	4	3	4	....	....	....	....	4	4	4	....	....	....	....	....	....	4	29
514	Vacuum Oil Co.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
521	Western Mining Corp.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
523	Anglo-Westralian Pty., Ltd.	....	....	....	....	....	....	....	4	....	....	....	....	12	....	....	....	....	....	....	....	....	....	....	....	....	....	4	20
526	Wolfram Hill, N.L.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
527	Western Mining Corp.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
528	Reynolds, L.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	Totals	652	14	16	26	241	4	6	227	2	2	2,586	100	189	66	4	1	2	248	75	370	4	2	2	93	41	2	69	4,392

Division VI.

Annual Report of the Inspection of Machinery Branch of the Mines Department for the Year 1951.

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, 1951, 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, 1921-1950, for the year ended 1951.

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 lb. 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 boiler.

Return No. 1.—During the year there were 206 new registrations of boilers. In this return are shown the countries of origin and the types of these pressure vessels.

Additions to the register in the preceding year numbered 196. The figures for this year indicate therefore, a slight increase in the rate of new registrations.

With reference to certain of the pressure vessels shown in this return as being imported from overseas, the water tube boilers of United Kingdom origin were in fulfilment of orders for South Fremantle Power Station; Industrial Extracts Ltd., Toodyay and State Sawmills, Shannon River. The digesters of Norwegian origin were imported for the Whaling Industry in this State.

Return No. 2.—Shows the number of useful boilers of the various types at the end of the year in proclaimed Districts in the State, also the comparisons with the year previous.

It is thought requisite at this juncture that some information should be conveyed in amplification of the expression—"useful".

Unless the condition of a boiler becomes so deteriorated beyond feasible repair that it must be permanently condemned against any further service as a pressure vessel it has always been the practice to qualify a boiler as still being useful, even should it have required more or less heavy repairs of a practicable nature when last inspected but repairs have not been proceeded with and the boiler has been put out of commission for an indefinite period.

In such circumstances, the boiler being repairable is qualified as useful until such time as there may be reason for it to be permanently condemned.

The foregoing is not intended to imply, however, that all boilers of the out of use category are of such conditions that repairs are necessary for their restoration to service. In many instances, their use has been discontinued for reasons unconnected with their condition.

Return No. 3.—Therein are shown the operations of the Inspection of Machinery Branch concerning boilers for the year 1951 and comparisons with 1950.

Districts worked from Kalgoorlie (Boulder Office) embrace all goldmining areas and also include the asbestos and lead fields in the inland districts of the North West northward from Peak Hill to North West coast.

Inspections in the remainder of the proclaimed districts in the State are carried out from Head Office. With these are included inspections at Carnarvon, Point Cloates, Learmonth, Broome, Derby, Wyndham and Cockatoo Island (Onslow, Roebourne and Port Hedland are visited from Kalgoorlie).

MAINTENANCE, ETC.

In general, owners of boilers have given every consideration to the care and maintenance of their plants but, unfortunately, there are many who fail to appreciate the importance of proper practices in the care and operation of their steam generators.

In many instances, expensive and prolonged repairs could be avoided were some regard given to remedying defects as they occur and whilst of minor nature. It is not rare at annual inspections for an Inspector to find that a most apparent defect has materialised and has obviously existed over a period of several weeks and probably some months without any attempt being made towards correction.

Another matter concerning maintenance to which reference here is not out of place is the attention which should be given to the fittings associated with boiler gauge glasses.

In too many cases there is a tendency to neglect correct routine manipulation of the steamway and waterway cocks together with the drain cock when proving the water level in a boiler.

It should be appreciated that not only should a test of the correctness of the water level as shown in the gauge glass be carried out by opening the drain cock of this fitting and blowing some water and steam to waste and then shutting the drain, but at regular intervals the steamway and waterway cocks should be alternately shut off whilst drain is open to ascertain in turn whether the passage through each mounting, steamway and waterway, is thoroughly clear.

Boilers generally have two sets of guage glasses fitted. In this regard, there is also a tendency in some cases to rely solely on one set for ascertaining water level and not even the drain of the second set is operated occasionally to verify whether this guage is functioning.

It has often been found at inspections that steamway and waterway cocks were immovable due to lack of proper use.

Due to deposits contained in the boiler water, the passages can become obstructed. In the absence of complete testing of these mountings this obstruction can become so considerable as to result in a false water level in the gauge glass; the natural consequence is a higher level than what is actually the condition of the boiler content.

Too often, this neglect of water guages has been the cause of extremely severe damage to boilers.

The correct procedure for ascertaining whether the guage glass mountings are in order is as follows. Open drain, shut waterway end, open waterway, shut steamway end, open steamway and shut drain. The volume of steam and water blowing to waste alternatively will indicate clear passages or otherwise.

BOILER FUEL.

Per medium of special equipment of various designs for introduction into the furnaces, sawdust is gradually gaining favour as a fuel in this State. This puts into good use an otherwise waste porduct with the exception of that which is used in certain industrial processes.

RETURN No. 1.—SHOWING THE NUMBER OF BOILERS OF EACH TYPE, AND COUNTRY OF ORIGIN OF NEW REGISTRATION FOR THE YEAR ENDED 31ST DECEMBER, 1951.

Type.	Country of Origin.						Total.
	United Kingdom.	U.S.A.	Norway.	Eastern States.	Western Australia.	Unknown Sources.	
Cornish	....	....	....	....	1	....	1
Vertical Stationary	....	....	....	2	2	....	4
Vert. Mult. Stat.	....	....	....	1	....	....	1
Ret. Mult. Stat. U/f	....	....	....	....	6	....	6
Water Tube	7	....	....	13	30	....	50
Sectional	....	....	....	1	....	....	1
Digester	....	....	10	1	3	....	14
Vulcaniser	....	....	....	6	1	....	7
Steam Jacketed Vessel	....	....	....	2	10	....	12
Steriliser	....	....	....	....	16	....	16
Air Receiver	17	2	....	7	55	8	89
Gas Receiver	1	....	....	1	3	....	5
TOTAL	25	2	10	34	127	8	206

RETURN No. 2.—SHOWING CLASSIFICATION OF VARIOUS TYPES OF USEFUL BOILERS IN PROCLAIMED DISTRICTS ON 31ST DECEMBER, 1951.

Types of Boilers.	Districts Worked from PERTH.	Districts Worked from KALGOORLIE.	Totals.	
			1951.	1950.
Lancashire	46	53	99	97
Cornish	147	458	605	611
Semi Cornish	11	37	48	48
Vert. Stationary	415	349	764	764
Vert. Portable	66	16	82	83
Vert. Multi Stat.	52	25	77	76
Vert. Multi Port	17	3	20	20
Vert. Pat. Tubular	48	....	48	48
Loco. Rect. F/box Stat.	90	61	151	150
Loco Rect. F/box Port.	255	64	319	321
Loco Circ. F/box Port	139	8	147	147
Locomotive	84	37	121	121
Water Tube	386	118	504	454
Ret. Multi U/Fired Stat.	215	58	273	268
Ret. Multi U/Fired Port	1	8	9	9
Ret. Multi Int. fired Stat	51	12	63	63
Ret. Multi Int. fired Port	2	....	2	2
Egg ended and other specified	388	34	422	406
Digesters	275	10	285	273
Air Receivers	1,000	520	1,520	1,456
Gas Receivers	34	....	34	25
Vulcanizers	353	10	363	356
Steam Jacketed Vessels	458	13	471	471
Total Registration Useful Boilers	4,533	1,894	6,427	6,259
Total Boilers out of use 31st December, 1951	1,951	1,518	3,469	3,435

RETURN No. 3.—SHOWING OPERATIONS IN PROCLAIMED DISTRICTS DURING YEAR ENDED 31ST DECEMBER, 1951.

Types of Boilers.	Districts Worked from PERTH.	Districts Worked from KALGOORLIE.	Totals.	
			1951.	1950.
Total number of useful boilers Registered	4,533	1,894	6,427	6,259
New Boilers registered during year	200	6	206	196
Boilers Reinstated	1	....	1	1
Boilers Converted	....	3	3	1
Boilers inspected—				
Thorough	2,576	371	2,947	2,831
Working	725	8	733	450
Boilers condemned during year—				
Temporarily	10	....	10	11
Permanently	33	4	37	34
Boilers sent to other States during the Year	2	....	2	....
Boilers sent from other States during the year	....	....	....	....
Transferred to other Departments	....	....	....	2
Transferred from other Departments	3	....	3	4
Number of notices of repairs issued during year	647	39	686	642
No. of Certificates issued including those issued under Sec. 30 during the year	2,582	377	2,959	2,824

SECTION 2.

EXPLOSIONS AND INTERESTING DEFECTS.

During the year there were two explosions of pressure vessels, one being a moderately large air receiver and the other an oil monteju. Neither of these had been registered with the department and therefore had not previously come under our notice.

(a) In the case of the first incident the receiver was 4ft. 10in. length and 3ft. 6in. diameter x $\frac{3}{8}$in. plate thickness and it appeared to be a unit that had been constructed during the war for use as an air reservoir for air raid syrens.

At the time of failure the receiver was in use at a garage and was located in a horizontal position outside the building.

As a result of the explosion which happened at a quarter after 8 o'clock one evening, one end was completely blown off and was projected into the river after having travelled at least 350 yards and passing over a house in its flight and hitting a tree.

The shell with the opposite end still attached and intact was blown through scrub for a distance of 30 to 40 yards, finally lodging against a brick wall of an outhouse. The brick wall of the garage was also partly blown in by the force of the explosion.

Examination of the shell and intact end plate disclosed that the ends, which were dished concave to pressure, were attached to the shell firstly by turning the edges of the shell plate over the end plates when the latter had been fixed in position and then by welding to the end plates the edge of the lappings of the shell so formed.

Unfortunately, the receiver end which disappeared into the river could not be recovered in spite of much searching; its condition therefore could not be ascertained.

It was apparent however that rupture had occurred all around the shell at the heel of the flanging or lapping formed by turning the end of the shell plating over the end plate.

Inspection of the remaining portions of the receiver showed the opposite end plate to be deep blue in colour and dry whilst the shell was rusty and carried some pools of oil from the compressor. Along the extreme bottom of the shell the plate was found to be a little wasted by corrosion.

There was no evidence to show that the receiver had been fitted with a safety valve and it appeared that reliance was placed solely on the automatic cut out on the compressor for prevention of charging to over-pressure.

The dry state and colour of the one end plate seen might suggest that the explosion resulted from a glowing particle of carbon in an overheated compressor escaping into the receiver, and there igniting oil vapour. On the other hand this theory is rather contradicted by the appearance of the surface of the shell plate.

Again, it is difficult to establish that the vessel was charged to an extreme over-pressure by the compressor as this was a small two-stage unit belt-driven by an electric motor of only 1½ horsepower. It is therefore very difficult to establish that this charging unit would have been capable of generating to the extreme amount of pressure which would have been necessary to burst the receiver were it suitably designed and constructed.

At the time of the failure no person was working at the garage and the owner was unable to advance any evidence which may have assisted in determining the initial circumstances leading up to the mishap.

It has not been ascertained whether the compressor had been overlooked when work at the garage had ceased and been left with the motor switched on.

However, whether the direct cause of the explosion was combustion of oil vapour in the receiver by red hot carbon in the compressor head or delivery pipe or whether it was incidental to over-pressure to which the receiver may have been subjected by the compressor is not of major importance in this instance, especially as no person was injured.

What is of utmost importance, though, is the fact that whichever the cause, this air receiver failed circumferentially around the shell plating and not in a longitudinal direction as could be expected in a suitably designed vessel. A cylindrical vessel subject to pressure internally is twice as strong circumferentially than it is longitudinally strength of longitudinal seams neglected, providing approved rules in design are adopted.

Concerning designs of air receivers manufactured in this State and submitted for registration under the Inspection of Machinery Act, this department for many years has disallowed the method of connecting end plates with the shell plating in cases of large diameter and moderately heavy thickness of plate as was used in the construction of this receiver.

In hammering the edge of the shell plate over the periphery of the end plate a sharp corner or heel is imposed circumferentially in the shell plate. This is conducive to a weakening of the metal fibre across the heel, especially if the flanging process be carried out with the plate insufficiently heated.

Added to such possible shortcomings in workmanship is the inherent weakness of a sharp corner in withstanding the hinging effect to which it would be subjected by the total pressure exerted on such a large diameter end plate.

There can be no doubt therefore that the shell had been seriously weakened circumferentially by the method employed for attachment of the ends.

(b) Concerning the second explosion, the monteju which failed was used in connection with a lift for servicing cars and trucks in another garage. The lift consists of a skeleton platform surmounting a ram working in an oil cylinder and operated hydraulically. The monteju did duty as a container for oil.

To raise the lift, air under pressure was admitted to the monteju thereby displacing the oil and forcing it into the ram cylinder.

As the capacity of the monteju did not exceed 5 cu. feet it was not subject to registration and inspection under the Act.

Standing in a vertical position, this vessel was of cylindrical construction 3ft. length x 1ft. 4⅜in. diameter x 3/16th in. plate thickness with end plates concaved to pressure. The top end plate was of dished formation with radius equal to the diameter; the boundary of the plate was not flanged to cylindrical form for attachement to the shell. This end was fixed in place by introducing it a short distance into the shell and then arc welding it to the projecting internal surface of the shell.

The bottom end plate was fashioned similarly as a concave disc but due to a discrepancy in diameter this plate did not fit inside but apparently seated against the end of the shell. In this position it was attached to the edge of the shell plate by a corner weld which allowed only a minimum section of fusion to both plates.

The failure of this monteju was caused by rupture of the welding around this end, resulting in the shell with top end intact being blown upwards through the roof of the building and lodged on another portion of the roof about 40ft. from where it made its exit.

In this case there is no doubt that bad workmanship was responsible for the explosion. Fortunately the incident was not attended by injury to any person.

If it were universally appreciated what an enormous amount of energy can be stored up in pressure vessels, many an accident might be avoided by a care-consciousness in construction. For example, taking this instance, the vessel was required for a working pressure of 120 lb. per sq. inch. As the area of the end was 210.59 sq. inches the total load on this plate together with the welding by which it was secured was 25,270 lb., i.e., 11.28 tons.

SECTION 3.

INSPECTION OF MACHINERY.

See Returns Nos. 4, 5 and 6.

The groups of machinery in the register for the year 1951 totalled 28,260, an increase of 1,664 above the total for the previous year. Reference to Return No. 3 will show dissections of these totals into the numbers of groups operated by the various groups of power.

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, 1951.

Classification.	Districts Worked from PERTH.	Districts Worked from KALGOORLIE.	Totals.	
			1951.	1950.
No. of Groups driven by steam engines	406	525	931	928
No. of Groups driven by oil engines	1,909	1,104	3,013	2,639
No. of Groups driven by gas engines	68	195	263	258
No. of Groups driven by Compressed air	....	62	62	62
No. of Groups driven by Electric motors	19,701	4,285	23,986	22,706
No. of Groups driven by hydraulic pressure	5	....	5	3
Totals	22,089	6,171	28,260	26,596

RETURN No. 5.—SHOWING OPERATIONS IN PROCLAIMED DISTRICTS DURING YEAR ENDED 31ST DECEMBER, 1951.

(*Machinery Only.*)

Classification.	Districts Worked from PERTH.	Districts Worked from KALGOORLIE.	Totals.	
			1951.	1950.
Total registrations useful machinery	22,089	6,171	28,260	26,596
Total inspections made	17,406	2,719	20,125	19,543
Certificates (bearing fees)	4,175	477	4,652	4,767
Certificates (steam without fees)	26	1	27	49
No. of extension certificates issued under Sec. 42 of Act	....	....	....	....
Notices issued (Mach. dangerous)	270	10	280	360

RETURN No. 6.—SHOWING CLASSIFICATION OF LIFTS ON 31ST DECEMBER, 1951.

Types.	How Driven.	Totals.	
		1951.	1950.
Passenger	Electrically driven	197	196
	Hydraulically driven	1	1
Goods	Electrically driven	100	99
	Hydraulically driven	3	3
	Belt driven	4	4
Service	Electrically driven	45	45
		350	348

ACCIDENTS TO MACHINERY.

There were four accidents of most serious import during the year and these were related to winding machinery on the goldfields. By great misfortune one of these was attended by fatalities.

Case 1.—The drawbar of a trailer skip in an underlay shaft failed, and the skip running away struck four men working near the bottom of the shaft. Three of these were killed instantly and the fourth was seriously injured.

This trailer skip was attached to the main skip by means of two chains and a drawbar. The 4 x 1 inch M.S. drawbar extended longitudinally for the full length of the skip beneath its floor and projected a short distance from the front end.

The bar was secured to the skip by a 1 in. bolt through each of two timber cross members positioned adjacent to the axles. A chain bridle approximately 10 ft. long was shackled to the projecting front end of the drawbar for attachment to the main skip.

The accident was caused, at a time the skip was laden with logs, by fracturing of the drawbar through the bolt hole where the bar was secured to the front end of the skip.

It is considered that fatigue had taken place through the section of the material at the bolt hole due to tangential stressing of the bar at this point on each occasion the skip was trailed from its horizontal track at the surface to the incline track leading down the shaft.

The foundation of this skip has now been redesigned in order to remove such undesirable conditions.

Case 2.—The winding rope of an ore skip carried away at approximately 20 ft. from the capel end while the skip was being filled at the No. 12 loading pocket.

Although this rope had been in service for only 16 months, examination of the severed strands revealed very severe corrosion of several inner wires, also outer ones where obscured from the surface with rope in ravelled state. On the other hand, all outer wires of each strand in vicinity of the break where exposed to view before the failure gave no indication of the slightest depreciation.

It was very evident, however, that there had been little if any penetration of oil or grease despite frequent oiling of the rope during service. The wires below the surface were bare of oil and had corroded to pin points at places.

The shaft wherein this rope was being used is extremely wet toward the lower levels and the water is definitely acid. It is quite obvious therefore that the surface skin of grease was ineffective as a seal against entry of moisture into the rope, and the absence of oil on the inner wires left them unprotected against the deleterious effect of the dampness.

Prior to hauling being resumed in the shaft, the ropes in both compartments were renewed. Following the change of ropes, the one from the adjacent compartment which had been discarded was cut for examination at a position corresponding to the break in the other. Inspection revealed that this rope also was in a similarly corroded condition under the surface.

The specifications of the defective ropes when new were:—Black special 115/125 tons quality, 4½ in. circ. 6/27 Langs Lay; ultimate breaking strain 95.5 tons.

Weight of skip with ore when full 9.1 tons.

Case 3.—In this instance the yoke of an ore skip failed. In shape, this yoke constituted two sides of a triangle meeting at a large apex formed as a square with corners vertical. The apex was hollow, and this hollow was also shaped as a square with the sides parallel to the exterior.

Through this hollowed apex a drawbar was introduced for attachment to the yoke at one end and to plates connected to the butterfly at the other.

At the time of the accident the skip contained ore and the yoke failed by completely fracturing at three different positions.

Both arms fractured near mid length and fracture also took place across opposite corners of the apex.

The history of the construction of this yoke is unknown. Portions of the appliance were subjected to physical tests at the University but the reactions were very confusing.

The conclusions of the metallurgical experts were that the material was typical of dead soft mild steel probably forged to shape and that the yoke had been in service for approximately 16 years.

As a result of this accident yokes of similar construction have been condemned.

Case 4.—This incident concerns the failure of the king pin of an ore skip by which the skip was suspended from the winding rope. A nut and washer attached to the bottom end of this pin which passed down through the yoke or bridle carried the weight of the skip.

The king pin failed by fracturing through in a clean break at the bottom of the thread immediately above the nut.

There would seem no doubt that the failure was due to the frequent alterations of stresses being concentrated at the cross section through the root of the screw-thread close to the nut due to impact when loading the skip plus the effect of overcoming inertia when hauling.

There is an inherent weakness in such an arrangement whereby tensile stresses due to heavy loads "damp out" more or less instantaneously at a sharp change of section as would occur in the case of a nut and screw supporting a load.

Appropriate action has subsequently been taken on the mine to redesign the hauling attachments on all skips.

SECTION 4.

PROSECUTIONS FOR BREACHES OF THE ACT.

There was no breach of the Act justifying prosecution during the year.

SECTION 5.

ACCIDENTS TO PERSONS.

See Section 3 Accidents to Machinery, Case 1.—Three persons killed and one seriously injured.

Another accident, in this instance connected with a pressure vessel, also most unfortunately resulted in the death of the attendant.

This vessel is a large autoclave constructed in the form of a cylinder and seated in a horizontal position at ground level. Dimensions 43ft. 3in. length x 5fh. 6in. diameter constructed for working pressure 160lb. per square inch.

Each end is sealed with a heavy door pivoted at the centre to a frame which swings on hinges.

The doors and the door seatings attached to the ends of the vessel are so designed that the doors are secured in the closed position by being rotated a few inches by means of a rack and pinion. A short lever forms a component part of the pinion, the rotation of the door in either direction is usually performed by two persons with the aid of a length of pipe which is engaged on the short pinion lever to obtain the extra leverage required to rotate the door.

On such occasions that the door is opened by one man only, it is the practice to place a jack under a projection near the periphery of the door and rotate it by this means to disengage it from the locking cleats, as it is too difficult for the rack and pinion gear to be used single handed.

Incorporated with the steam line to the interior of the autoclave are a steam valve and an exhaust valve, the latter opening to atmosphere. On the bottom of the vessel a drain valve is fitted.

After each processing for which this autoclave is used has been completed, the steam valve is shut and no further operation takes place for several hours. During this period the pressure is allowed to slowely decrease with the gradual drop in temperature.

After this lengthy interval the contents are removed, but before attempting to open a door it is the customary procedure to open the drain and exhausting valves to ensure that any possible remaining pressure or water is exhausted, or alternatively to destroy any vacuum in the vessel.

On the occasion of the fatal accident which is the subject of this report the attendant was opening up the autoclave without assistance by the use of the jack.

Whilst this was being done the door, on being released from the locked position, was violently swung open on its hinges with a loud report and the attendant being in front of it manipulating the jack was hit with such great force that he must have died instantly.

Subsequent investigation disclosed that neither the exhaust nor drain valves were open. It would appear therefore that the deceased, although having been employed on this work for several months leading up to the accident, had overlooked the customary precautions.

Although there was no evidence to determine the actual pressure remaining in the autoclave at the time of opening up, past experience suggested that the pressure would have been not more than two to three lb. per square inch. Even at this pressure the total force would be very considerable in view of the large area of the door.

Subsequent to this accident an interlocking device has been designed to prevent the door from being rotated sufficiently to be released unless any remaining pressure has been exhausted.

Return No. 7.—*Showing Number of Serious Accidents both Fatal and Non-Fatal which occurred in Proclaimed Districts during the Year ended 31st December, 1951.*

(F) Denotes "FATAL."

Industry.	Circular Saw.	Buzzer.	Thicknesser.	Bandsaw.	Chain Mortiser.	Spindle Moulder (Shaper).	End Matching Machine.	Printing Machine.	Stapler.	Leather Cutting Press.	Press (Metal).	Emery Wheel.	Gearing.	Belting.	Buffing.	Rolls.	Wireworking.	Conveyor.	Bag Elevator.	Sifters (Flour).	Mincer.	Dough Moulder.	Chilean Mill.	Locomotive.	Lift.	Teasing Machine.	Bottle Manufacturing Machine.	Hoist.	Winch.	Turbine.	Skip.	Boiler Oil Firing System.	Pellet Machine.	Autoclave.	Wool Winding Machine.	Toilet Paper Machine.	Totals per Industry.
Woodworking and Furniture	11	5	1	2	1	2	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	23
Leather Goods	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Metalworking and Engineering	....	....	....	....	....	....	....	....	....	....	8	1	....	....	2	1	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	14
Printing and Allied Industries	....	....	....	....	....	....	....	3	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	8
Flour Milling	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1 (F)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1 (F)
Gasworks	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1
Building Materials and Building	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	1	....	....	1	....	1	....	....	....	....	....	....	....	4
Cement Pipe Manufacturing	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1 (F)	....	....	1 (F)
Food and Drink Processing	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	2	....	....	....	....	2	1	....	....	....	....	....	....	....	....	....	1	....	....	....	8
Refrigeration	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Chemical Industry	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Glassmaking	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	1
Mining	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1 (F)	....	....	....	....	1 (F)
Quarrying	....	....	....	....	....	....	....	....	....	....	....	....	....	1 (F)	....	....	....	....	....	....	....	....	....	1 (F)	....	....	....	....	....	....	....	....	....	....	....	2 (F)
Other	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1	....	....	....	....	....	2	....	....	....	....	....	....	1	....	1	....	6
Totals per Type of Machine	13	5	1	2	1	2	1	3	3	2	8	1	3	1 (F)	2	3	2	1	1	1 (F)	2	1	1	1 (F)	2	1	1	1	1	1	1 (F)	1	1	1 (F)	1	2	75 (5 F)

SECTION 6.

EXAMINATION OF ENGINE DRIVERS, CRANE DRIVERS AND BOILER ATTENDANTS.

During the year the Board of Examiners granted 176 Engine Drivers, 96 Crane and Hoist Drivers and 89 Boiler Attendants Certificates.

Compared with previous year (1950) these figures represent decrease 40, increase 50 and increase 15 respectively.

SECTION 7.

AMENDMENTS TO ACT.

In July amendments to the Regulations of the Inspection of Machinery Act incidental to the fees chargeable for machinery inspections were implemented.

These amendments in the great majority of cases, have reflected in a large scale reduction of receipts of revenue in the Branch.

SECTION 8.

STAFF.

On 30the June, Mr. R. J. Ross having reached the age limit retired from the position of Deputy Chief Inspector of Machinery. As a consequence of this retirement Mr. C. F. Buttle was transferred to Head Office to the position Senior Inspector and Mr. K. C. Harvey to Kalgoorlie *vice* Mr. Buttle as Inspector of Machinery in Charge at that station.

In conclusion, I desire to express appreciation to all members of the Staff of this Branch for their keen efforts toward prospering the efficient conduct of our work; to all other officers of the Mines Department for their ready assistance whenever desired; and to officers of other branches of the W.A. Government and of Commonwealth Departments, with whom we have been associated, for their co-operation. I would also like to convey our appreciation to kindred Authorities in other States and New Zealand for their courtesy in their relations with this Branch.

J. F. WINZAR,
Deputy Chief Inspector of Machinery.

Annual Report of the Government Chemical Laboratories for 1951.

Contents.

Division VII.

Annual Report of the Government Chemical Laboratories.

The Under Secretary for Mines.

I have the honour to present for the Honourable the Minister for Mines, my Annual Report on the operations of the Government Chemical Laboratories, for the year ending 31st December, 1951.

STAFF.

The total staff employed as at the 31st December, 1951, was 56, consisting of 40 professional officers, 7 clercial and 9 general.

There were a number of staff changes during the year, as follows:—

Resignations.—Messrs. K. J. Carter, B. G. Pearce, S. M. Woodman, Chemists and Research Officers, Agriculture Division; G. H. Grahame, Mineralogist and Research Officer, Mineral Division; and Miss L. Masel, Librarian.

Appointments.—Messrs. D. P. Carter, Analyst and Research Officer, Food and Drug Division; L. J. Sutherland, Mineralogist and Research Officer, Mineral Division; and G. W. Stewart, Laboratory Assistant, Administration.

Mr. L. Brennan, Fuel Chemist and Research Officer, is working at the Collie Annexe Laboratory, and Messrs. E. C. Hodgson, D. P. Carter, Analysts and Research Officers, with Mr. Liber, Laboratory Technician, are working at the Lincoln Street Annexe Laboratory.

ACCOMMODATION.

Since the occupation of the laboratories in Adelaide Terrace, in 1943 there has been a considerable expansion of work in all Divisions. This has now reached such proportions that we will seriously have to consider further extensions, particularly in three older Divisions, Food and Drug, Mineral and Agriculture. In each of these, small laboratories, which were earmarked for special purposes, have had to be used to house staff engaged on normal duties and consequently are not being used for the purposes for which they were originally intended.

The temporary annexe laboratory at the Grain Distillery Buildings, Collie, is still in operation on coal washing research. Another annexe laboratory was established in March this year at the corner of Smith and Lincoln Streets, Perth, to carry out work for the Metropolitan Water Supply, Sewerage and Drainage Department in connection with river corrosion problems.

LIBRARY.

The laboratories have now an up-to-date and well indexed library. We have at our disposal a number of recent standard technical works on special and general subjects as well as current periodicals from most English speaking countries which gives a world coverage on recent advancements in Chemistry, Chemical Engineering, and Mineralogy. Up to date technical literature is the life blood of an institution such as this; without it no real advancement can be made.

Miss Masel, Librarian, resigned in November to be married. Our thanks are due to her for coming back and acting in a temporary capacity until we could make suitable arrangements for an appointment of a permanent nature.

GENERAL.

The number of samples received for analysis and for chemical and mineral examination this year was very nearly double that of last year; the total number received being 22,409 as against 11,814. This was largely due to the increase in our activities in connection with the work for the Metropolitan Water Supply, Sewerage and Drainage Department at the Annexe Laboratory and the increase in our own departmental activities. The volume of work of an advisory nature on chemical matters for all departments continues to increase. Such work is apart from the increased volume of the number of samples received.

The total number of samples received from each Government Department is as follows:—

Mines Department	911
Department of Agriculture	2,878
Public Health Department	375
Metropolitan Water Supply, Sewerage and Drainage Department	15,355
Government Stores and Tender Board	26
Department of Industrial Development	21
Police Department	349
Commonwealth Departments	116
Other Departments	715
State Industries	213

Samples received from the general public, both pay and free numbered 1,450.

All these are classified in detail according to the source from which they were received in the following table:—

Samples Received During 1951.

Table I.

Source.	Total.
Under Secretary for Mines	6
State Mining Engineer	24
State Batteries	249
Government Geologist	133
Departmental	471
Explosives	25
State Coal Mining Engineer	3
Industrial Development Department	21
State Alunite Industry	1
Wood Distillation Charcoal Iron Industry	20
Works and Labour Department	303
Metropolitan Water Supply	15,355
Public Health Department	352
Agriculture Department	2,878
Factories	19
Police and Coroner	294
Police, C.I.B.	43
Police, L.I.B.	12
Government Stores and Tender Board	26
Royal Perth Hospital	23
Milk Board of Western Australia	9
War Service Land Settlement Scheme	88
Native Affairs Department	3
Fisheries Department	23
Education Department	3
Premiers Department	1
Forests Department	171
Free Public	405
Pay Public	1,045

Table I.—*continued.*

Source.	Total.
Pay State Housing Commission	7
Pay State Shipping Service	12
Pay Local Governing Bodies	1
Pay W.A.G.R.	50
Pay Wyndham Meat Works	2
Pay Main Roads Department	6
Pay Civil Aviation Department	9
Pay A.I.D.	16
Pay British Phosphate Commission	37
Pay Arbitration Court	1
Pay Repatriation	7
Pay Commonwealth Works and Housing	11
Pay Commonwealth Health Department	7
Pay Commnowealth Light House and Navigation Service	2
Pay Commonwealth Oil Refineries	1
Crown Law Department	9
Bureau of Mineral Resources	25
Samples are allocated to the various divisions according to the specialised nature of the chemical work undertaken by each Division.	
Total	22,409

The laboratories have representatives on a number of advisory, technological and interdepartmental committees as follows:—

Attended by Director at regular intervals.

- Water Purity Committee.
- Wellington Dam Purity Committee.
- Coking Committee.
- National Association of Testing Authorities (State Committee).
- Commonwealth Scientific and Industrial Research Organisation (State Committee).

Attended by Deputy Government Analyst at regular intervals or convened for specific functions:—

- Food Advisory Committee.
- Swan River Reference Committee.
- Government Tender Board—Oil Committee.
- Insecticide Committee.
- Interdepartmental Committee on Fruit Products.
- Interdepartmental Committee on Dairy Products.
- Technological Standing Committee on H_2S problems (interstate).

Attended by Deputy Government Agricultural Chemist at regular intervals or convened for specific functions:—

- Corrosion of Metals Committee.
- Interdepartmental Committee on Dairy Products.
- Cereal Group Committee (Interstate).

Attended by Deputy Government Mineralogist at regular intervals or convened for specific functions:—

- Corrosion of Metals Committee.

Attended by Fuel Technologist at regular intervals or convened for specific functions:—

- Coking Committee.
- Fuel Research Committee (Interstate).

Mr. H. P. Rowledge, Director, and Mr. A. Reid, Chief Industrial Chemist, visited the Eastern States during the year to investigate matters in connection with the establishment of the Unit Process Plant for the Industrial Chemistry Division.

Mr. Hood, Deputy Government Analyst, visited Melbourne in November to attend a meeting of the "Technological Standing Committee on H_2S Problems."

The Fuel Technology Division published three papers during the year:—

1. "Sawdust as a boiler Fuel" published in "Fuel."
2. A paper on the "Manufacture" of Carburetted Water gas from Collie Coal, was read to the W.A. Branch of the Australian Chemical Institute and published in their Proceedings.
3. "A new Mini-Gas Calorimeter" published in "Fuel."

FOODS, DRUGS, TOXICOLOGY AND INDUSTRIAL HYGIENE DIVISION.

A wide variety of samples were examined in this Division during the year for various Government Departments and the general public as shown in Table 2.

The majority of the chemical work for the Department of Public Health and the Police Department is allocated to this Division but certain work of a specialised nature is also handled for other Departments such as the Department of Agriculture.

The examination of foodstuffs is one of the most important activities. Analyses of these are undertaken for the Public Health Department, the Milk Board and Government Tender Board to check their composition and purity. By this means protection is given to the general public and Government Institutions to ensure pure and wholesome foods are available.

Eighty milk samples taken by Inspectors of the Public Health Department and the Milk Board were examined to check the composition and efficiency of the pasteurisation of milk supplied in the Metropolitan area and to protect consumers against adulteration by addition of water.

One hundred and thirty-three exhibits in connection with actual or suspected poisoning were received during the year from the Police Department and Department of Public Health. Twelve specimens of anaesthetics were received by order of the District Coroner in cases of death under anaesthetic. No indications of deterioration were obtained. A number of bloods and urines were examined for alcoholic content taken from people killed in traffic accidents or who met a violent death. Exhibits for the Criminal Investigation Branch were examined in connection with suspected cases of law breaking.

Samples of anaesthetic ether drawn from Government supplies were tested for conformity with British Pharmacopoeia standards and all were found to conform. Drugs and medicines including hypodermic and narcotic drugs and tablets were examined as well as preparations and medicinal supplies for the Government Stores to check composition and correct dosage.

A survey of the fluorine content of water supplies undertaken in collaboration with the dental officers of the Department of Public Health was completed during the year.

Samples handled for the Department of Agriculture included: 40 samples of cheese to check the composition of products from various factories throughout the State; oranges grown in various districts were analysed to determine degree of maturity and suitability for picking; insecticides were examined to check composition and homogeneity; linseed was analysed for oil content.

Under the heading "Industrial Hygiene" investigations were carried out in co-operation with officers of the Public Health and the Factories Departments in industries and factories to determine the hazards to health, if any, to the employees. Eighty-seven samples of urine from various sources were examined as a routine check on workers exposed to lead or arsenic hazards.

The chemical control of sewerage is undertaken for the Metropolitan Water Supply, Sewerage and Drainage Department. During the year 1909 routine samples were collected and examined. Investigational work was carried out in connection with the generation of hydrogen sulphide in sewage and corrosion of sewer pipes. An annexe laboratory has been established at Lincoln Street to undertake research work in this connection. The examinations of trade wastes are carried out to ensure they are of such composition as will be suitable to be received in the sewer.

The collection and examination of samples from the Swan River in connection with pollution problems continues. The results show little variation from the previous year and indicate the river generally is fairly clean except at certain specific points.

Table 2.

FOOD AND DRUG DIVISION, 1951.

	Public Health Department.	Agriculture Department.	Metropolitan Water Supply.	Police and Coroner.	Police—C.I.B.	Police—L.I.B.	Government Stores and Tender Board.	Works and Labour Department.	Wood Distillation, Charcoal Iron and Steel Industry.	Explosives Branch.	Royal Perth Hospital.	Departmental—Government Chemical Laboratories.	Chief Inspector of Factories.	Milk Board of W.A.	Fisheries Department.	Crown Law Department.	Education Department.	Premiers Department.	Chief Coal Mining Engineer.	State Mining Engineer.	Free.	Pay—Public.	Repatriation Commission.	Commonwealth Works and Housing.	State Housing Commission.	Western Australian Government Railways.	Aeronautical Inspection Directorate.	Wyndham Meat Works.	State Shipping Service	Main Roads Department.	Commonwealth Health Department.	TOTAL.
Foods—																															
Butter		12																													12
Self Raising Flour		26																													26
Tinned Cherries	1																														1
Cows Milk	67											2		9		2															80
Tallow		1																			3						2				6
Mince, sausage meat and binder	9															7															16
Cheese		40																													40
Pork fat		36																													36
Margarine		2																													2
Oranges		10																													10
Split peas	9																														9
Coffee Essence	1																														1
Celery	1																														1
Haricot beans	1																														1
Powdered milk	1																														1
Sea pilchards															17																17
Milk and chocolate	1																														1
Tomato pulp																					1										1
Apple juice	1																														1
Tomato sauce and chutney							7																								7
Pickles							3																								3
Tomato soup	14						2																								16
Worcester sauce							3																								3
Tea	1																														1
Jelly crystals	1																														1
Human Toxicology—																															
Exhibits—Blood and urine for alcohol and carbon monoxide	1			167	3																1										172
Exhibits—human toxicology	11			112	21																2										146
Criminal Cases—																															
Court charge				1																											1
Murder cases					7																										7
Drunken driving				1																											1
Racehorse doping					7																										7
Anaesthetic—Deaths				12																											12
Industrial Toxicology—																															
Air-shiphold	10																														10
Air—factory													4																		4
Urine	20																					3	7			50				7	87
Mine explosion																				3											3
Spindle oil													1																		1
Air and blood (Wundowie)	7																														7
Coal mine air																			3												3
Slag wool													1																		1
Animal Toxicology		12		1	4																1										18
Sewage—																															
Weekly routine			1,909																												1,909
Investigational			13,225					36																							13,261
Complete Analyses			12																												12

Country sewage								14																								14
Beach survey			110																													110
Trade waste			14																													14
River and Harbour pollution								270				5																				275
Insecticides, etc.—																																
Insecticides	7	14																														21
Fly spray							6																									6
Argentine ant bait	1																															1
Cattle Dip		24																														24
Fluorine in phosphates, bones, faeces, urine		61																														61
Water (fluorine)	115																															115
Liquors—																																
Cider		3																														3
Brandy						1																										1
Whisky						6																										6
Gin						2																										2
Beer																		1														1
Wine		43				1																										44
Rum						1																										1
Schnapps						1																										1
Water (Poisons)	2	2																														4
Water	1														6		1					1										9
Water (Swan River)	1																															1
Drugs and Medicines—																																
Tablets	2																															2
Mynex tablets	1																															1
Eyedrops	3																															3
Rheumatism cure	1																															1
Procaine	1																															1
Synthanol	1																															1
Ampoules liquid	6																															6
Drugs	11																															11
Phenobarb tablets																						1										1
Cataplasma kaolin							1																									1
Epsom salts																	1															1
Dangerous Drugs—Heroin					1		1																									2
Ether Supplies											21																					21
Human Milk	13																															13
Chemicals							1																									1
Oily substance (tallow)		1																														1
Natives tobacco							2																									2
Wheat (poison)		1																														1
Lubricating oil								1																					2			3
Aluminium food containers	1																															1
Citrus wraps		4																														4
Oiled apple wraps		2																														2
Linseed		312																														312
Karri bark extract												2																				2
Fuel Oil									5																					1		6
Laminated aluminium package	1																															1
Petroleum tests																					2											2
Greaseproof paper																											4					4
Paints								2				2													4				10			18
Rubber buckets																											1					1
Panelite plaster board										1																						1
Perspex sheet																											8					8
Mallet bark																						1										1
Explosives										24																						24
Whale solubles		1																						1								2
Lambs thyroid gland		1																														1
Totals	325	608	15,270	294	43	12	26	323	5	25	21	11	6	9	23	9	2	1	3	3	2	14	7	1	4	50	13	2	12	1	7	17,132

Table 3.

AGRICULTURE DIVISION, 1951.

Material.	Agriculture Department.	Works and Labour Department.	Metropolitan Water Supply	State Mining Engineer.	War Service Land Settlement Scheme.	Departmental—Government Chemical Laboratories.	Wood Distillation, Charcoal Iron and Steel Industry.	Industrial Development Department.	Education Department.	Native Affairs Department.	Royal Perth Hospital.	Free.	Pay—Public.	Pay—Civil Aviation Department.	Pay—Forests Department.	Pay—Commonwealth Works.	Pay—Commonwealth Light House and Navigation Service.	Pay—Local Governing Bodies.	Public Health Department.	TOTAL.
Water	134	136	46	1	88	14	....	1	1	3	....	3	801	6	13	10	2	1	16	1,276
Marine Growth	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1
Soils	328	....	6	....	....	....	....	....	....	....	....	....	18	....	148	....	....	....	....	500
Fertilisers—																				
Manure	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Guano	....	....	....	....	....	....	....	....	....	....	....	....	8	....	....	....	....	....	....	8
Fertiliser	10	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	12
Fertiliser Act Samples	11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	11
Limestone (Soil Dressing)	23	....	....	....	....	1	....	....	....	....	....	2	12	....	....	....	....	....	....	38
Superphosphate	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Copper Material	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Quicklime	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Hydrated Lime	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Agricultural Lime	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Fish Manure	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Ash	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Sawdust Litter (Poultry)	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Fodders and Cereals—																				
Pastures	107	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	107
Oat Plants	193	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	193
Barley Plants	8	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8
Elephant Grass	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Sudan Grass	48	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	48
Vetch	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Wheat Plants	461	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	461
Sub-clover	302	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	302
Sorrel	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Wireweed	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Lucerne	27	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	27
Sweet Corn	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Peas	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Lupin Seed	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Brewers Grain	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Wheat Grain	260	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	260
Oat Grain	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12
Barley Grain	67	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	67
Straw (Wheat)	18	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	18
Sweet Dairy Meal	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Dried Kangaroo	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Laying Mash	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Chick Mash	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	1
Calf Milk	....	....	....	....	....	....	....	....	....	....	....	....	3	....	....	....	....	....	....	3
Whale Solubles	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Feeding Stuffs Act Samples	18	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	18
Wild Turnip Seed	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1

Fruit—																						
Vine Leaves	66	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	66
Strawberry Leaves	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Passion Fruit Leaves	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
Pear Tree Leaves	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Orange Leaves	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Plum Tree Leaves	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Mandarin Leaves	8	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8
Apple Leaves	50	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	50
Vegetable—																						
Lettuce Leaves	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12
Pumpkin Leaves	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Cabbage	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Potato Plants	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Tomato Plants	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Swede Plants	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Beetroot Plants	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Wheat f.a.q. and Flour	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Flour	15	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	17
Horse Hoofs, Pasture, etc. (Se)	....	....	....	....	....	18	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	18
Bones, Faeces, etc. (Fluorine)	7	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7
Fruit Tree Spray	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Brine	....	....	....	....	....	2	....	....	....	....	....	1	....	2	....	....	....	....	....	....	....	5
Culture Solution and Soil	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8	....	....	....	....	....	8
Flotation Concentrate	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	1
Pine Root Material	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	2
Tar Distillation (Hg)	....	....	....	....	....	....	8	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8
Tobacco Leaf	21	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	21
Iron Oxide	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	2
Totals	2,265	136	52	1	88	35	8	1	1	3	1	5	855	7	171	10	2	1	16	3,658

Table 4.
MINERAL DIVISION, 1951.

	Pay.	Free.	State Batteries.	Government Geologist.	Departmental Government Chemical Laboratories.	State Mining Engineer.	Industrial Development Department.	Metropolitan Water Supply.	Agricultural Department.	Under Secretary for Mines.	Factories.	Works and Labour Department.	Wood Distillation, Charcoal Iron and Steel Industry.	Bureau of Mineral Resources.	Pay, Main Roads.	Pay, Civil Aviation Department.	Pay, British Phosphate Commission.	Pay, A.I.D.	Pay, State Housing Commission.	Pay, Arbitration Court.	Public Health Department.	State Alunite Industry.	TOTAL.
Alloys and Metals (including Corrosion)	8	1	....	....	....	....	9	4	....	....	....	8	....	....	....	2	....	3	....	....	....	....	35
Ceramics—																							
Clays	....	6	....	....	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	11
Dolomite	....	1	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Kyanite	3	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Refractories	2	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3
Magnesite	....	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	2
Natural Mineral Pigments—																							
Ochres and Oxides	1	4	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Metallic Ores and Minerals—																							
Beryllium	6	3	....	....	....	....	....	....	....	2	....	....	....	1	....	....	....	....	....	....	....	....	9
Copper Ores	16	57	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	77
Gold Ores	14	13	....	....	....	2	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	30
Gold Umpire	....	....	31	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	31
Gold Tailings	2	1	198	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	201
Heavy Sands	1	7	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	8
Iron Ore	1	6	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9
Lead Ores	14	12	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	27
Lead Zinc Concentrate	1	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	2
Chromite	....	....	....	6	....	....	....	....	....	....	....	....	....	11	....	....	....	....	....	....	....	....	17
Manganese	....	11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	11
Columbite	2	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Tantalum	2	3	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Tungsten	25	4	6	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	37
Tin Ores	....	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12
Tin Concentrate	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Tin/Tantalite Ore	6	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6
Graphite	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Uranium	....	1	....	....	1	....	....	....	....	....	....	....	....	8	....	....	....	....	....	....	....	....	10
Zircon	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Molybdenum	....	....	....	....	....	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Monazite	1	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Bismuth	3	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	4
Lithium	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Yttrium	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1
Minerals for R.A. Test	....	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5
Other Economic Ores and Minerals—																							
Asbestos	1	2	....	....	....	1	....	....	....	....	....	....	....	2	....	....	....	....	....	....	....	....	6
Limestones	11	5	....	27	5	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	49
Bentonite	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Phosphates	....	....	....	....	....	....	....	....	....	....	....	....	....	2	....	....	37	....	....	....	....	....	39
Gypsum	....	9	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	10
Pyrite	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2
Clays	....	....	....	15	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	15

Barite								1																			1
Opal																2											2
Corundum								2																			2
Marcasite										1																	1
Glauconite										1																	1
Diatomaceous Earth										19																	19
Potash																									1		1
Garnet																2											2
Mineral Specimens for Determination							27	205		8	1	6	1		5					1	2				1		257
Miscellaneous—																											
Caustic Lime									14																		14
Construction and Building Materials							8	5						8					33			3				2		59
Rock										2										1							2
Blast Furnace Dust																				1							1
Charcoal																				1							1
Silica								1																			1
Oil																			2								2
Fibrolite Pipes														19													19
Galvanised Pipe														1													1
Industrial and Health Hazard																		13							1	10	24
TOTALS							156	388	249	81	17	20	13	32	5	6	13	44	6	25	5	2	37	3	2	1	11	1	1,117

AGRICULTURE, FORESTRY AND WATER SUPPLY DIVISION.

The work of this Division is mainly concerned with chemical examination of samples for the Departments of Agriculture, Forests and Water Supply as shown in Table 3. Work of specialised nature for other departments and general public is also undertaken.

A total of 1,276 samples of water were received in this Division during the year, about 80 per cent. of which were received from farmers, graziers, market gardeners etc., the War Service Land Settlement Scheme and the Department of Agriculture, to determine their suitability for domestic, irrigation and stock purposes.

The routine examination of existing water supplies to cities and towns was continued. In this connection samples were regularly analysed from Canning Dam, Churchman's Brook and Victoria Reservoirs, the Wungong Pipe-head Dam and Mt. Eliza Reservoir. Samples were also examined from Mundaring Weir, Mt. Charlotte Reservoir, Kalgoorlie, and Wellington Dam.

A number of soils were examined for the Department of Agriculture from different sources as follows—the high pH soils from the Carnarvon District, the Merredin, Wongan Hills, Avondale, and Bramley Agricultural Research Stations.

Soils were examined for the Forests Department chiefly in connection with the deterioration of Pine Forests in certain areas.

Samples of fertilisers and feeding stuffs were examined for compliance under their respective Acts. Analyses during the year undertaken for the Department of Agriculture included: samples in connection with extensive trials of the efficiency as fertilisers of various sources of phosphorus in comparison with superphosphate with the object of conserving the latter; samples of pastures and feeding stuffs on rate and time of application of superphosphate experiments in the South West; samples from experiments at Denmark Research Station on the rate of liming of soils, and from various other sources.

The following work was undertaken in connection with Plant Nutrition experiments for the Department of Agriculture: Apple leaves were analysed for manganese content; calcium, nitrogen and phosphorus on clover from seed before and after inoculation with different fertiliser treatments; determination of copper, phosphorus and potassium on a series of subterranean clover samples; the magnesium content of samples of lettuce leaves; mandarin leaves in connection with nutritional problems; fertiliser experiments with copper, zinc, manganese on different varieties of oats; samples from zinc and copper fertiliser trials on pastures; samples of vine leaves for suspected nutritional deficiencies; samples of wheat grain from various fertiliser experiments etc.

The programme of work undertaken in conjunction with the Department of Agriculture embracing chemical work on tobacco quality was continued. During the year samples examined included soils and waters in connection with tobacco growing and samples of commercial leaf. The latter comprised samples of North American leaf from both the Eastern area and the Old Belt area, and various samples from North Queensland.

The Deputy Government Agricultural Chemist has been engaged on research of "Bacterial digestion of sewage in saline waters" to increase our knowledge of the degree of digestion in various concentration of saline waters. A progress report will be published on this subject.

MINERALOGY, MINERAL TECHNOLOGY AND GEO-CHEMISTRY DIVISION.

The main activities of this Division are concerned with the examination of samples from the various branches of the Mines Department, State Batteries, Government Geologist, State Mining Engineer and from the general public. Certain work of a specialised nature is also undertaken for other Government Departments. A detailed classification of the samples handled by this Division is shown in Table 4.

Of the 249 samples received from the State Batteries, 229 were gold assays, 31 of which were umpire assays, the remainder being check assays. Six tungsten analyses were done in connection with concentration of tungsten ores and 14 samples of caustic lime were examined for the various batteries.

Eighty-one samples or specimens from mineral deposits throughout the State were examined for the Government Geologist, and included limestones, clays, diatomaceous earth, chromite etc. Of these eight were for mineral determination and optical examination.

Twenty samples were received from the State Mining Engineer for analysis or mineral determination. These included copper, gold, lead, tungsten and rare earth minerals and a tin concentrate.

One of the chief activities of this Division is the examination of economic minerals concerned with the development of the mineral industry of this State. It is also responsible for the keeping of the mineral records. Many enquiries regarding the mineral distribution, market potentialities and value were answered during the year. Apart from mineral specimens examined departmentally, 232 were received for mineral determination from the general public, 205 of which were done free under Regulation 2C of our regulations.

This is a service provided by the Government to prospectors and others under certain conditions as assistance to the mineral industry.

A number of samples were also tested for radioactivity free as part of the search for uranium minerals in this State; there were not any of economic significance.

Twenty-two samples of alloys and metals were analysed for one or more constituents and a number of metal or alloy components of fabricated articles were examined to determine the nature and cause of corrosion.

Under the heading of Ceramics several samples of clay from various localities were tested as to their suitability for use in the manufacture of bricks, tiles and other ceramic products. Thirteen samples of clay were also analysed for the Government Geologist to determine their suitability for cement manufacture.

Six samples of naturally occurring mineral pigments were examined to see if they were suitable for the Industry.

A number of building materials naturally occurring and manufactured were examined as follows—aggregates for cement brick making, building stones, wall plaster, fly ash, spun concrete pipes, asbestos-cement pipes.

Twenty-four samples of airborne dust were examined in respect to their industrial hazard.

FUEL TECHNOLOGY DIVISION.

Since the establishment of this Division five years ago much valuable work has been done in connection with the development of the Collie Coalfield and the efficient use of the coal.

In this respect the Laboratory keeps abreast with developments in the field by examination of the composition and purity of the coal and a study of its characteristics in relation to industry.

In all, 486 samples of varied nature were examined as shown in Table 5. Four hundred and fifty-two of these were coal samples, the remainder being of a miscellaneous nature associated with Fuel Technology Research. Of the 452 coal samples analysed 52 were for the Government Geologist, 339 were examined in connection with our own coal washing experiments and 13 for our Laboratory fuel survey.

Apart from the analytical work undertaken a considerable amount of investigational work has been carried out this year in the laboratory and in industrial plants as follows:—

1. Research on the production of coked briquettes from Collie coal as a metallurgical coke substitute.
2. An investigation to determine the reactivity of Collie coal was commenced during the year. This has been undertaken to ascertain its influence on the properties of the coals in connection with its use in cupolas and for briquetting.
3. The coal washing experiments at the Collie laboratory were continued during the year where one of our Research Officers, Mr. L. Brennan, is stationed. It is hoped that a report to determine whether Collie coal is amenable to washing will be furnished late next year.
4. Work has been carried out relating to the more efficient use of coal, wood or sawdust in boiler plant. In some cases it has been possible to effect economics in fuel consumption.

Table 5.

FUEL TECHNOLOGY DIVISION.

FUEL TECHNOLOGY DIVISION.	Departmental.	G. Geologist.	Free.	W. Distillation, Charcoal Iron Industry.	Industrial Development Department.	Royal Perth Hospital.	Pay.	C.O.R.	TOTAL.
Coal—									
Washing	339	....	....	....	....	....	....	....	339
Briquetting	4	....	....	....	....	....	....	....	4
Cupola Tests	11	....	....	....	....	....	....	....	11
Drilling	....	51	....	....	....	....	....	....	51
Fuel Lab. Survey	13	....	....	....	....	....	....	....	13
State Electricity Commission	9	....	....	....	....	....	....	....	9
Proprietary	....	....	....	....	....	....	13	....	13
Ex. Fremantle Gas Works	3	....	....	....	....	....	....	....	3
Coal Miscellaneous—									
East Collieburn	2	....	....	....	....	....	....	....	2
Centaur	....	1	....	....	....	....	....	....	1
Coal Inclusion	1	....	....	....	....	....	....	....	1
Callide (Q)	2	....	....	....	....	....	....	....	2
Augusta (Brown)	....	....	2	....	....	....	....	....	2
Denmark	1	....	....	....	....	....	....	....	1
Charcoal	....	....	....	1	2	....	....	....	3
Slag Wool—Cupola	6	....	....	....	....	....	....	....	6
Oxygen	....	....	....	....	....	1	....	....	1
Sponge Iron	1	....	....	....	4	....	....	....	5
Tar	11	....	....	....	1	....	....	....	12
Sawdust Briquettes	1	....	....	....	....	....	....	....	1
Fuel Oil	....	....	....	....	....	....	....	1	1
Gas (Wundowie)	3	....	....	....	....	....	....	....	3
Veneer	....	....	....	....	....	....	2	....	2
TOTAL	407	52	2	1	7	1	15	1	486

INDUSTRIAL CHEMISTRY DIVISION.

The year was a busy one for the Division. Apart from routine work, which occupied most of the time, and research for which there was only restricted opportunity, there was much activity in the planning and equipping of the Division's Unit Process Plant. This plant which is expected to be under construction early in 1952 should, on completion, enable use to vigorously pursue the research and development work necessary to the establishment of Chemical Industry in this State.

The Director and the Chief Industrial Chemist visited the Eastern States to study the organisation and equipment in laboratories with similar functions to our own and to find what equipment could be bought or manufactured in Australia. As a result we were enabled to draw up a list of suitable equipment, for which the Government has provided the sum of £26,000. Some of this equipment will come from England, the Continent and from the United States of America and certain items will be of local manufacture. It has been selected partly on the basis of experience and partly on the recommendations and advice of experts in the field of Chemical Engineering. Recent references in technical literature indicate that the selection compares favourably with new installations for similar purposes in England, Holland and the United States of America.

The work undertaken by this Division can be listed under three headings:—

1. Assistance to State Industries and Departments.
2. Routine work and inquiries.
3. Research.

In connection with routine work and inquiries opportunity was taken to expand the technical information service which is available to the public. There were over 800 inquiries during the year, mostly on minor matters of supply of chemicals and equipment, on the properties of chemicals, and in connection with minor operational difficulties. A number of local manufacturers sought technical advice on problems encountered in the course of the manufacture of their products.

(Sgd.) H. P. ROWLEDGE,
Director.
Government Chemical Laboratories.

Division VIII.

Annual Report of the Chief Inspector of Explosives for the Year 1951.

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 1951.

The quantity of explosives imported into the State during the year is shown in Table No. 1 and Table No. 2 giving a comparison of the quantities imported during the past five years.

TABLE No. 1.

Importation of Explosives into Western Australia during 1951.

		lb.
Gelignite		4,170,400
Gelatine Dynamite		123,850
Permitted Explosives		188,450
Blasting Powder		30,500
		4,513,200
Detonators: Number Ordinary		2,000,000
Electric		133,000
Delay		89,376
Fuse (yards)		5,820,000

TABLE NO. 2.

Explosives.	1947.	1948.	1949.	1950.	1951.
	lb.	lb.	lb.	lb.	lb.
Gelignite	3,379,650	2,817,700	3,098,900	3,215,850	4,170,400
Gelatine Dynamite	548,800	346,650	437,500	180,300	123,850
Permitted Explosives	443,750	621,600	932,500	179,800	188,450
Blasting Powder	22,500	35,500	55,000	52,000	30,500
Detonators	3,360,000	3,514,000	3,750,000	3,626,000	2,222,376
Fuse (Yards)	5,344,800	5,085,600	4,845,600	5,324,800	5,820,000

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	1,796
Fuse	504

The following table shows the number of licenses issued during the year.

Magazines on Government Reserves	45
Magazines used by Government Departments and on private property	137
Store Licenses Mode A	74
Store Licenses Mode B	1
Fireworks Licenses	492
Importation Licenses	2

The quantity of explosives used in the different classes of industry for the year 1950 and 1951, is given hereunder.

	1950	1951
	lb.	lb.
Gold Mining	3,252,650	3,616,500
Coal Mining	323,700	345,700
Agriculture	86,200	100,250
Quarrying	160,101	254,550
Mining and Base Metals	64,300	279,900
Government Departments	81,450	53,750
Miscellaneous	98,950	60,000

Although fewer than in 1950, the year's inspections included a number in remote districts not recently covered. Apart from their primary purpose, these visits establish contact between explosives users and the Department, and often permit of immediate decisions regarding intended new or enlarged magazines. One instance of heavy over stocking was found, and repairs to magazines or receptacles were ordered in some cases, but generally the storage of explosives proved to be satisfactory. Details of unserviceable explosives destroyed either in the country or at Woodman's Point Reserve are tabulated below:—

Date, Place, Kind and Quantity, Remarks.

March: Mt. Magnet; 2 plugs, unidentifiable; age, unknown history.

March; Cue; 31 metal flasks sporting powder; age, unknown history and ownership.

May; Woodman's Point; 173 cases Polar A2 Monobel; ruined by moisture before shipment.

Nov.; Collie; 40 plugs Polar A2 Monobel; ruined by moisture before shipment.

Nov.; Collie; 2 cases Polar A2 Monobel; ruined by moisture before shipment.

Sept.; S. Fremantle; 2 dozen bullets, A.A. shell etc.; dangerous in private possession.

Except for small quantities of Cordtex (detonating fuse) and millisecond delay detonators imported from abroad, the State's requirements of explosives and accessories were manufactured by Messrs. Nobel in Victoria. Nine vessels brought 89,664 cases to Fremantle, and a further 600 reached Kalgoorlie direct by rail. Unfortunately, an undue incidence of sub-standard material was experienced right throughout the year, the first notable example being two consignments of Polar A2 Monobel affected by moisture before shipment. Each of the 202,000 cartridges had to be examined individually, and as a result, 173 cases were destroyed. The next month, 11 tons of gelatine dynamite heat-tested on an average at only 5.26 minutes, but rose progressively so that ultimately the whole consignment could be released for immediate consumption. Shortly afterwards, observations on a pronounced smell associated with explosives were substantiated by companies from Boulder, where miners had threatened to cease using certain grades as then supplied. The odoriferous principle, said to cause headache and generally lowered efficiency, was identified as orthonitrotoluene, which confers plasticity on the material and, being itself explosive, may replace nitro-glycerin in small measure. Following representations to the manufacturers, orthonitrotoluene is henceforth only to be incorporated in large-diameter cartridges not intended for use underground. Finally, exudation or seepage of nitro-glycerin from explosives magazined at Wittenoom Gorge was encountered on a large scale, involving about 37 tons. Although inspections are not yet completed, it appears that about 1,500 cases will have to be withheld from consumption.

The packaging of explosives has been satisfactory, calling for little comment beyond reference to a bitumen-bonded cellulosic board as a possible substitute for wood. A 60 case trial consignment last August withstood sea, rail and road transport well, and was favourably received by users on the mines. Although less rigid than the conventional pine case, with some detriment to stacking qualities, the new material satisfactorily resists fire, termite attack and water absorption.

An occurrence which could have precipitated disaster came under notice during inspection of holds when m.v. Taranui was discharging explosives at Woodman's Point Jetty on June 8th. Seawater in the starboard pocket adjoining the detonator

magazine had caused swelling and heating of bagged haricot beans comprising part of a general cargo underlying the explosives. Whereas atmospheric reading was but 20° C. temperatures from 30° C. to 43° C. were found in and among the beans. Forty-six of the superposed explosives cases were tangibly warm, and several damp from condensed moisture. Two hours after removal and opening, representative cases were still at 30°-33° C., causing at first some apprehension that chemical decomposition might have been initiated. However, as ambient air temperature was assumed 16 hours later, the effect appeared ascribable purely to transmitted heat. The incident was reported to various authorities concerned, with a demand that any material prone to heat on reaction with water be henceforth excluded from explosives consignments. It is gratifying to record that on subsequent visits m.v. Taranui has brought explosives either alone or with hermatically sealed drummed material.

Fire and explosion destroyed a licensed magazine and its contents comprising 694 cases of explosives at Wittenoom Gorge on March 12th. Although chemical deterioration through termite attack, perhaps accelerated by sustained high temperature, was a suspected cause, evidence was so effaced by the blast that reconstruction and explanation proved impossible. No person was injured, and the extremely slight damage to property would suggest that a preponderating quantity burnt before the remainder detonated.

The need of an isolated jetty for handling explosive ordnance and hazardous chemicals having long been felt, it is hoped that a promised visit of the Operational Safety Committee next year will enable a plan to be formulated. At present, vessels which cannot berth at Woodman's Point or Naval Base either lighter their dangerous cargos or work alongside jetties or wharves never intended for such traffic. Imperial and Commonwealth-owned explosives are not controlled under the Western Australian Act, and by invoking National Security Section 66, all State regulations may be over-ridden. Certainly the authorities have instituted whatever safety precautions are possible in the circumstances, but the fact remains that the handling of high explosives in harbours and ports may be xepected to recur at intervals until alternative accommodation is provided.

The section dealing with explosives in draft amendments to the Coal Mines Regulation Act, 1946, was reviewed at the Chief Coal Mining Engineer's request. An apparent misapprehension regarding inadequate storage was dispelled by pointing out that the Explosives Act imposes no limit in licensed magazines sited and constructed according to departmental recommendations. Clause 43, providing that "wrappers on the ends of cartridges may be removed if by so doing better detonation is obtained" was opposed on the grounds that the danger of such practice would be out of all proportion to any possible advantage.

At Woodman's Point Explosives Reserve the entire southern and portion of the eastern boundary fence have been rebuilt. When the remaining sections are completed, thought must be given to providing a road connecting the entrance with the jetty. The present lack of vehicular access means that ambulance and fire-fighting facilities could not be brought within effective distance of where most likely required. These considerations aside, time saved by eliminating the existing 27 chain foot journey to and from the vessel or lighter could increase a working day's output by 140 cases of explosives.

Whilst dealing with the Explosives Reserve, it is my duty to plead for retention of its present position at Woodman's Point. Industrial expansion south of Fremantle has focussed covetous eyes on the 227 acre block, none of which should be ceded if safety distances and provision for future growth are to be preserved. Assertions that "the Reserve will have to go" are frequently heard, without any constructive suggestions as to where it might be situated in order equally or better to fulfil its purpose. Two years ago, thousands of pounds were spent on lengthening the jetty which, benefitting from storm protection in the lee of Garden Island, is able to accommodate vessels whose only alternative method of discharge would be by lighter from Gage Roads. Another feature peculiarly suiting Woodman's Point for an explosives area is rising ground skirting Naval Base Road to form a natural mound screening habitation eastward thereof. These advantages, with others such as accessibility, might not be reproducible elsewhere. Explosives are so basically essential that their centre of importation, examination, storage and distribution has a right to remain where it has proven safe and satisfactory since its establishment early this century. Encroachment on buffer zones surrounding the Area must also be prevented inasmuch that an inevitable reduction in quantities of explosives handled and stored would follow. As is known at the cost of restricted supplies for W.A., Victoria is in the throes of such a dilemna through expansion of Altona townsite toward the explosives reserve. A similar situation must not be tolerated here.

Of 25 firework consignments totalling 1,381 cases from England and Hong Kong, 530 samples were examined for prohibited admixtures, safety in firing, soundness of construction, etc., and chemical analysis proved necessary in a few instances. One Kwong Man Lung line known as "Drops" was condemned because of shedding molten globules capable of igniting cloth. Faulty sealing permitting escape of contents resulted in British made "Empire Torches" being withheld from sale pending overhaul. The defect, however, was practically confined to a small sample parcel; of 32 gross torches inspected, only a dozen were confiscated.

A small committee appointed by the Premier's Department to arrange a fireworks display for the anticipated Royal visit in March, 1952 met several times late in the year. The services of an expert pyro-technician were secured and a programme befitting the occasion prepared. Heirisson Island, chosen as the firing site appeared to offer unique possibilities from the spectators' view-point and safety considerations. The fireworks, all of Australian manufacture, were ordered and arrangements made for storage at Woodman's Point Explosives Reserve until required.

Thanks are due for co-operation extended by officers in the professional, records and clerical branches of the Department, both in town and country. Mr. Wood's duties, including those as Sub-Inspector have been performed with usual zeal and fidelity, and the staff at Woodman's Point are also to be commended for a satisfactory year's work.

F. F. ALLSOP,
Chief Inspector of Explosives.

24th November, 1952.

Division IX.

Report of Chairman, Miner's Phthisis Board, and Superintendent Mine Workers' Relief Act.

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 1951.

Under arrangements similar to previous years, the Commonwealth 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, where visits are not warranted as very few mine workers are employed.

Mine Workers' Relief Act.

The examinations under the Mine Workers' Relief Act during the year totalled 4,942 compared with 5,426 for the previous year, a decrease of 484. The results of the examinations for 1951, together with those for the previous years are shown in the tables annexed hereto. A graph is also attached illustrating the trend of the examinations since their inception in 1925. In explanation of these figures, I desire to make the following comments.

Normal, etc.

These number 4,642 or 93.94 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 5,077 and 93.57 per cent.

Early Silicosis.

These number 261, of which 13 were new cases and 248 had been reported previously, the figures for 1950 being 14 and 269 respectively. Early Silicotics represent 5.27 per cent. of the men examined the percentage for the previous year being 5.22 The percentage of new cases was 0.26 compared with 0.26 for 1950.

Advanced Silicosis.

Of the 29 cases reported, nine were men who advanced from Early Silicosis during the year, the other 20 having been previously reported. Advanced Silicotics represent 0.60 per cent. of the men examined, the percentage for the previous year being 1.01 The percentage of new cases was 0.18 compared with 0.26 for 1950.

Silicosis plus Tuberculosis.

Six cases were reported, compared with three for the previous year, and represents 0.10 per cent. of the men examined. The percentage for the previous year was 0.05.

Tuberculosis only.

Four cases were reported, compared with eight for the previous year, and represents 0.09 per cent. of the men examined.

Aluminium Therapy.

Facilities for the introduction of Aluminium Therapy have now been installed in each of the big mines in the State, and is reported to be functioning satisfactorily.

The reports on Silicosis cases from the Kalgoorlie Health Laboratory are being closely watched, but as yet the figures show no variation compared with previous years. It is probably too early yet to express an opinion as to whether the treatment is likely to be effective, as the process has been in operation little more than 12 months.

Mobile X-Ray Unit.

The new Unit continued to give excellent service and during the year the hazardous trip to the Goldfields of the North-West was undertaken without mishap.

Mines Regulation Act.

Examinations under the Mines Regulation Act totalled 2,256. This was in addition to the 4,942 examinations under the Mine Workers' Relief Act. These show a decrease of 699 compared with the previous year.

The 2,256 men comprise 1,620 new applicants and 636 re-examinees for the Initial Certificate.

Particulars of the examinations are as follows:—

New Applicants.

Normal	1,501
Pneumoconiosis	4
Silicosis Early	1
Query Tuberculosis	18
Pneumoconiosis plus Query Tuberculosis	1
Other Conditions	95
	1,620

Of the above applicants for admission into the industry, 1,501 received the Initial Certificate, 20 received Temporary Rejection Certificates, 98 received Permanent Rejection Certificates and in one case no certificate was issued. Thus of 1,620 applicants, 1,501, or 92.65 per cent. were eligible for employment anywhere on a mine. The percentage of those permanently rejected was 6.05.

Re-examinations.

Normal	460
Pneumoconiosis	92
Silicosis Early	14
Query Tuberculosis	15
Tuberculosis	2
Pneumoconiosis plus Query Tuberculosis	2
Pneumoconiosis plus Tuberculosis	1
Silicosis Early plus Query Tuberculosis	1
Other Conditions	49
	636

These men had previously been examined and some were engaged in the industry prior to this examination, 460 received the Initial Certificate, two received Temporary Rejection Certificates, 15 received Permanently Rejection Certificates, 50 received Re-admission Certificates, 105 received Special Certificates, and in four cases no certificate was issued. Thus of the 636 men examined 510 were eligible for employment anywhere on a mine, 105 were eligible for employment only on the surface and 21 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	1,961
Rejection Certificate (Temporary), Form 3	22
Rejection Certificate, Form 4	113
Re-admission Certificate, Form 5	50
Special Certificate, Form 9	105
No Certificate	5
	2,256

The percentage of men of normal health to the number examined was 86 compared with 83 for the previous year.

Miner's Phthisis Act.

The amount of compensation paid during the year totalled £25,076 8s. compared with £25,911 18s. for the previous year, a decrease of £887 10s. which can be attributed to the death of some of the beneficiaries and attainment of the age of 16 years by some of the dependant children.

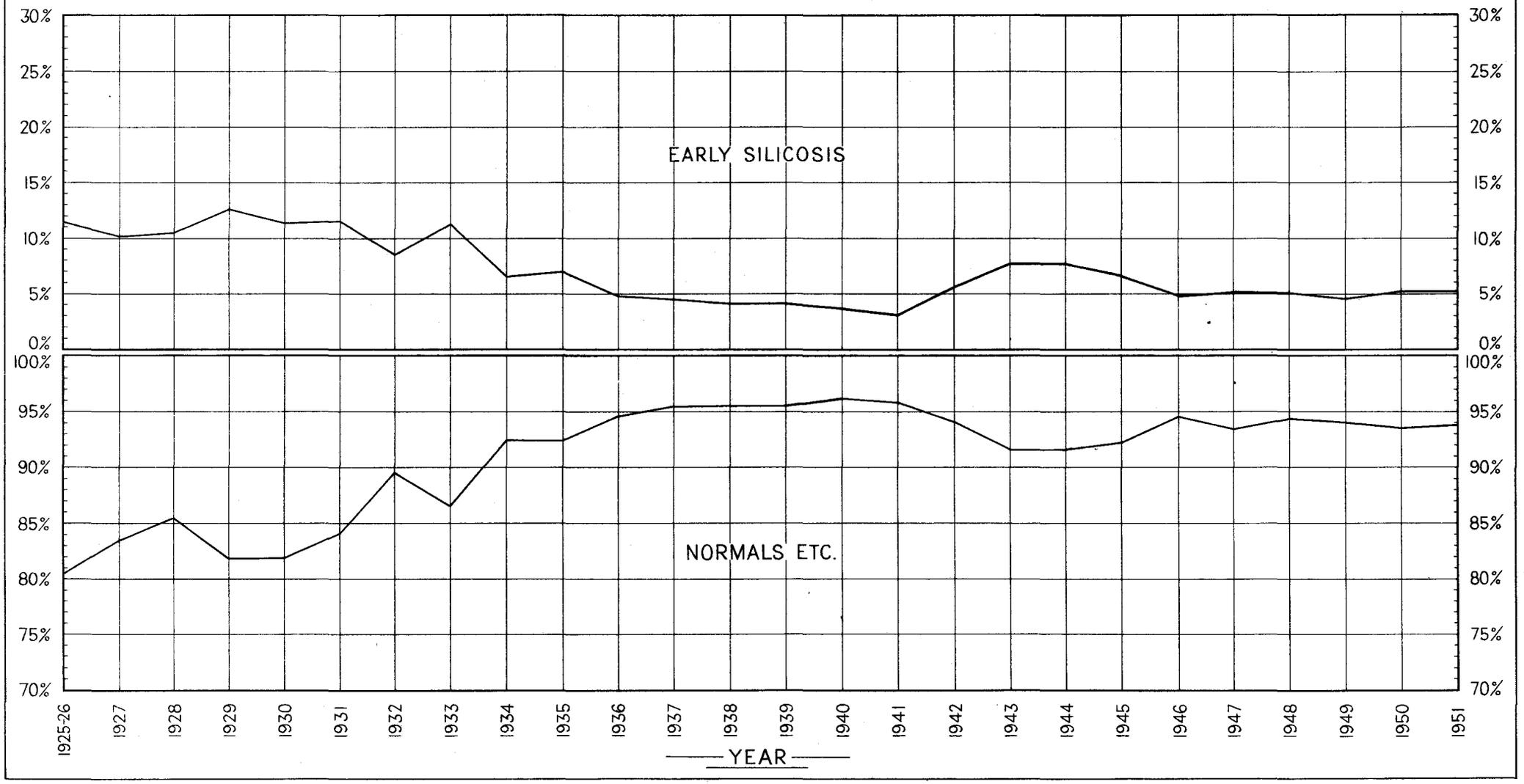
The number of beneficiaries under the Act on the 31st December was 221 being 27 ex-miners and 194 widows.

J. THOMAS,
Chairman Miners' Phthisis Board and
Superintendent Mine Workers' Relief Act.
20th March, 1952.

PERIODICAL EXAMINATION OF MINE WORKERS

GRAPH Nº1

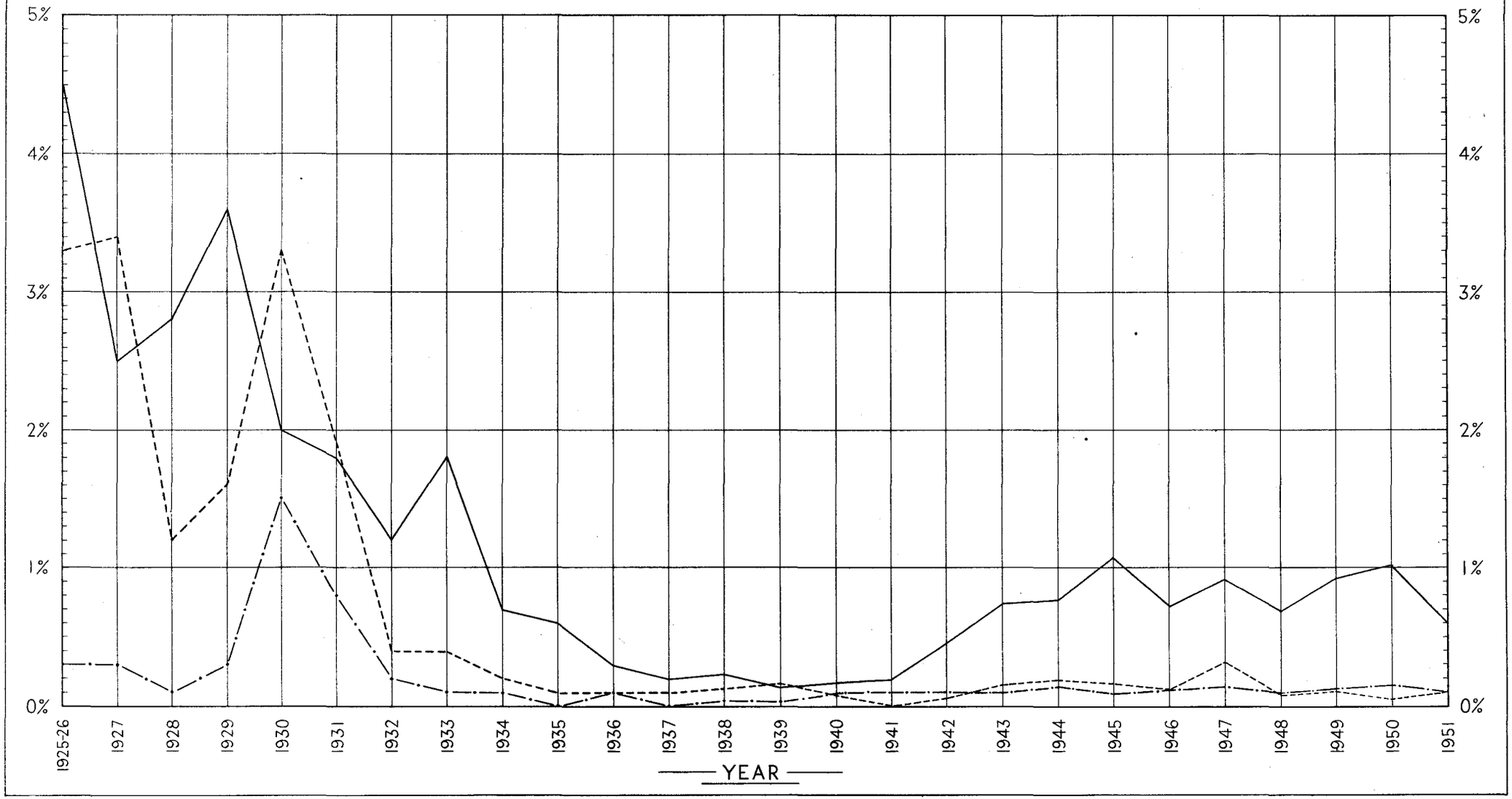
Showing Percentages of Normals and Early Silicotics, from 1925-26 onwards



PERIODICAL EXAMINATION OF MINE WORKERS

GRAPH Nº 2

Showing Percentages of Silicosis Advanced, Silicosis plus Tuberculosis and Tuberculosis only, from 1925-26 onwards



Silicosis Advanced ———— *Silicosis Plus Tuberculosis* - - - - - - - - *Tuberculosis Only* —·—·—·—·

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.				
	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.	Total number of men Examined.
1925	....	....	3,239	80·5	....	....	....	459	11·4	....	....	....	....	183	4·5	....	....	....	....	....	131	3·3	....	....	11	0·3	4,023
1926																											
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

Division X.

Report of the Chief Coal Mining Engineer for the Year 1951.

Under Secretary for Mines:

I have the honour to submit to the Hon. Minister for Mines the Annual Report on the operations of the Collie Coalfield for the year ended 31st December, 1951.

The aggregate output sold for the period under review was 848,347 tons, which again is a record for the coalfield. The output for 1950 was 814,351 tons. The 1951 output is therefore an increase of 4.18 per cent. or 33,946 tons.

The output of deep mined coal was 480,546 tons as compared with 556,523 tons, a decrease of 13.65 per cent. or 75,977 tons. Most of this decrease is due to extensive development programmes commenced during the year, especially at the Proprietary Mine which alone accounts for approximately 25 per cent. of the decrease.

No less than 10,771 manshifts were worked on development at the Proprietary Mine between May and the end of the year, which represents no less than 33 per cent. of the total shifts worked.

The developments referred to are for purposes of reorganisation, concentration and mechanisation, and in the case of the Proprietary Mine for the winning of three new seams of coal—two above the existing seam and one below.

It is to be hoped that most of the developments, now in progress, will be completed and in production during 1952 when the rate of deep mine production should increase. Further developments are contemplated when the existing are completed and in production.

The production from open cut mines was 367,801 tons as compared with 258,270 tons for 1950, an increase of 42.4 per cent. or 109,531 tons.

Development of a new open cut by the Amalgamated Collieries at Ewington was commenced at the latter end of the year. No coal was produced during the year but some will come into production early during 1952.

Comparison Coal Sold, 1950-1951:

Table "A" is the tabulated data of coal sold during 1951 as compared with 1950. The Cardiff and Neath Seams have been treated as one mine. The output from the Neath Seam can only be estimated as there is no means of recording the actual output from this seam. The estimated value of coal sold during 1951 is also shown.

Loss of Output:

Table "B" shows the loss of output that took place during the year. A very significant fact is that no loss took place due to strikes and the management and men are to be commended for such happy and harmonious relationship.

The total loss due to all causes was only 24,409 tons, a decrease of 21,508 tons on the previous year. This represents only 2.8 per cent. of the aggregate. This small amount can be regarded as negligible but as mechanisation increases one can expect a bigger loss due to mechanical breakdowns.

Apportionment of Output:

Table "C" shows the apportionment of the output during the year. The Railways were again the biggest consumers with a consumption of 373,866 tons or 44.00 per cent. of the aggregate. This is an increased consumption of 2,356 tons on 1950. The consumption of Collie coal by the Railways appears to have been comparatively constant during recent years. No regard is made to the quantity of imported coal used by the Railways and it may well be that there is an increase in the latter.

The State Electricity Commission consumed 299,156 tons or 35.27 per cent. of the aggregate as compared with 276,158 tons for 1950. This is an increase in consumption of 8.3 per cent. or 22,998 tons.

Private consumers again increased their consumption from 92,850 tons in 1950 to 98,657 tons in 1951, an increase of 6.25 per cent. It is difficult to judge the requirements of private consumers as they are rationed, but it is known their requirements far exceed their allocations. It is significant that the increase by private consumers was chiefly in large coal.

The trend in consumption of Collie coal during the five years 1947-1951 is shown in Table "D."

The greatest increase is by the State Electricity Commission which shows that in five years their consumption has increased by over 72,000 tons or an increase in the period under review of 31.73 per cent. It appears the State Electricity Commission are catering for an increase of 10 per cent. per annum. On this assumption their consumption in 1959-60 will be double their present, or at the rate of approximately 600,000 tons per annum.

It will be noticed that during the same period the Cement Works have increased by 49.51 per cent., also private consumers by 46.07 per cent.

The Collie Power Station will continue to increase in consumption as far more power will be consumed as the mines become mechanised.

In Europe and the U.S.A. the production of coal is at the rate of five tons per annum per head of population. It is true climatic conditions are different. At present the production in W.A. is approximately 1.6 tons per annum per head of population. It would be safe to assume the requirements at, say, three tons. On this assumption the production should be over 1½ million tons.

Comparison Open Cut and Deep Mines.

While the consumption has been rapidly increasing the output from deep mines has been gradually decreasing as shown in Table "E" and Graph. An examination of this Table and Graph shows that the percentage of open cut coal has gradually increased from 0.43 per cent. in 1943 to 43.4 per cent. in 1951.

The estimated outputs for 1952 show the estimated deep mines output to be 657,000 tons and open cut 425,000 tons, making the open cut 40 per cent. of the aggregate or a decrease of 3.4 per cent. on 1951.

It is hoped that these estimates will be achieved.

Open cut mines at Collie have a limited life and one must therefore visualise the whole of the State's requirements to be obtained from deep mines. The existing deep mines, even when fully mechanised, cannot possibly produce the State's requirements and probably another four new mines will be required.

Western Collieries intend having two new deep mines in operation during 1952, also the Griffin Company will probably commence another mine on their Muja leases. The Amalgamated Collieries have commenced a new deep mine on their Black Diamond leases and are contemplating another new deep mine on the Ewington leases.

When these new mines come into production then there should be no anxiety regarding production, provided all the mines are fully mechanised and planned on a long term basis. Mining is, of course, a hazardous undertaking, but successful mining involves these hazards.

Planning on a long-term basis will cater for such hazards especially as the Collie seams lend themselves to the Retreating system. If this system, on the block panel principle, is adopted throughout with adequate reserve faces then a constant predetermined output can be maintained.

The principle, adopted in the past, of driving tunnels in each seam might have been justified due to lack of capital. The system is not the orthodox manner of developing a lease containing more than one seam, and the Companies contemplating new mines on leases where there are a number of seams should seriously consider driving cross measure drifts or rock slopes intercepting each seam on the lease. One tunnel would then be equipped to serve all seams worked simultaneously or in turn. The original capital, although greater than for tunnelling in the one seam, would be spread over the life of each individual seam with obvious advantages.

STATISTICS, MEN EMPLOYED, OUTPUTS INDIVIDUAL MINES, OUTPUT PER MANSHIFT.

Table "F" shows the number of men employed, shifts worked and output per manshift for each individual deep mine. It will be seen that the output per manshift for all deep mines was 1.74 tons as compared with 2.04 tons for 1950, a reduction of 14.7 per cent. or 0.3 tons. This is a formidable reduction especially so as the output per manshift was already very low. Much of the reduction was caused by transferring men from production to development work. This has reflected itself in the percentage of manshifts worked on the coal face which have reduced from 25.3 per cent. in 1950 to 23.12 per cent. in 1951. A reduction of 5,321 manshifts.

Apart from the reduction in manshifts at the coal face there has also been a reduction of 6.45 per cent. from 8.06 tons to 7.54 tons in the output per face worker. This may not seem very much, but, on 63,751 manshifts at the faces, represents a reduction of no less than 33,135 tons. Much of this reduction is accounted for at the Wyvern Mine where a reduction of 1.19 tons per manshift took place at the face. This accounts for 11,044 tons and is due to faulting on both sides of the mine, also the trackless mining unit was transferred to Centaur as there was no further use for it at Wyvern. This transfer contributed to the above mentioned reduction.

The reduction at Griffin from 6.24 tons per manshift in 1950 to 5.83 tons per manshift—face worker—accounts for a reduction of 3,802 tons. This reduction was due chiefly to transferring labour to development in the stone drive section in order to re-organise for mechanisation. Similar reorganisation took place at many of the other deep mines especially at Cardiff where the reduction from 12.0 tons per manshift to 10.23 tons per manshift per face worker accounts for a reduction of 23,968 tons. When the developments referred to are complete and mechanised it is hoped that these losses will be more than recouped.

It will be noticed that of the total number of 202,898 manshifts worked at the mines, only 41,398 manshifts or 20.41% were worked at the coal face. Herein lies the inefficient position of the coalfield. No system of work that absorbs almost 80 per cent. of the total personnel on non-production can ever be efficient. Drastic changes are required. The personnel employed on haulage and maintenance work last year absorbed no less than 40 per cent. of the total shifts worked, or 57 per cent. of the underground shifts. This is an indication of the state of the haulage system and the heavy maintenance work involved in the present system of mining. It is true that during the year a considerable number of men were put on to development work who would be classified as maintenance men. Nevertheless in 1950 no less than 38 per cent. of the total personnel were employed in the two categories mentioned. It is therefore obvious that any scheme of re-organisation must admit or cater for a minimum number of men in the categories mentioned.

A significant feature of the manshifts worked during 1951 is that during that year the total number of shifts worked by each underground worker was 283.9 as compared with 273.5 for 1950, an increase of 10.4 shifts.

One attributes this increase to the incentive payment which came into operation in May 1951. As the incentive payment operated for only approximately half the year it is assumed that for a full year the increase would be in the region of 20 shifts per underground worker. This is quite a substantial increase and should reflect itself on output.

It is unfortunate that one cannot say the same regarding surface workers as in this category of employees a reduction took place. During 1950 each surface employee worked, on the average, 283.1 shifts, but in 1951 he only worked 273.5, a reduction of 9.6 shifts. It is difficult to account for this. It is appreciated that the increase in the number of underground shifts may be due to an increase in the amount of overtime, and a reduction in overtime would account for the reduction in the number of shifts worked by the surface employees. It is not possible to segregate the possible normal shifts from the aggregate as the Department have no record of overtime shifts.

Mechanisation:

The most significant feature during the year was the introduction of five mechanical units for coal production. Two were introduced in the Neath Seam, one in the Cardiff and at the end of the year, one at Proprietary and one at Co-operative. The trackless mining unit installed at Wyvern in 1950 was transferred to the Centaur Mine.

The two mechanical units in the Neath seam includes the Continuous Miner. This machine, designed and manufactured in the U.S.A., is a recent innovation for Pillar and Stall work. The machine cuts and loads the coal in one operation, thus eliminating under or over-cutting, boring and blasting. It has proved itself eminently suitable for the Collie coal and there can be no doubt there is scope at Collie for more machines of this type especially in heading work for development purposes. Unfortunately the Neath seam requires heavy and continuous timbering and consequently the machines are restricted in their performance due to the confined space, especially at intersections. This applies more particularly to the operation of the shuttle cars.

It therefore appears that an alternative form of transport is necessary from the Continuous Miner to the belts or bins. The ideal form of transport would appear to be some form of telescopic conveyor. The need for such a conveyor in the industry has been realised for some considerable time both in Europe and the U.S.A. Extensive research work and experiments have consequently been carried out in recent years. Good progress has been made—the results are very encouraging and it seems we are on the eve of such a conveyor being a practical proposition and commercialised. Should such be the case the value of the Continuous Miner in heading work will be considerably enhanced.

The other mechanical units introduced during the year, considering the lack of experience of personnel involved, have given satisfactory and encouraging results. Here again the heavy timbering necessary considerably curtails the performance of the machines due to the time taken in erecting the necessary timbering.

Roof Control.

The controlling of the roof in the coalfield is a matter of some anxiety. It appears that this vitally important matter has not received the attention it warrants. It has never been approached scientifically. Strata control is really the essence of successful mining engineering and must not be allowed to be regarded as an academic matter. There is

tremendous scope for much research work and not only into the question of roof control but in many other matters, even into the system of work itself.

In past years there was justification for advancing the bords on the strike line. To advance in any other direction would have introduced difficulties with the horse haulage system and drainage. With modern machinery such as belts and scraper chain conveyors the directions of the bords with regard to dip of seam is not of such significance and the bords should be driven in the direction that allows of the best form of roof control.

Another matter requiring a thorough investigation is the depth of undercut or overcut. Overcutting is specially mentioned as very frequently better results are obtained from it especially with bad roofs. The depth of cut, whether overcut or undercut, has a most important bearing on roof control. The results will probably be different for different directions of bords. It is therefore essential to ascertain which direction and what depth and position of cut gives the best form of roof control. The only way to find out is by the liberal use of subsidence recorders supervised by a competent person. The whole problem is a very complex one and is a matter for the specialist in roof control to solve. The need for research work on the matter is apparent when one considers the number of falls and consequent loss of output that have occurred at Collie during the year.

The managements would be well advised to devote to this matter the time that its importance warrants, as successful roof control is often the difference between profit and loss, apart from the fact that from a safety point of view good roof control is essential. The use of mobile machinery brings the matter into prominence as there is always a danger of such machines displacing timber, especially at the intersections.

Roof Bolting:

Experiments with roof bolting have been carried out at Phoenix, Wyvern, Centaur and Neath. The results are encouraging and in each case an improvement in roof conditions is apparent.

To change over from the conventional system of timbering to roof bolting is a change of a major nature and should not be undertaken lightly or indifferently. The character of the strata overlying the Collie coal seams is such that one cannot afford to take even the slightest risk.

Roof bolting was first practised in the United States in metalliferous mining and later extended to coal mining. The use of roof bolts has become so extensive that the Bureau of Mines created a separate department to take control of roof bolting installations.

An extract from a recent report issued by the above department (Roof Control Section of the Bureau's Health and Safety Division) is as follows—

"Although roof bolting is practised in more than 450 coal and 50 non-coal mines in the United States, the experience gained thus far has been insufficient to form the basis for a set of rules applicable under all conditions. For the present, every mine, and even part of the same mine, where roof conditions vary, must be regarded as a special case."

The report continues as follows—

"Roof bolting, no less than conventional mine timbering, must be done in accordance with a definite plan. Failure to adopt a roof bolting plan, or not to adhere closely to it if one has been adopted, is cited as a factor in many accidents involving roof-bolted areas that the Bureau has investigated.

Roof bolting, properly done, has proved to increase not only safety, but also productivity.

The conclusion, that with its adoption many or all of the time-proven rules of good mining practice can be cast aside is far from being the case."

Such is the experience of the United States where roof bolting has been in operation for many years. At Collie roof bolting is in its infancy and one would be well advised to proceed with the utmost caution as it is well known that the Collie strata varies considerably from mine to mine as well as in each mine.

Development:

In the report for 1950 concern was expressed as to the rate of development, which had been neglected for many years, and which was causing a severe handicap to production.

During 1951 attention was given to this all-important matter and a considerable number of men were transferred from production to development and re-organisation work. Probably the largest transfer took place at the Proprietary Mine in May, when no less than seventy men were transferred to development and re-organisation. During the period May/December as previously stated no less than 10,771 manshifts were worked.

This represents a loss in output at the Proprietary of no less than 19,000 tons. Similar developments, but not on such a large scale, took place at many of the other mines.

In spite of the development undertaken during the year much still remains to be done and until it is done the coalfield will not reach a position of stability. One cannot but emphasise on the matter as consumption by almost all consumers is increasing rapidly and will continue to increase for many years.

The commencing of new deep mines is only a temporary expedient. To open new mines and neglect to develop, re-organise and mechanise the old mines will ultimately end in disaster. To safeguard the future, re-organisation and mechanisation must take place today in all deep mines.

Apart from re-organisation and mechanisation the system of work should receive close study. The Pillar and Stall advancing system with pillar extraction has certain merits, such as quick returns on capital, but at Collie there is no pillar recovery and the advantages, such as quick returns on capital, do not exist.

With modern face machinery, coal headings can be driven rapidly, especially at Collie, where no brushing of the roof is necessary, and large outputs can be obtained during the development period. Prior to the introduction of modern face machinery there was some justification for the reluctance on the part of the management to wait for the completion of the development before full production from retreating faces, but today there can be no serious objections to adopting the retreating system.

The advantages from a managerial point of view are enormous, part from the fact that a pre-determined and constant output can be maintained at a higher rate of efficiency and consequently lower costs.

Accidents:

The total number of serious accidents in 1951 was 148, not including two accidents in the open cuts and one in the new tunnel at Western No. 1, as shown in Table "G".

This compares with 139 in 1950, an increase of 6.5 per cent. or nine accidents.

In 1950 there were 120 accidents underground as compared with 118 in 1951, a decrease of two accidents, whereas on the surface there were 19 in 1950 as compared with 30 in 1951.

The incidence of accidents at each individual mine is again based, for purposes of comparison, on the rate per 100 men employed, per 100,000 tons produced, and 10,000 manshifts worked, as per table "H".

If one makes allowance for the reduced output due to causes previously stated there is no appreciable difference in the rate of accidents except at the Co-operative mine where the accident rate, for no apparent reason, has almost doubled. This is a record I am sure the Co-operative mine does not wish to retain.

Table "J" shows a detailed classification of all non-fatal reportable accidents. This classification is a guide to one as to where to concentrate for a reduction in accidents. A very significant

fact, as illustrated in the classification, is that of a total number of underground accidents of 436 no less than 316 or 72.4 per cent. of the underground accidents are due to miscellaneous reasons. This appears phenomenal and this prolific cause of accidents should be investigated at each individual mine as all mines seem to be similarly affected.

During the year there were two fatal accidents, one at the Cardiff mine and the other at the Co-operative mine.

Both accidents are not unconnected with shotfiring as they both occurred after shotfiring had taken place. This indicates the necessity for a thorough examination of places after the firing of shots.

It will be appreciated that the vibrations due to shotfiring often causes movement of strata and breaks in the strata occur which often are almost impossible to detect.

The potential dangers of shotfiring are apparent to everyone and one cannot stress too strongly the need for the utmost precautions.

Table "K" shows the current and progressive totals since 1929. It will be seen that a progressive reduction is shown since 1943 and it is regrettable that such a reduction was not continued in 1951.

The increased use of machinery and a reduction in shotfiring should tend to a reduction in all accidents in the future.

Staff:

I would like to record my thanks to the Inspectorate, as a whole, the administration staff at headquarters, the representatives of the workmen, officials and the various managers for their help and co-operation during the year.

G. MORGAN,
Chief Coal Mining Engineer.

Table "A."

TABULATED DATA AND ESTIMATED VALUE OF COAL SOLD IN 1951 FROM EACH INDIVIDUAL MINE COMPARED WITH 1950 AS REPORTED TO THE MINES DEPARTMENT.

	1950.		1951.		Increase on 1950.	Decrease on 1950.	Estimated Value, 1950.	Estimated Value, 1951.
	Output.	Percentage of Total.	Output.	Percentage of Total.				
Deep Mines—								
Co-operative	73,724	9·10	80,564	9·50	6,840	....	117,857	166,963
Proprietary	116,073	14·20	82,432	9·71	....	33,641	183,739	169,291
Cardiff	104,332	12·70	95,445	11·25	....	8,887	164,510	201,539
Stockton	93,012	11·40	76,417	9·01	....	16,595	148,553	159,261
Wyvern	94,277	11·60	71,521	8·43	....	22,756	143,760	141,198
Griffin	68,812	8·50	56,046	6·61	....	12,766	104,931	112,144
Phoenix	6,293	·80	6,732	·79	439	....	9,602	13,794
Centaur	....	....	10,608	1·25	10,608	....	....	22,999
Black Diamond Tunnel	....	....	781	·09	781	....	....	....
Total	556,523	68·30	480,546	56·64	....	75,977	872,952	987,189
Open Cuts—								
Stockton	169,768	20·90	193,408	22·80	23,640	....	272,900	401,732
Black Diamond	83,258	20·20	85,300	10·06	2,042	....	134,000	180,771
West Colliery	4,949	·60	89,093	10·50	84,144	....	7,858	147,096
Total	257,975	31·70	367,801	43·36	109,826	....	414,758	729,599
Deep Mines	556,523	68·30	480,546	56·64	....	75,977	872,952	987,189
Open Cuts	257,975	31·70	367,801	43·36	109,826	....	414,758	729,599
Grand Total	814,498	100·00	848,347	100·00	33,849	....	1,287,710	1,716,788

Table "B."

Comparison of Overall Coal Production Losses for 1950 *and* 1951 *showing where Losses Occurred as Reported to the Mines Department.*

Year.	Pit Top Meetings.	Railway Wagon Shortage.	Strikes.	Other Causes.	Total.
1950	3,927	31,933	135	9,922	45,917
1951	3,145	6,390	....	14,889	24,409
Increase on 1950	....	....	....	4,967	....
Decrease on 1950	782	25,543	....	....	21,508

Table C.

Tabulation showing Apportionment of Coal Sold during 1951 *as Reported Weekly to the Mines Department.*

Colliery.	Locos.	%	Trams (Power).	%	Private Large.	%	Private Small.	%	Cement Works.	%	Collie Power House.	%	Total Sold.
Co-operative .... Black Diamond O/C. Black Diamond Tunnel	86,273	51·77	42,479	25·49	18,331	11·00	4,746	2·85	11,475	6·89	3,341	2·00	166,645
Proprietary	41,593	50·46	2,807	3·41	17,320	21·01	673	·81	2,439	2·96	17,600	21·35	82,432
Cardiff .... Neath .... Stockton .... Stockton O/C.	....	....	66,060	69·21	4,870	5·10	1,467	1·54	23,048	24·15	....	....	95,445
	163,957	60·76	74,648	27·66	11,249	4·16	1,223	·46	12,120	4·50	6,628	2·46	269,825
Griffin	9,251	16·49	13,623	24·32	21,358	38·11	11,814	21·08	....	....	....	....	56,046
Wyvern	20,021	27·99	45,917	64·20	1,073	1·50	4,493	6·28	....	....	17	·03	71,521
Phoenix	....	....	6,732	100·00	....	....	....	....	....	....	....	....	6,732
Centaur	....	....	10,608	100·00	....	....	....	....	....	....	....	....	10,608
Western Collieries	52,771	59·23	36,283	40·72	39	·05	....	....	....	....	....	....	89,093
Total	373,866	44·07	299,156	35·27	72,923	8·60	25,734	3·03	49,082	5·78	27,586	3·25	848,347

Table D.

Tabulation showing Appointment of Collie Coal Sold during The Five Year Period 1947–1951.

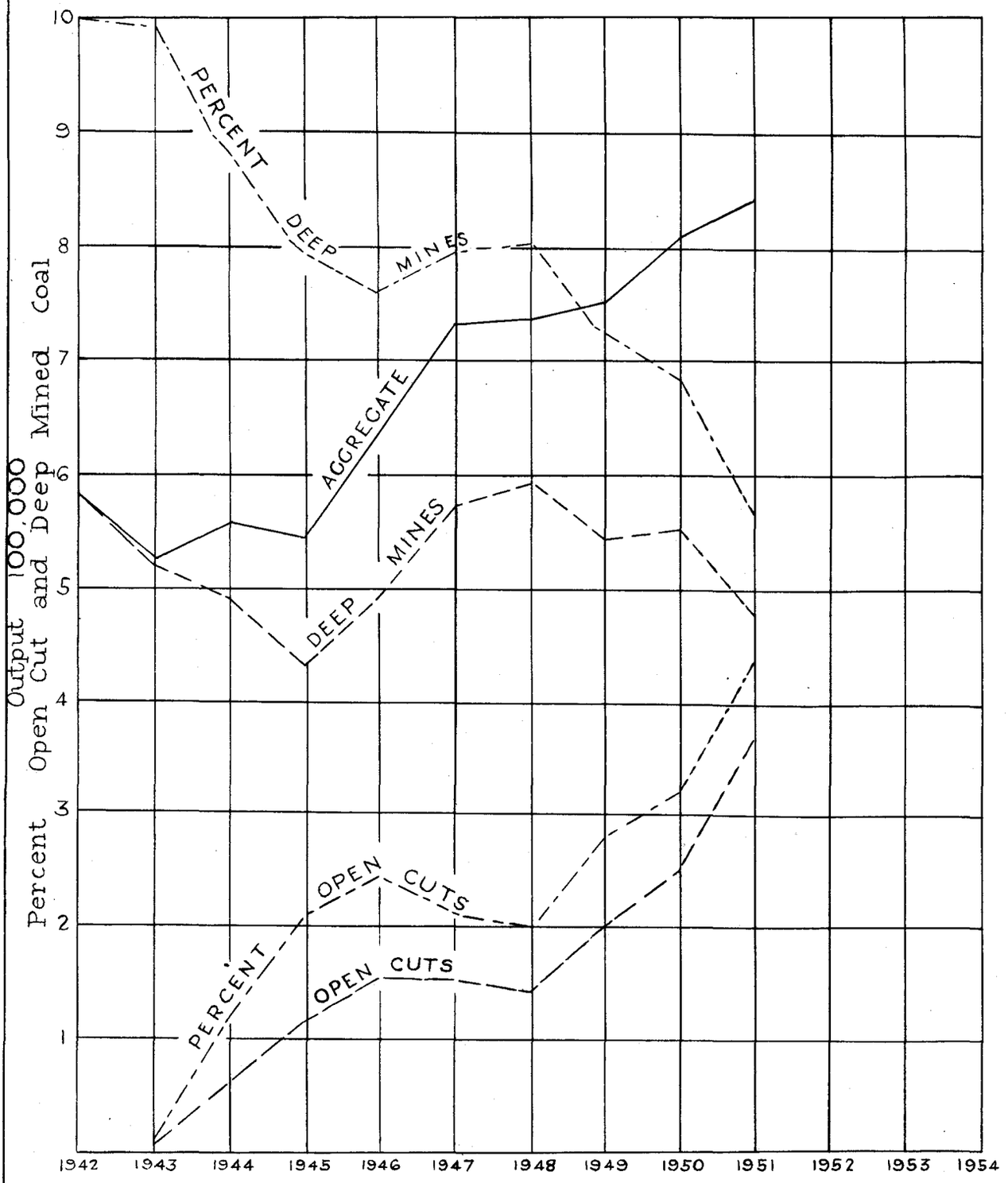
Year.	Railways.	%	S.E.C.	%	Collie Power Station.	%	Cement Works.	%	Private Consumers.	%	Total.
1947	379,774	51·98	227,101	31·09	23,268	3·19	32,828	4·49	67,538	9·25	730,509
1948	363,678	49·62	243,546	33·23	22,242	3·03	36,997	5·05	66,475	9·07	732,938
1949	358,945	47·82	266,872	35·56	23,218	3·09	37,524	5·00	64,045	8·53	750,604
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
Increase or Decrease	—5,908	—5·04	72,055	....	4,318	....	16,254	....	31,119	....	17,838
Percent. Increase since 1947	—1·56	....	31·73	....	18·56	....	49·51	....	46·07	....	....

Table E.

Collie Coal Produced, 1943–1951.

	1943.	1944.	1945.	1946.	1947.	1948.	1949.	1950.	1951.
Open Cuts	2,308	66,779	111,951	152,074	151,699	147,468	206,108	257,975	368,330
Deep Mines	529,238	491,543	430,458	490,057	579,008	590,565	544,358	556,523	480,146
Aggregate All Mines	531,546	558,322	542,131	642,131	730,707	738,033	750,466	814,498	848,476
Percentage Open Cuts to Aggregate	0·43	11·96	20·63	23·68	20·76	19·98	27·46	31·67	43·4
Percentage Deep Mines to Aggregate	99·57	88·04	79·37	76·32	79·24	80·02	72·54	68·33	56·6
Persons Employed	838	880	860	955	1,032	1,064	1,044	1,099	1,125

GRAPH SHOWING
ANNUAL TREND IN OUTPUTS



127

128

129

NEATH

Loc

MAIN TUNNEL
Travelling Way

Shaft

4386

373

201

COLLIERY

Extraction of Tops

ROAD

202

CARDIFF

Extraction of Tops

203

RAILWAY

224

225

226

CARDIFF AND NEATH

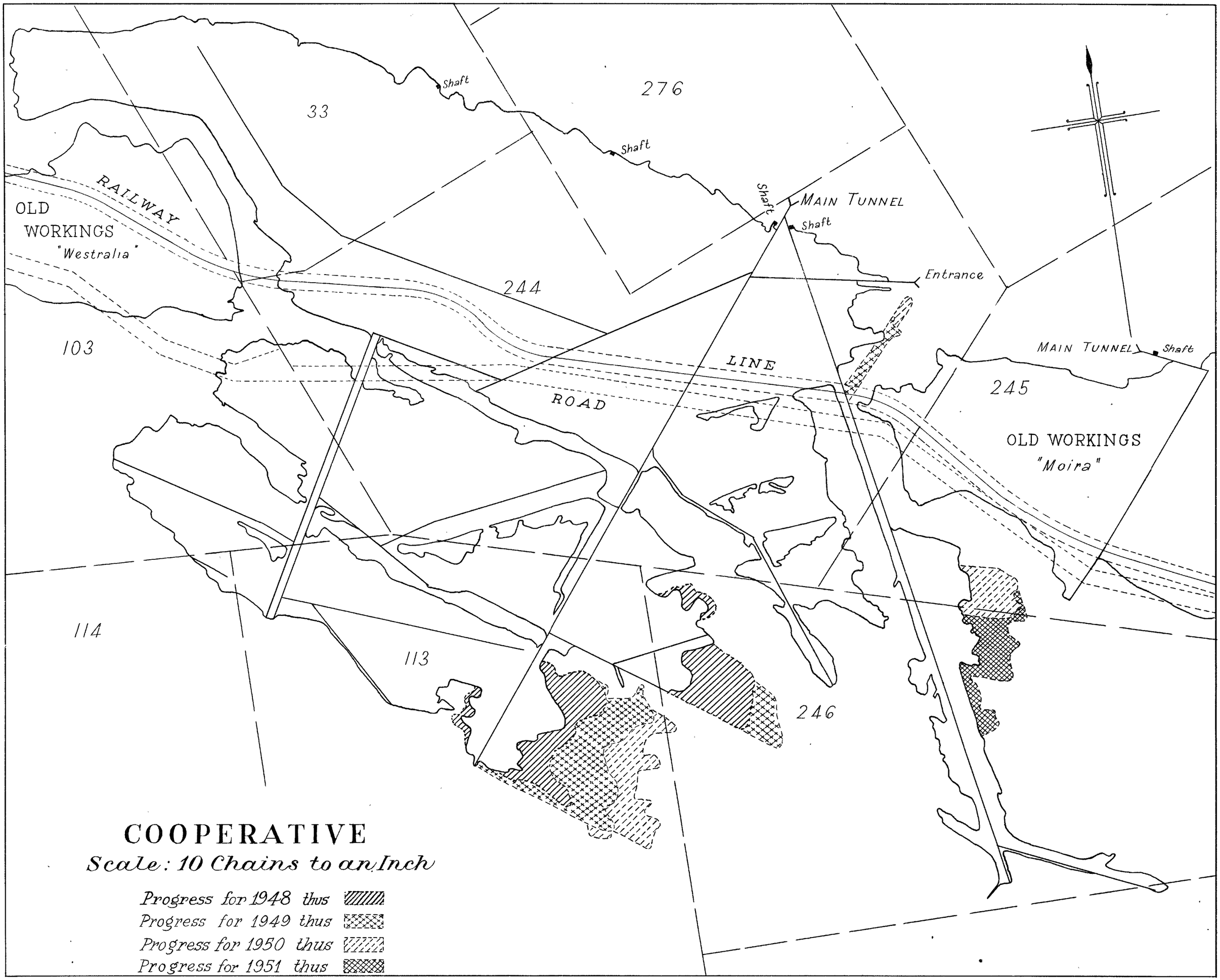
Scale : 10 Chains to an Inch

Progress for 1948 thus ////////

Progress for 1949 thus XXXXXX

Progress for 1950 thus ////////

Progress for 1951 thus ▩


Shaft
33
276
Shaft
Shaft
MAIN TUNNEL
Shaft
Entrance
RAILWAY
OLD
WORKINGS
"Westralia"
244
103
LINE
ROAD
MAIN TUNNEL
Shaft
245
OLD WORKINGS
"Moira"
114
113
246
COOPERATIVE
Scale: 10 Chains to an Inch
Progress for 1948 thus
Progress for 1949 thus
Progress for 1950 thus
Progress for 1951 thus

PROPRIETARY

Scale: 10 Chains to an Inch

Progress for 1948
Progress for 1949
Progress for 1950
Progress for 1951

MAIN TUNNEL
Travelling Way
RAILWAY
LINE
N
WALLSEND
COLLIE CARDIFF
ROAD
RAILWAY

86
337
339
340
76
344
343
342
341

77

Loc 1383

288

289

79

TOP SEAM

291

78

Loc 4382

MAIN TUNNEL

357

OPEN CUT

358

271

Internal Shaft

TOP SEAM

359

360

STOCKTON

Scale : 10 Chains to an Inch

Progress for 1948

Progress for 1949

Progress for 1950

Progress for 1951

108

Collie River

334

Shaft

MAIN TUNNEL

Shaft & fan

110

Shaft

TROUGH

Stone drive

FAULT

109

280

N

GRIFFIN

Progress for 1948
Progress for 1949
Progress for 1950
Progress for 1951

138

137

151

Scale : 10 Chains to an inch

110

109

WYVERN

Progress for 1948
Progress for 1949
Progress for 1950
Progress for 1951

138

137

110

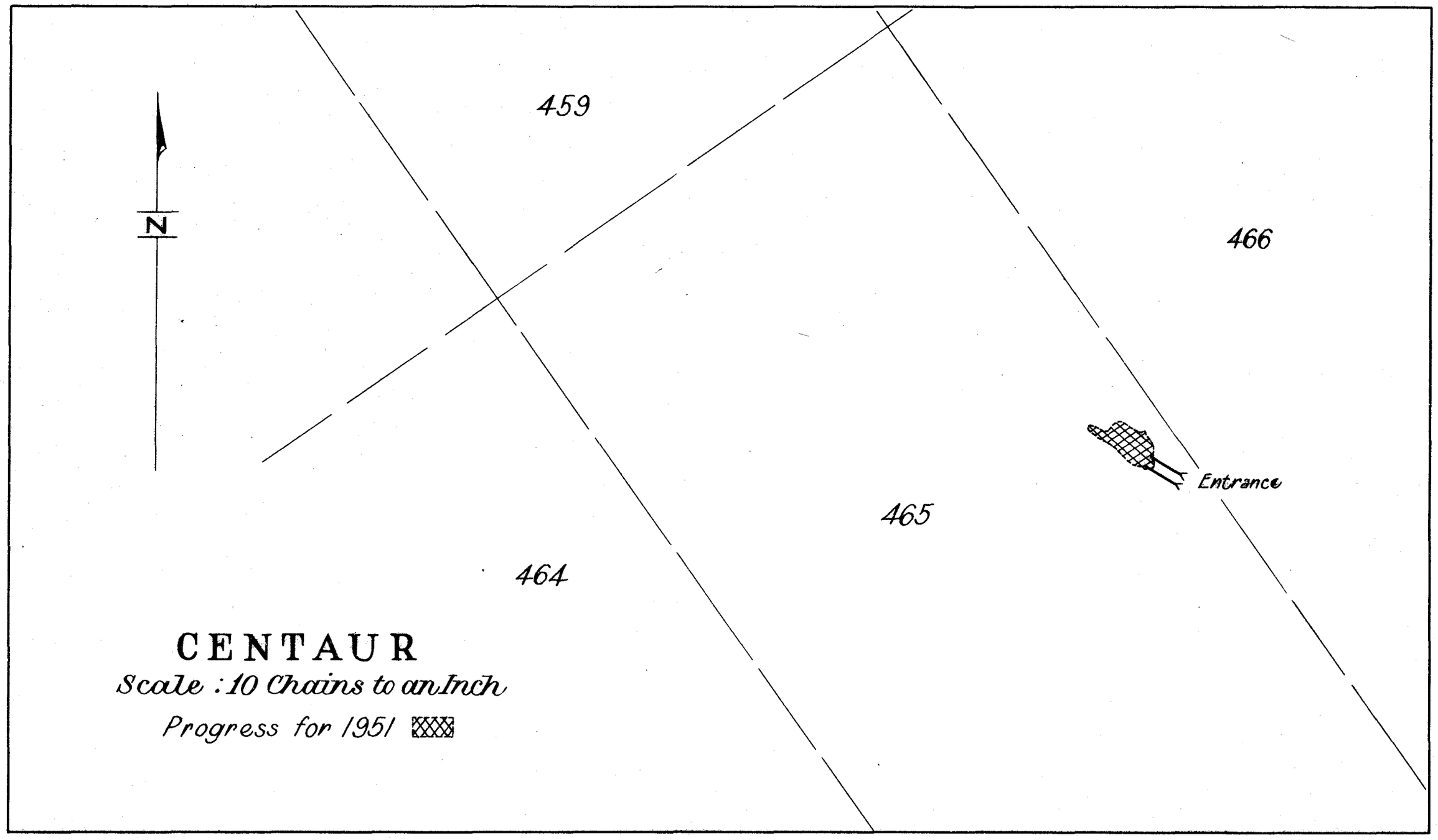
109

PHOENIX

Progress for 1948
Progress for 1949
Progress for 1950
Progress for 1951

137

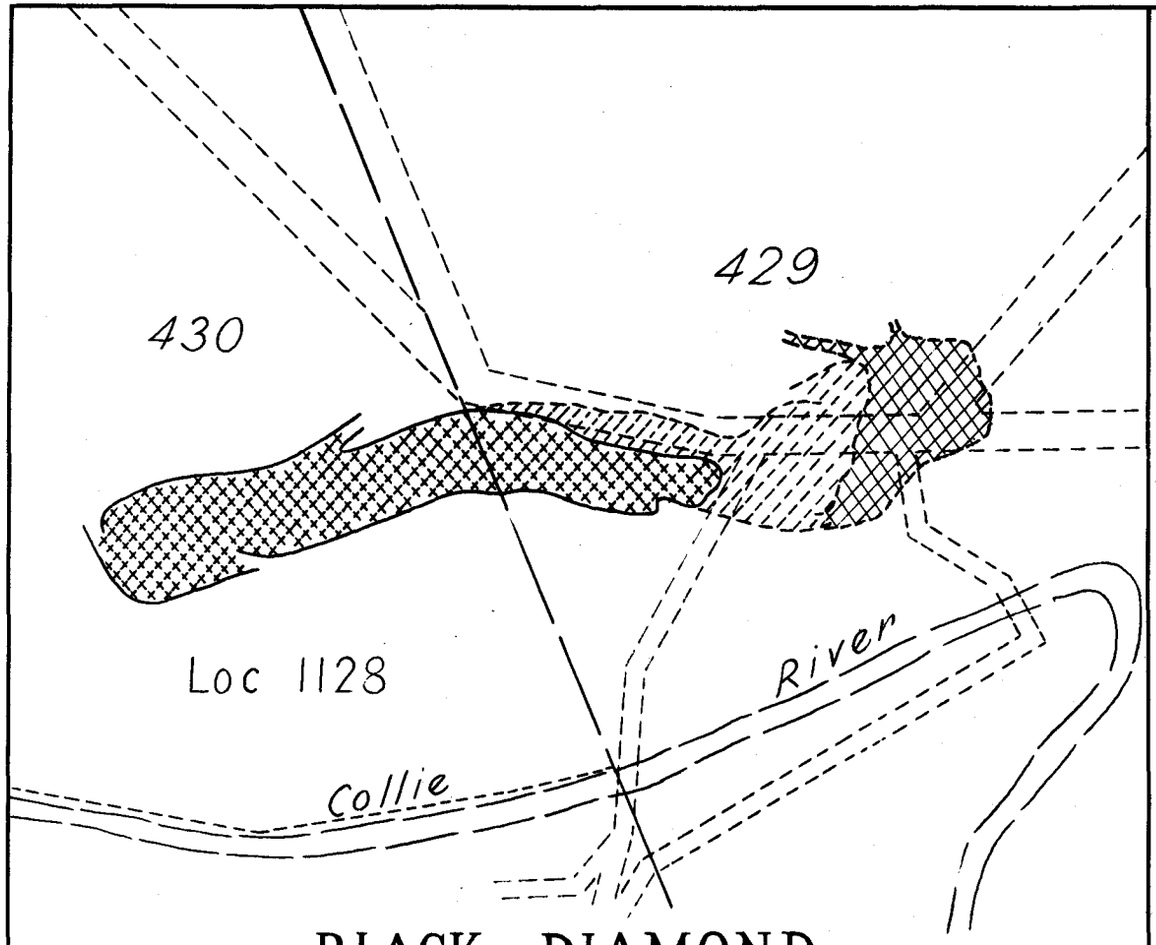
D.&W.



CENTAUR

Scale : 10 Chains to an Inch

Progress for 1951



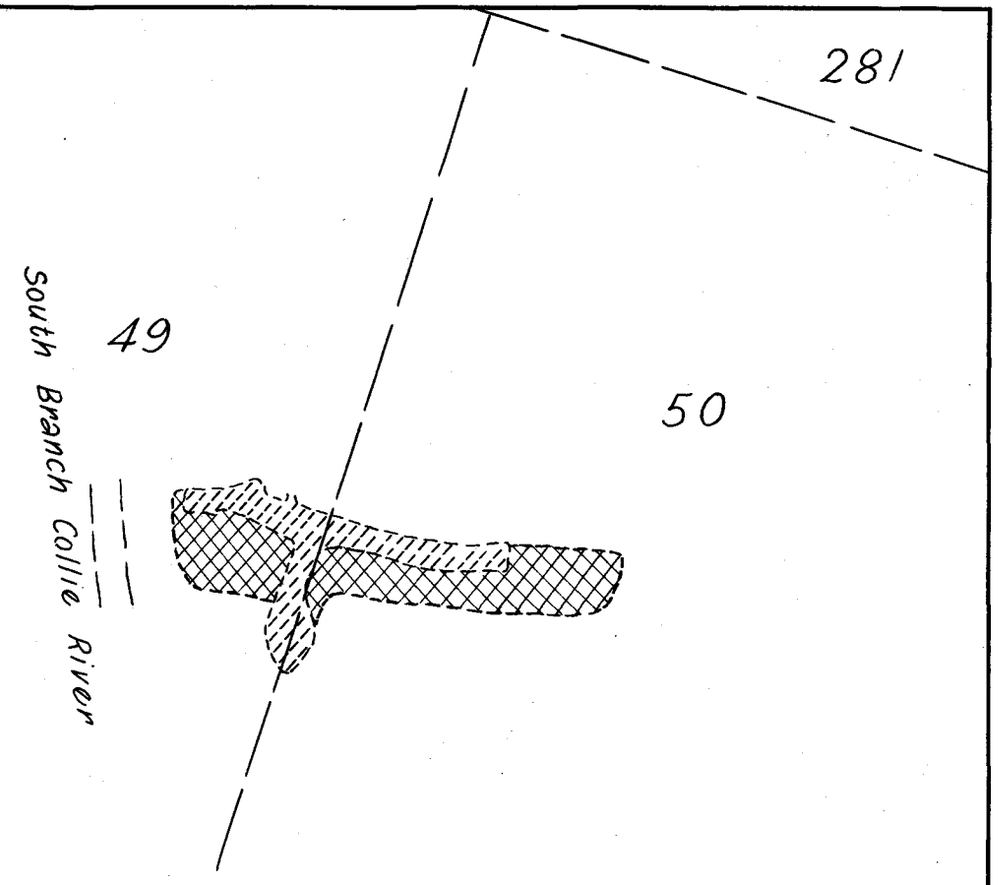
BLACK DIAMOND

Scale: 10 Chains to an Inch

Progress for 1949

Progress for 1950

Progress for 1951



COLLIE - BURN

(Western Collieries Ltd)

Scale: 10 Chains to an Inch

Progress for 1950

Progress for 1951

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.*

1951.

Name of Mine.	Face Workers.	Haulage.	Underground Maintenance.	Pump Attendants.	Officials.	Total Underground.	Total Surface.	Total Employed.
Cardiff—								
No. of men employed	32	16	26	3	8	85	45	130
Percentage to Total Employed	24.61	12.31	20.00	2.31	6.15	65.38	34.62	100
Manshifts worked during year	9,326	4,339	10,211	1,309	3,144	28,329	12,094	40,423
Percentage Manshifts to total worked	23.07	10.73	25.26	3.24	7.78	70.08	29.92	100
O.M.S. in each category	10.23	22.00	9.34	72.91	30.35	3.37	7.89	2.36
Co-operative—								
No. of men employed	43	34	32	5	8	122	45	167
Percentage to Total Employed	25.75	20.35	19.16	3.00	4.79	73.05	26.05	100
Manshifts worked during year	10,612	9,545	10,593	2,246	2,867	35,863	13,049	48,912
Percentage Manshifts to total worked	21.69	19.51	21.65	4.59	5.86	73.32	26.68	100
O.M.S. in each category	7.59	8.54	7.61	35.87	28.10	2.24	6.17	1.65
Proprietary—								
No. of men employed	47	57	67	6	12	189	36	225
Percentage to Total Employed	20.89	25.34	29.78	2.66	5.33	84.00	16.00	100
Manshifts worked during year	11,803	16,177	21,002	2,711	3,828	55,521	9,423	64,944
Percentage Manshifts to total worked	18.17	24.90	32.33	4.20	5.89	85.49	14.51	100
O.M.S. in each category	6.98	5.09	3.92	30.41	21.53	1.48	8.74	1.27
Stockton—								
No. of men employed	43	23	12	3	7	88	27	115
Percentage to Total Employed	37.39	20.00	10.43	2.61	6.09	76.52	23.48	100
Manshifts worked during year	9,657	5,910	3,602	1,224	2,044	22,437	7,551	29,988
Percentage Manshifts to total worked	32.20	19.71	12.01	4.08	6.82	74.82	25.18	100
O.M.S. in each category	7.91	12.93	21.21	62.43	37.38	3.46	10.12	2.55

Total Amalgamated Deep Mines—							Total Surface.	Central Workshops.	Total Employed.
No. of men employed	165	130	137	17	35	484	153	68	705
Percentage to Total Employed	23.40	18.44	19.43	2.41	4.97	68.65	21.70	9.65	100
Manshifts worked during year	41,398	35,971	45,408	7,490	11,883	142,150	42,117	18,631	202,898
Percentage Manshifts to total worked	20.41	17.72	22.38	3.69	5.86	70.06	20.76	9.18	100
O.M.S. in each category	8.11	9.33	7.39	44.81	28.24	2.36	7.97	18.01	1.65

Griffin—							Total Surface.	Total Employed.
No. of men employed	38	36	19	3	6	102	26	128
Percentage to Total Employed	29.69	28.12	14.84	2.35	4.69	79.69	20.31	100
Manshifts worked during year	9,605	9,677	4,963	1,293	2,010	27,548	8,139	35,687
Percentage Manshifts to total worked	26.91	27.12	13.91	3.62	5.63	77.19	22.81	100
O.M.S. in each category	5.83	5.79	11.29	43.34	27.88	2.04	6.88	1.57
Wyvern—								
No. of men employed	34	6	25	3	5	73	19	92
Percentage to Total Employed	36.96	6.52	27.17	3.26	5.44	79.35	20.65	100
Manshifts worked during year	9,281	1,794	7,123	1,323	1,551	21,072	5,889	26,961
Percentage Manshifts to total worked	34.43	6.65	26.42	4.91	5.75	78.16	21.84	100
O.M.S. in each category	7.71	40.09	10.04	54.06	46.11	3.39	12.14	2.65
Phoenix—								
No. of men employed	6	....	4	....	2	12	2	14
Percentage to Total Employed	42.85	....	28.57	....	14.29	85.71	14.29	100
Manshifts worked during year	1,723	....	948	....	611	3,282	479	3,761
Percentage Manshifts to total worked	45.81	....	25.21	....	16.24	87.26	12.74	100
O.M.S. in each category	3.91	....	7.10	....	11.02	2.05	14.06	1.79
Centaur—								
No. of men employed	12	1	10	1	2	26	16	42
Percentage to Total Employed	28.57	2.38	23.81	2.38	4.76	61.90	38.10	100
Manshifts worked during year	1,734	104	1,495	131	379	3,843	2,441	6,284
Percentage Manshifts to total worked	27.59	1.65	23.79	2.09	6.03	61.15	38.85	100
O.M.S. in each category	6.12	102.00	7.09	80.98	28.00	2.76	4.35	1.69

Table F—*continued.*

Name of Mine.	Face Workers.	Haulage.	Underground Maintenance.	Pump Attendants.	Officials.	Total Underground.	Total Surface.	Total Employed.
Total Griffin Mines—								
No. of men employed	90	43	58	7	15	213	63	276
Percentage to Total Employed	32.61	15.58	21.02	2.53	5.43	77.17	22.83	100
Manshifts worked during year	22,343	11,575	14,529	2,747	4,551	55,745	16,948	72,693
Percentage Manshifts to total worked	30.73	15.92	20.00	3.77	6.26	76.68	23.32	100
O.M.S. in each category	6.48	12.52	9.97	52.75	31.84	2.60	8.55	1.99
Grand Total—Amalgamated and Griffin Deep Mines—								
No. of men employed	255	173	195	24	50	697	284	981
Percentage to Total Employed	25.99	17.63	19.88	2.45	5.10	71.05	28.95	100
Manshifts worked during year	63,741	47,546	59,937	10,237	16,434	197,895	77,696	275,591
Percentage Manshifts to total worked	23.12	17.24	21.74	3.75	5.96	71.81	28.19	100
O.M.S. in each category	7.54	10.11	8.02	46.94	29.24	2.43	6.13	1.74

TABLE "G."

SERIOUS ACCIDENTS—COLLIE COALFIELD 1951.

	MAJOR INJURIES—EXCLUSIVE OF FATAL.																						MINOR INJURIES.											
	FRACTURES.										AMPUTATIONS.												FRACTURES.											
MONTH 1951.	Head.	Shoulder.	Arm.	Hand.	Spine.	Rib.	Pelvis	Thigh.	Leg.	Ankle.	Foot.	Arm.	Hand.	Finger.	Leg.	Foot.	Toe.	Loss of Eye.	Serious Internal.	Hernia.	Dislocation.	Other Major.	Total Major.	Finger.	Toe.	Head.	Eyes.	Shoulder.	Arm.	Hand.	Back.	Rib.	Leg.	Foot.	Other Minor.	Total Minor.
Jan.	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	1	....	....	1	....	2	....	1	7
Feb.	1	....	....	....	....	2	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	4	....	....	....	....	1	1	3	....	1	2	2	1	11
Mar.	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1	3	1	1	....	....	....	2	2	3	1	3	2	3	18
Apr.	....	....	1	....	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	3	....	....	....	....	....	1	2	2	4	1	2	15
May	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	1	2	....	....	....	1	....	....	4
June	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1	....	....	2	....	3	....	1	1	1	....	1	....	2	2	3	19
July	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	....	....	....	....	....	1	3	....	....	....	....	....	1	2	2	....	2	2	2	11
Aug.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	....	....	1	2	1	....	2	....	2	8
Sept.	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	1	....	....	2	2	1	....	....	....	1	1	2	....	2	1	2	12
Oct.	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	2	1	1	....	....	....	1	1	3	....	1	1	2	11
Nov.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1	....	....	....	1	....	....	2	2	....	....	1	1	7
Dec.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	1	1	....	1	....	1	6
Total	1	1	2	....	....	5	....	....	1	2	1	....	....	1	....	....	....	....	....	4	....	4	22	7	6	....	3	3	10	17	18	4	22	12	25	129

Table "H."

ACCIDENT RATE FOR INDIVIDUAL MINES, SHOWING COMPARISON WITH 1950 (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.											
	1950.	1951.	1950.	1951.	1950.	1951.	1950.	1951.	1950.	1951.	1950.	1951.	1950.	1951.
Proprietary	7	2	37	27	44	29	242	225	18·18	12·88	37·90	35·19	6·91	4·62
Co-operative	3	9	16	29	19	38	175	167	10·80	22·75	25·77	47·18	3·93	7·77
Cardiff-Neath	1	6	18	15	19	21	130	130	14·60	16·15	18·21	22·00	5·26	5·19
Stockton	4	7	20	14	24	21	132	115	18·18	18·26	25·80	27·48	6·58	7·00
Griffin	2	3	18	18	20	21	137	128	14·60	16·40	29·06	37·47	5·19	5·88
Centaur	....	1	....	2	....	3	....	42	....	7·14	....	28·28	....	4·77
Wyvern	2	2	11	11	13	13	98	92	13·26	14·13	13·79	18·18	4·58	4·82
Phoenix	....	....	....	2	....	2	11	14	....	14·28	....	29·56	....	5·32
Total	19	30	120	118	139	148	925	913	15·02	16·21	25·00	30·80	5·46	5·38

Note: Neath—1 accident only (Underground).

Table "J."

CLASSIFICATION OF ALL NON-FATAL ACCIDENTS (DEEP MINES).

Name of Mine.	Underground.							Surface.	Total All Accidents.
	Falls.		Haulage.	Explosives.	Machinery.	Miscellaneous.	Total.		
	Roof.	Sides.							
Co-operative	12	4	14	....	5	78	113	35	148
Proprietary	6	....	19	....	3	85	113	13	126
Cardiff and Neath	5	....	2	....	5	41	53	24	77
Stockton	7	1	10	....	6	38	62	24	86
Total, Amalgamated	30	5	45	....	19	242	341	96	437
Griffin	7	....	8	....	4	52	71	13	84
Wyvern	1	....	1	....	....	22	24	7	31
Total, Griffin	8	....	9	....	4	74	95	20	115
Total, All Mines	38	5	54	....	23	316	436	116	552
Percentage to Total	6·89	0·91	9·79	....	4·16	57·25	79·00	21·00	100·00

NOTE.—Above does not include three accidents at Phoenix and Western No. 1.

Table K.

TABLE SHOWING FATAL ACCIDENT RATE PER 1,000 PERSONS EMPLOYED FOR EACH YEAR AND PROGRESSIVELY SINCE 1929 TO 1950.

Year.	Men Employed.		Fatal Accident.		Death Rate per 1,000.	
	Current.	Progressive.	Current.	Progressive.	Current.	Progressive.
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	....	8	....	1·37
1937	723	6,540	....	8	....	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

ANNUAL REPORT OF THE COAL MINES ADVISORY BOARD.

The Under Secretary for Mines:

The Coal Mines Advisory Board continued its activities throughout the year.

In July Mr. Newburn, the Miners' Representative, resigned due to his appointment as Under manager at the Black Diamond Mine, and was succeeded by Mr. W. Bastow, who had also succeeded Mr. Newburn at President of the Miners' Union.

The Board held nine meetings and matters of vital interest to the industry were discussed. Particular reference was made to the development for purposes of mechanisation at all the deep mines.

Mr. Rowe, the Companies' Representative, submitted plans and details of all schemes of reorganisation of the mines in his charge. These schemes, many of which are now in the process of implementation and will be completed in the near future, were thoroughly discussed and approved by the Board.

The reduction in deep mine output has been a matter of much concern to the Board but it was agreed that due to the inadequate flow of new labour into the coalfield there was no alternative but to transfer a considerable number of men on production to development purposes.

In May a large transfer of such labour took place at the Proprietary Mine where over 70 men were transferred from production to development. Similar transfers took place at other mines but not to such a large extent.

Apart from the policy of re-organisation and mechanisation another important matter discussed was the question of technical training in coal mining.

As previously mentioned no facilities exist at present to deal with this matter which we consider of vital importance to the industry. The educational authorities have considered the matter and have agreed to the appointment of a mining lecturer. Such an appointment will be welcomed by all the mining students at Collie.

It is regrettable that the miners of Collie do not make as much use of the Advisory Board as they could. The Board was created in order to discuss all matters pertaining to the production of coal in Western Australia but it is rarely that the miners' representative has asked for such matters to be included on the Agenda and I would suggest that the miners make more and full use of the Board and refer any matter in connection with production for discussion by the Board.

The housing problem at Collie was frequently discussed at our meetings. The matter was also thoroughly discussed at other conferences at Collie and as a consequence the rate of erecting houses at Collie has been greatly accelerated.

The necessity for proving the serious faulting south of the Proprietary, Wyvern and Stockton Mines was discussed at length and as a consequence the deep drilling programme was temporarily suspended in order to prove the above mentioned faults.

During the year the faults south of the Proprietary and Wyvern Mines were proved. In both instances serious faulting was proved which indicates the necessity for further boring in both cases. Such boring could be deferred until the second drill is available. The deep drill is now engaged in drilling south of the Stockton Mine to prove the numerous faults known to exist in this area.

G. MORGAN,
Chairman, Coal Mines Advisory Board.

Coal Mines Regulation Act, 1946.

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

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 1951.

May Examinations: There were no candidates for First Class Certificate of Competency.

There were five candidates for examination for Second Class Certificates, three of whom were successful and were issued with Certificates.

There were four candidates for Third Class Certificates, two of whom were successful and were issued with Certificates.

October Examinations: There were no candidates for First Class Certificate of Competency.

There were two candidates for Second Class Certificates. Only one of these candidates sat for the examination, but failed. The other candidate asked that his application be transferred to a later examination, for domestic reasons, and this request was granted by the Board.

There were 13 candidates for Third Class Certificates. One application was cancelled because of lack of qualifications and of the remaining 12 candidates six were successful and issued with Certificates.

During the year 11 candidates were issued with Certificates as follows:—

Second Class Certificates of Competency as Under Managers.—Fewster, K. F.; Fogarty, A. T.; Henderson, C. D.

Third Class Certificates of Competency as Deputies.—Adams, L. J.; Brown, C. F.; Edwards, F.; Partridge, B.; Phease, W. E.; Simmonds, R. A.; Stocks, W.; Weir, L. N.

First Class Reciprocal Certificate of Competency was granted to Mr. J. Johnson. He was the holder of a First Class Certificate issued by the Board of Trade, England, endorsed and registered in New South Wales.

The Board would again respectfully draw to the attention of the Hon. Minister the fact that there are still no facilities for technical training at Collie for the lower grades of mine officials, or at Perth for the higher grade, and we are satisfied that such facilities are essential for the benefit of officials as well as the industry itself.

G. MORGAN,
Chief Coal Mining Engineer,
Chairman.

H. A. ELLIS,
Government Geologist,
Member.

JAMES GILLESPIE,
Senior Inspector of Mines, Collie,
Member.

Mining Statistics to 31st December, 1951.

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(8)—65961

TABLE I.

PRODUCTION OF GOLD AND SILVER FROM ALL SOURCES, SHOWING IN FINE OUNCES THE OUTPUT AS REPORTED TO THE MINES DEPARTMENT DURING 1951, 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 Ore. ‡ denotes mainly derived from Copper Ore.)

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1951.					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	109	"Mt. Bradley"	....	....	....	....	....	....	....	193·00	50·94	....
		Voided leases	....	....	....	....	....	....	....	1,352·75	1,404·40	....
		Sundry claims	....	....	....	....	....	7·62	7·62	2,484·00	1,871·92	....
Hall's Creek		Voided leases	....	....	....	....	....	....	....	423·00	477·76	....
		Sundry claims	....	....	....	....	....	27·73	....	204·55	159·68	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	....	....	....	....	....	....	....	2,919·25	1,631·30	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 parcels treated at : Sundry claims	....	....	....	....	....	....	....	....	....	†5·90
		Reported by Banks and Gold Dealers	44·72	74·20	....	·99	....	8,514·99	1,070·30	·75	2·53	....
		Tota	**44·72**	**74·20**	....	**·99**	....	**8,673·77**	**2,104·82**	**22,589·40**	**17,119·55**	**113·68**
West Kimberley Goldfield.												
Napier Range	M.L. 29	Devonian Silver Lead Mine	....	....	....	....	†348·63	....	....	....	....	†5,350·65
Mt. Broome		Sundry claims	....	....	....	....	....	....	13·76	....	....	....

Richenda	....	Sundry claims	....	....	....	....	....	....	....	....	1·00	2·49	....
	From Goldfield generally :—													
	Reported by Banks and Gold Dealers		....	....	....	....	....	1·30	10·92	....	....	....
	Totals		....	....	....	....	†348·63	**1·30**	**24·68**	**1·00**	**2·49**	†5,350·65

Pilbara Goldfield.

MARBLE BAR DISTRICT.

Bamboo Creek	1107	Bulletin	....	....	406·00	132·97	....	....	....	457·50	172·07	....
	850	Federation	....	....	155·00	99·62	....	....	8·22	2,589·00	1,948·06	·10
	(707)	Kitchener	....	....	168·00	412·16	....	....	....	10,262·00	14,157·21	·75
	1010	Mickey	....	....	20·00	4·72	....	....	....	1,761·00	472·31	1·42
	1096	Mt. Prophecy	....	....	615·00	379·37	....	....	....	1,058·00	535·34	9·95
	817	Prince Charlie	....	....	202·00	64·59	....	....	3·68	3,732·00	3,552·35	52·29
	1072	Princess May	....	....	48·00	15·01	....	....	....	48·00	15·01	....
	924	True Blue	....	....	....	....	....	....	....	2,093·25	85·22	....
		Voided leases	....	....	....	....	....	13·54	560·19	34,160·35	38,855·26	....
		Sundry claims	....	....	....	....	....	8·97	307·83	5,095·85	2,999·42	4·89
Boodalyerrie	....	Voided leases	....	....	....	....	....	....	292·07	120·25	587·86	....
		Sundry claims	....	....	....	....	....	....	7·16	....	....	....
Braeside	....	Sundry claims	....	....	....	....	†2,366·27	....	....	....	....	†8,134·16
Lalla Rookh	....	Voided leases	....	....	....	....	....	....	4·78	3,612·00	4,696·33	574·01
		Sundry claims	....	....	....	....	....	....	....	7,943·00	7,675·09	....
Marble Bar	930, 956	Alexander leases	....	....	200·00	55·70	....	....	....	200·00	55·70	....
	1094	Blue Bar	....	....	50·00	7·71	....	....	....	179·00	29·96	....
	(927, etc.)	Comet Gold Mines, Ltd....	....	....	2,475·30	2,760·19	261·03	....	....	116,941·74	105,898·34	475·85
	930, etc.	Prior to transfer to Comet Gold Mines, Ltd.	....	....	....	....	....	....	....	2,195·75	1,235·42	....
	927	Halley's Comet	....	....	1,104·00	178·94	....	....	....	1,104·00	178·94	....
	912	Homeward Bound	....	....	....	....	....	....	....	6,292·25	3,111·75	....
	1054	Illareen	....	....	....	....	....	....	....	40·00	6·32	·36
	1089	Repeater	....	....	....	....	....	....	....	548·20	123·83	6·26
		Voided leases	....	....	....	....	....	....	199·09	40,460·55	40,719·73	·83
		Sundry claims	....	....	134·00	48·61	....	67·08	251·77	20,020·29	12,570·68	6·59
North Pole	(1040)	Australian Mining and Industrial Finance Pty., Ltd.	....	....	1,475·00	656·09	....	....	....	3,722·00	1,498·92	260·08
	(1040)	Prior to transfer	....	....	....	....	....	....	....	69·00	31·07	....
		Voided leases	....	....	....	....	....	....	....	548·00	400·52	....
		Sundry claims	....	....	....	....	....	....	....	669·75	298·62	15·82
North Shaw	....	Voided leases	....	....	....	....	....	7·53	....	1,072·45	996·29	....
		Sundry claims	....	....	....	....	....	2·84	567·06	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 1951.					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.
PILBARA GOLDFIELD—continued.												
MARBLE BAR DISTRICT—*continued.*												
Pilgangoora	....	Voided leases	....	....	....	....	....	16·65	....	2,255·00	403·60	....
		Sundry claims	....	....	....	....	....	161·08	8·13	481·60	146·39	....
Shark's	1108	Edith Mae	....	....	....	....	....	....	....	18·75	18·57	1·16
	1081, etc.	Table Top Leases	....	....	....	....	....	....	....	237·25	120·02	14·08
		Voided leases	....	....	....	....	....	1·43	....	1,720·75	1,951·08	....
		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	2,698·78	....
Warrawoona	1087	Town Talk	....	....	....	....	....	....	....	300·45	127·91	13·34
	1013	Trump	....	....	313·00	15·69	....	....	....	3,693·05	597·73	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	....
Wyman's Well	1084	New Copenhagen	....	....	....	....	....	....	....	350·00	72·90	·58
		Voided leases	....	....	....	....	....	....	42·86	2,977·29	1,258·44	....
		Sundry claims	....	....	12·50	9·32	....	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	....	....	....	....	40·96	4·32	239·89	574·50	642·82	40·96
		From District generally :—										
		Sundry Parcels treated at :										
		State Battery, Bamboo Creek	....	....	....	*168·40	1·19	....	....	40·00	*10,480·78	186·23
		State Battery, Marble Bar	....	....	....	*338·13	1·15	....	....	12·00	*10,921·12	1·15
		Ironclad Battery	....	....	....	....	....	....	....	....	*237·71	....
		Great North-Western Cyanide Plant	....	....	....	....	....	....	....	....	*271·37	·65
		Various Works	....	....	....	....	....	....	....	237·95	*1,391·56	....
		Reported by Banks and Gold Dealers	7·88	....	....	6·49	....	14,360·49	440·85	....	10·95	4·22
		Totals	**7·88**	**....**	**7,377·80**	**5,353·71**	**2,670·60**	**15,070·55**	**4,428·90**	**316,757·17**	**312,810·30**	**9,818·86**

NULLAGINE DISTRICT.

Eastern Creek	276L	Rose	....	....	116·00	82·29	....	....	....	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	....	....	150·00	21·61	....	....	....	1,090·50	307·62	·15
	229L	Barton	....	....	849·00	455·72	....	1·22	....	4,924·00	2,579·31	1·63
	231L, etc.	Blue Spec Gold Mines, N.L.	....	....	8,108·30	2,787·29	....	....	....	34,272·69	17,271·13	....
	(267L)	Little Wonder	....	....	42·00	6·40	....	....	....	3,643·50	939·01	....
	300L	Middle Creek	....	....	19·00	4·72	....	....	....	36·00	10·25	....
		Voided leases	....	....	....	....	....	....	1·02	13,228·65	10,332·19	7·50
		Sundry claims	....	....	74·00	65·88	....	....	....	5,548·10	2,330·96	....
Mosquito Creek	51L	Hit or Miss	....	....	123·00	14·16	....	....	....	160·00	24·91	....
		Voided leases	....	....	....	....	....	1·07	30·12	8,232·30	12,814·22	....
		Sundry claims	....	....	....	....	....	....	181·64	3,702·44	3,785·88	....
Nullagine	292L	Alice	....	93·34	22·50	28·91	....	....	316·05	66·00	131·39	14·35
	297L	Mundella	....	....	10·50	22·00	....	....	....	39·50	125·23	....
	294L	Nullagine View	....	....	....	....	....	....	289·63	41·00	397·35	23·69
	289L	Paul's Leader	....	....	2·00	15·07	....	....	269·40	25·50	348·52	12·60
		Voided leases	....	....	....	....	....	....	40·56	9,002·75	12,498·93	·20
		Sundry claims	....	....	10·00	21·95	....	315·53	668·82	5,940·55	10,294·06	5·24
Twenty Mile Sandy	256L	Bill Jim	....	....	40·00	13·96	....	....	....	2,022·50	1,036·51	....
		Voided leases	....	....	....	....	....	....	16·97	5,221·20	7,971·21	·32
		Sundry claims	....	....	50·00	20·35	....	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	....	....	....	....	*45·19	....
		W. M. McKinnon, D.C.s. 10L, 14L, 15L	3·89	2·23	....	....	....	3·89	2·23	....	....	....
		Shamrock Battery, M.A.17L	....	....	....	....	....	....	....	....	*24·44	1·00
		Twenty-Mile Sandy Battery, Res. 9718	....	....	....	6·49	....	....	....	12·00	*1,745·36	·37
		Various Works	....	....	....	....	....	....	....	112·50	*6,340·55	....
		Reported by Banks and Gold Dealers	80·49	....	....	....	....	9,832·75	100·89	....	29·81	5·08
		Totals	**84·38**	**95·57**	**9,616·30**	**3,611·99**	....	**10,196·52**	**1,977·04**	**112,870·88**	**111,293·51**	**106·55**

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	....

Table I.—*Production of Gold and Silver from all sources*—continued.

Mining Centre.	Number of Lease.	Registered Name of Company or Lease.	Total for 1951.					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.
WEST PILBARA GOLDFIELD—continued.												
Lower Nicol	....	Voided leases	....	....	....	....	....	....	1·10	653·20	402·22	....
		Sundry claims	....	....	....	....	....	10·44	2·71	10·00	11·51	....
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, 174	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	176	Nancy	....	....	25·00	13·18	·08	....	....	60·00	32·82	·08
		Voided leases	....	....	....	....	....	177·74	41·37	10,936·00	11,347·42	....
		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	....	7·97	....	....	†115·88	....	7·97	....	....	†185·48
		Various Works	....	....	....	....	....	....	....	....	*102·39	4·90
		Reported by Banks and Gold Dealers	....	....	....	....	....	6,086·74	170·45	103·50	228·32	·11
		Totals	....	**7·97**	**25·00**	**13·18**	**115·96**	**6,321·90**	**363·89**	**24,660·96**	**24,192·96**	**1,574·87**
Ashburton Goldfield.												
Belvedere	....	Voided leases	....	....	....	....	....	....	9·88	1,560·00	435·86	176·48
Dead Finish	(47)	Star of the West	....	....	....	6·52	....	....	....	1,417·50	595·09	·03
		Voided leases	....	....	....	....	....	....	....	281·50	279·51	....
		Sundry claims	....	....	....	....	....	....	11·89	104·25	245·08	....

Melrose	....	Voided leases	....	....	....	....	....	....	....	....	2,704·00	840·26	213·11
		Sundry claims	....	....	....	....	....	12·41	21·88	562·00	262·78	6·40
Mt. Edith	....	Sundry claims	....	....	....	....	....	....	....	5·00	3·97	....
Mt. Mortimer	....	Sundry claims	....	....	....	....	....	364·63	315·64	44·50	40·25	74·47
Uaroo	....	Voided leases	....	....	....	....	....	....	....	....	....	7,713·22
	From Goldfield generally :—											
		Sundry claims	....	....	....	....	†4,682·07	....	....	....	....	†15,505·87
		From Banks and Gold Dealers	....	....	....	....	....	8,884·23	120·11	....	7·12	....
		Totals	....	....	....	**6·52**	**4,682·07**	**9,261·27**	**479·40**	**6,678·75**	**2,709·92**	**23,689·58**

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 (Pegasus)	....	....	210·00	70·87	....	....	193·77	2,079·00	3,738·77	....
	590P	Wyndham	....	....	....	....	....	....	....	96·00	7·08	....
		Voided leases	....	....	....	....	....	60·68	30·91	5,077·25	2,842·45	....
		Sundry claims	....	....	....	....	....	235·35	23·51	1,501·77	791·34	....
Horseshoe	568P	Horseshoe Lights	....	....	....	....	....	....	....	3,914·00	894·44	....
	575P	Labourchere Main Lode	....	....	....	....	....	....	....	535·00	60·38	....
		Voided leases	....	....	....	....	....	15·57	1,975·37	4,371·38	2,684·27	2·00
		Sundry claims	....	....	....	....	....	20·12	829·58	1,812·05	691·38	....
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 1951. 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.
PEAK HILL GOLDFIELD—continued.												
Peak Hill	512P	Atlantic	....	....	....	....	....	1·69	2·87	4,535·25	578·96	....
	511P	Commercial	....	....	....	....	....	....	....	2,838·75	487·90	....
	584P	Dazzle Star	....	....	74·00	12·50	....	....	....	207·00	70·21	....
	567P	Miner Bird	....	....	150·00	43·42	....	....	....	1,149·00	563·41	....
	553P	Morning Star	....	....	....	....	....	....	4·43	2,797·25	403·00	....
	506P	No. 1, North	....	....	10·00	5·82	....	....	86·47	6,474·20	1,514·35	....
	492P	North Star	....	....	....	....	....	23·20	69·63	13,147·50	2,064·51	....
		Voided leases	....	....	....	....	....	7·39	920·21	521,744·33	247,050·17	2,285·63
		Sundry claims	....	....	....	....	....	61·51	306·63	34,064·85	8,924·29	....
Ravelstone		Voided leases	....	....	....	....	....	....	101·64	4,219·85	3,117·68	....
		Sundry claims	....	....	....	....	....	....	....	553·60	283·17	....
Wilgeena	572P	O.K.	....	....	16·00	2·75	....	....	....	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 Goldfield generally :—											
	Sundry parcels treated at :											
	State Battery, Peak Hill		....	....	....	*135·23	....	....	3·05	15·00	*7,168·89	....
	Aust. Machinery & Investment Co., T.Ls. 1P, etc.		....	....	....	....	....	....	....	....	*1,677·23	....
	Various Works		....	....	....	....	....	....	....	30·00	*5,661·37	23·12
	Reported by Banks and Gold Dealers		....	....	....	....	....	2,846·65	444·36	....	12·51	....
	Totals		....	....	**460·00**	**270·59**	....	**3,374·41**	**5,300·33**	**622,704·43**	**296,756·50**	**2,361·42**

East Murchison Goldfield.

LAWLERS DISTRICT.

Kathleen Valley	(1330)	Beth-Heno	....	....	90·00	27·20	....	....	....	1,280·83	632·24	....
		Voided leases	....	....	....	....	....	....	144·85	79,222·83	48,388·30	....
		Sundry claims	....	....	65·00	143·83	....	14·37	526·03	5,583·75	2,587·62	....

Lawlers	(1236, etc.)	Australian Gold Production, Ltd.	5·78	....	325·00	87·17	·15	5·78	....	1,030·00	396·94	·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	....	48·09	....	....	....	400·21	451·61	17,347·48	9,568·69	268·34
Sir Samuel	(1333)	Vanguard	....	....	....	....	....	....	....	1,566·00	206·03	....
		Voided leases	....	....	....	....	....	....	359·03	273,627·55	141,431·55	10,234·80
		Sundry claims	....	....	25·00	10·72	....	53·89	64·96	7,343·00	4,497·79	·02
		From District generally :—										
		Sundry parcels treated at :										
		Australian Machinery and Investment Co., L.T.T.s 87H, etc.	....	....	....	....	....	....	....	5·00	*4,291·25	29·00
		Prior to Transfer, L.T.T.s 87H, etc.	....	....	....	....	....	....	....	....	*1,371·33	15·64
		Australian Machinery and Investment Co., T.A.26	....	....	....	....	....	2·12	....	12·03	*4,268·05	....
		Great Eastern Mining Syndicate, L.T.T. 1060H	....	....	....	....	....	....	....	....	*352·19	·12
		Tallon Doon Battery	....	....	....	....	....	....	....	....	*101·50	....
		Vanguard Cyanide Plant	....	....	....	4·89	....	....	....	4·00	*1,013·10	3·18
		State Battery, Sir Samuel (J. A. McLean)	....	....	....	....	....	....	....	53·50	*2,356·81	....
		Various Works	....	....	....	....	....	....	2·35	1,699·50	*26,067·02	936·09
		Reported by Banks and Gold Dealers	1·78	....	....	....	....	6,408·20	101·91	·05	9·84	....
		Totals	**7·56**	**48·09**	**505·00**	**273·81**	**·15**	**6,904·30**	**2,343·19**	**2,010,662·92**	**822,271·55**	**26,290·27**

WILUNA DISTRICT.

Coles	662J	Black Adder	....	....	....	9·69	....	....	....	1,689·00	986·60	....
		Voided leases	....	....	....	....	....	....	....	830·50	156·85	....
		Sundry claims	....	....	....	....	....	....	21·03	3,844·50	1,507·23	....
Corboys	680J	Mount Fisher East	....	....	101·00	193·40	....	....	....	293·00	606·11	....
		Voided leases	....	....	....	....	....	5·24	1·25	14,633·29	10,354·11	5·00
		Sundry claims	....	....	....	....	....	21·58	....	8,964·35	5,133·82	....
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	....
	677J	Lucky Hit	....	....	....	....	....	....	....	781·00	101·38	....
	263J, etc.	Wiluna Gold Mines, Ltd.	....	....	....	....	....	....	....	7,345,465·00	1,334,207·23	8,605·91
		Prior to transfer to present holders	....	....	....	....	....	....	....	341,730·57	133,457·92	89·32
		Voided leases	....	....	....	....	....	....	574·76	1,088,405·33	320,508·78	1,349·40
		Sundry claims	....	....	....	....	....	105·39	219·08	27,379·40	10,872·09	·33

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 1951.					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	....
		Coolgardie Brilliant Battery	....	....	....	....	....	....	....	....	*235·23	....
		Toscana Cyanide Plant	....	....	....	....	....	....	....	....	*2,577·90	....
		Waratah Cyanide Plant	....	....	....	....	....	....	....	....	*753·10	....
		Wiluna East Battery	....	....	....	5·96	....	....	....	....	*202·13	....
		State Battery, Wiluna	....	....	....	181·03	....	....	....	637·00	*23,512·98	218·70
		Various Works	....	....	....	....	....	....	....	139·00	*1,241·67	12·68
		Reported by Banks and Gold Dealers	....	....	....	....	....	49·54	56·58	....	58·49	....
		Totals	....	....	**101·00**	**390·08**	....	**222·36**	**1,247·37**	**8,873,130·94**	**1,870,760·82**	**10,281·34**
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	....
Bell Chambers	....	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 (998B)	North End Leases	....	....	220·00	170·06	....	....	....	39,647·95	5,848·29	....
		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	....
	959B	Prior to transfer	....	....	....	....	....	....	136·06	537·75	686·59	....
	1075B	Doolette South	....	....	....	....	....	....	217·54	2,114·00	2,313·45	....
	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 :											
	State Battery, Sandstone	....	....	....	....	....	....	....	....	290·50	*23,007·38	59·53
	State Battery, Youanmi	....	....	....	....	....	....	....	....	40·00	*5,461·83	....
	North End Battery Cyanide Plant	....	....	....	....	....	....	....	....	....	*4,934·14	....
	Various Works	....	....	....	....	....	....	....	....	92·50	6,510·12	....
	Reported by Banks and Gold Dealers	....	....	....	....	....	....	1,459·55	52·23	....	20·38	....
	Totals	....	....	**220·00**	**170·06**	....	**1,635·11**	**18,521·80**	**1,728,357·97**	**951,815·63**	**22,494·07**

Murchison Goldfield.

CUE DISTRICT.

Big Bell	2050, etc.	Big Bell Mines, Ltd.	....	....	369,412·00	49,726·30	18,838·33	....	....	4,315,033·00	556,455·88	195,563·87
	2050	(Little Bell)	....	....	....	....	....	....	4·49	579·75	60·95	....
		Voided leases	....	....	....	....	....	....	....	401·00	422·83	....
		Sundry claims	....	....	6·25	4·89	....	·39	6·32	382·75	357·46	....
Cuddingwarra	L.T.T. 1181H	J. W. Sear's Plant	....	....	123·00	12·81	....	....	....	123·00	12·81	....
		Voided leases	....	....	....	....	....	10·59	132·46	102,035·16	56,141·91	100·71
		Sundry claims	....	3·35	12·50	2·07	....	18·46	384·38	9,617·89	5,540·53	9·00
Cue	L.T.T. 1220H	James Harris' Plant	....	....	58·75	4·30	....	....	....	58·75	4·30	....
	2262	Table Top	....	....	218·75	269·89	....	....	....	218·75	269·89	....
	2247	Victory	....	....	....	....	....	....	....	226·75	125·38	....
		Voided leases	....	....	....	....	....	202·71	911·60	288,796·44	221,102·80	69·11
		Sundry claims	....	....	230·25	42·83	....	252·92	894·70	44,408·49	20,173·66	....
Eelya	2241	Eaglehawk	....	....	468·25	161·45	....	....	....	1,408·75	416·08	....
		Voided leases	....	....	....	....	....	....	8·78	1,069·00	1,811·26	....
		Sundry claims	....	....	190·75	38·59	....	6·20	143·81	2,001·90	1,037·45	....
Mindoolah	....	Voided leases	....	....	....	....	....	3·07	2·54	9,380·28	5,672·31	42·97
		Sundry claims	....	....	155·75	41·18	....	....	29·30	3,299·60	2,345·43	....

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 1951.					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.*												
Reedy	2253	Rand No. 3	....	....	....	12·72	....	....	....	4,152·25	1,356·56	....
	(1977, etc.)	Triton Gold Mines, N.L.	....	2·07	25·25	*120·38	....	....	2·07	702,484·50	221,283·04	20,461·06
	(1977, etc.)	Prior to transfer	....	....	....	....	....	....	....	16,338·50	7,471·50	5·00
		Voided leases	....	....	....	....	....	1·46	214·65	6,664·43	10,159·89	1·22
		Sundry claims	....	....	313·75	66·16	....	170·71	137·16	6,709·25	2,604·49	....
Tuckabianna	2237	Gidgie	....	....	....	....	....	....	79·16	2,671·15	1,803·84	....
	2260	Montorio	....	....	....	....	....	....	....	131·25	91·50	....
	2244	Winston	....	....	20·25	1·74	....	....	250·24	329·50	102·37	2·30
		Voided leases	....	....	....	....	....	649·70	297·68	12,908·48	7,321·43	....
		Sundry claims	....	....	20·75	3·15	....	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	....	....	....	....	....	115·23	789·31	10,040·30	10,263·41	....
Weld Range	(2256)	Never-Can-Tell	....	....	120·25	44·08	....	....	....	455·00	198·12	....
		Voided leases	....	....	....	....	....	....	23·64	1,714·75	938·99	....
		Sundry claims	....	....	48·25	13·52	....	....	3·90	1,438·50	1,136·41	....
	From District generally :—											
	Sundry Parcels treated at :											
		L. B. Rinaldi Plant, L.T.T. 1208H	....	....	....	25·72	....	....	....	....	25·72	....
		State Battery, Cue	....	....	....	*1,089·30	7·13	....	....	76·25	*25,184·01	117·35
		State Battery, Tuckanarra	....	....	....	....	....	....	....	518·50	*5,535·57	....
		Various Works	....	....	....	....	....	....	....	7,158·52	*29,387·81	1,147·77
		Reported by Banks and Gold Dealers	14·67	....	....	....	....	3,395·45	107·60	....	22·62	·07
		Totals	**14·67**	**5·42**	**371,424·75**	**51,681·08**	**18,845·46**	**5,063·64**	**8,424·29**	**5,577,079·99**	**1,222,343·06**	**217,693·20**
MEEKATHARRA DISTRICT.												
Abbotts		Voided leases	....	....	....	....	....	....	26·45	36,841·35	38,775·28	....
		Sundry claims	....	....	28·50	26·53	....	....	5·29	3,757·02	2,314·00	....
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	Margueritta	....	....	572·00	132·97	....	....	....	572·00	132·97	....
		Voided leases	....	....	....	....	....	29·02	420·32	6,875·26	7,500·57	·80
		Sundry claims	....	....	....	....	....	....	42·19	960·55	740·97	....
Gabanintha	1948N	Fortuna	....	....	327·50	314·00	....	....	....	327·50	314·00	....
	(1854N)	Golden Star	....	....	....	....	....	....	....	290·50	268·46	....
	1725N	New Brew	....	....	62·00	62·57	....	....	....	4,705·10	6,183·83	....
		Voided leases	....	....	....	....	....	11·79	38·14	24,574·00	14,660·91	815·57
		Sundry claims	....	....	205·75	149·82	....	16·78	159·05	4,824·75	2,863·83	....
Garden Gully	1927N	Sabbath	....	....	....	....	....	....	....	33·75	17·03	....
		Voided leases	....	....	....	....	....	26·36	74·91	30,238·32	21,847·71	1,102·59
		Sundry claims	....	....	....	....	....	....	18·74	2,905·44	1,695·15	....
Gum Creek	....	Voided leases	....	....	....	....	....	25·27	91·96	3,893·08	3,819·91	....
		Sundry claims	....	....	....	....	....	4·37	84·86	727·25	636·85	....
Holdens	1551N	New Waterloo	....	....	....	....	....	....	·99	1,468·00	918·92	....
		Voided leases	....	....	....	....	....	....	18·00	16,593·00	6,401·50	....
		Sundry claims	....	....	....	....	....	164·95	49·07	425·15	279·25	....
Jillawarra	1871N	Werribie	....	....	....	....	....	....	128·85	451·25	749·62	....
		Voided leases	....	....	....	....	....	....	1,134·68	1,548·55	2,815·78	....
		Sundry claims	....	....	....	....	....	173·02	150·04	440·75	403·14	....
Meeka Pools	....	Voided leases	....	....	....	....	....	....	....	111·58	82·27	....
		Sundry claims	....	....	....	....	....	....	2·84	233·57	205·38	....
Meekatharra	(1861N)	Adele May	....	....	32·75	25·92	....	....	....	76·25	72·18	....
	1922N	Albury Heath	....	....	208·00	257·26	....	....	....	647·00	1,107·66	....
	1855N	Commodore	....	....	....	....	....	....	....	1,160·25	380·89	....
	1553N	Consols North	....	....	....	....	....	....	....	659·75	1,359·33	....
	1571N	Coolgardie Brilliant, N.L.	....	....	....	....	....	....	....	2,451·36	541·38	....
	1571N	Prior to transfer to present holders	....	....	....	....	....	....	....	8,107·50	4,907·48	....
	1894N	Fenian Leases	....	....	....	102·57	....	....	....	329,424·69	261,890·24	....
	477N	(Fenian)	....	....	....	....	....	....	....	8,831·75	18,289·22	....
	1944N	Fortune Teller	....	....	705·00	295·21	....	....	....	705·00	295·21	....
	(1921N)	Federick	....	·39	....	....	....	....	·39	....	....	....
	1893N	Halcyon	....	....	1,616·75	189·36	....	....	·78	7,823·10	1,044·59	....
	1888N	Haveluck	....	....	302·00	38·92	....	....	56·94	3,327·75	911·00	....
	1559N	Ingliston	....	....	....	20·19	....	....	498·32	1,846·10	1,685·21	....
	1542N	Ingliston Alberts	....	....	....	....	....	....	....	305·50	446·00	....
	1542N, etc.	Ingliston Alberts Leases	....	....	....	....	....	....	....	2,983·70	1,283·06	....
	1895N, etc.	Ingliston Consols Extended Leases	....	....	....	....	....	....	....	873,719·47	357,046·42	....
	475N	Prior to transfer	....	....	....	....	....	....	....	1,536·25	4,248·25	·30
	1950N	Ingliston South	....	....	28·00	12·52	....	....	....	28·00	12·52	....
	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	....
	(1899N)	Marmont	....	....	....	10·23	....	....	89·33	60,425·20	43,203·21	....
	1577N	Mopoke	....	....	....	....	....	....	12·47	1,338·25	820·16	....
	1923N	Peter Pan	....	....	....	....	....	....	....	283·75	22·87	....
	1529N	Prohibition	....	....	....	....	....	....	....	3,950·00	1,853·54	·04

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 1951.					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.												
MEEKATHARRA DISTRICT—*continued.*												
	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	....	....	66·75	27·57	....	....	....	117·25	49·85	....
		Voided leases	....	....	....	....	....	3·88	1,337·17	397,569·18	220,933·17	2,454·74
		Sundry claims	....	....	108·00	78·33	....	229·71	628·85	24,824·95	9,758·58	....
Mistletoe	....	Voided leases	....	....	....	....	....	4·15	1,000·24	417·00	486·21	....
		Sundry claims	....	....	....	....	....	119·14	71·85	19·75	2·03	....
Mt. Maitland	....	Voided leases	....	....	....	....	....	....	....	88·00	80·11	....
		Sundry claims	....	....	....	....	....	....	....	420·75	240·86	....
Munara Gully	....	Voided leases	....	....	....	....	....	....	....	13,283·50	6,559·93	....
		Sundry claims	....	....	....	....	....	....	34·23	1,009·75	373·74	....
Nannine	1872N	Blue Pedro	4·06	....	....	2·93	....	4·06	15·26	9,566·40	2,021·11	....
	1941N	Caledonia Gold Mine	....	....	100·00	17·66	....	....	....	100·00	17·66	....
	(1939N)	Devil's Dice	....	....	59·50	7·53	....	....	....	59·50	7·53	....
		Voided leases	....	....	....	....	....	37·25	828·76	116,080·98	73,399·21	167·45
		Sundry claims	....	....	....	....	....	120·08	1,248·76	6,109·43	4,658·63	....
Quinn's	....	Voided leases	....	....	....	....	....	7·30	1,186·50	333,56·91	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	Bluebird	....	....	640·00	199·45	....	....	....	6,552·00	1,893·75	....
		Voided leases	....	....	....	....	....	19·03	1,972·23	28,175·54	14,609·36	8·68
		Sundry claims	....	....	39·50	46·45	....	61·89	647·51	10,645·92	4,945·82	....
		From District generally :— Sundry Parcels treated at : State Battery, Meekatharra	....	....	....	*521·55	....	....	....	99·50	*26,359·85	19·00

Meekatharra Sands Treatment and Mining, N.L.	....	....	....	*469·15	....	....	....	....	....	*6,696·58	....
Various Works	....	....	....	....	....	....	....	....	172·75	*6,730·59	342·17
Reported by Banks and Gold Dealers	11·83	....	....	8·16	....	12,170·88	179·70	13·50	48·82	....
Totals	**15·89**	**·39**	**5,102·00**	**3,016·85**	....	**14,308·81**	**17,645·56**	**2,266,486·21**	**1,296,195·25**	**5,042·31**

DAY DAWN DISTRICT.

Day Dawn	573D etc.	Mountain View Gold, N.L.	....	....	804·75	489·13	25·90	....	....	7,491·85	14,625·65	125·61
	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	....	....	98·50	58·23	....	96·42	521·05	13,249·01	6,613·55	·41
Lake Austin	....	Voided leases	....	....	....	....	....	613·00	3,079·62	36,872·20	51,050·49	....
		Sundry claims	....	....	27·25	10·70	....	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	9,915·71	....
		Sundry claims	....	....	4·75	4·24	....	62·93	509·50	4,349·42	1,757·28	....
From District generally :—												
Sundry Parcels treated at :												
Various Works		....	....	....	....	....	....	16·61	988·00	*1,988·33	....
Reported by Banks and Gold Dealers		13·73	....	....	....	....	2,192·95	37·30	....	12·57	·01
Totals		**13·73**	....	**935·25**	**562·30**	**25·90**	**3,214·29**	**11,339·12**	**2,029,075·63**	**1,372,444·44**	**169,336·47**

MOUNT MAGNET DISTRICT.

Jumbulyer	1410M	Gold Bug	....	....	....	....	....	....	2·20	623·20	204·49	....
		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	....
	1379M	Galtee Moore	....	....	....	....	....	....	....	6,026·00	1,583·06	·80
		Voided leases	....	....	....	....	....	....	3 226·91	145,016·55	126,817·92	458·82
		Sundry claims	....	....	....	....	....	23·30	108·82	13,979·32	5,438·99	....
Mount Magnet	1454M	Cushie Doo	....	....	6·25	9·89	....	....	....	6·25	9·89	....
	1255M, 1415M	Edward Carson Leases	....	....	....	....	....	....	....	17,890·50	12,819·89	7·76
	1287M	Havelock	....	....	....	....	....	....	11·05	4,332·50	840·14	....
	1282M, etc.	Hill 50 Gold Mine, N.L.	....	....	28,352·00	7,557·21	220·13	....	....	541,537·90	153,629·14	1,940·44
	1246M	Prior to transfer to present holders	....	....	....	....	....	....	829·41	8,787·65	4,122·61	·21

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 1951.					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.												
MOUNT MAGNET DISTRICT—*continued.*												
Mount Magnet — *continued.*	1361M	Jupiter	....	....	39·75	5·19	....	....	·83	611·05	241·66	....
	1444M	Late Comer	....	....	16·00	74·13	....	....	2·53	307·25	260·31	....
	1447M	Morning Star	....	....	43·50	25·95	....	....	....	273·40	85·97	....
	1441M	Perseverance	....	....	197·75	12·17	....	....	....	673·50	64·49	....
	1322M	Three Boys	....	....	33·00	1·72	....	....	231·11	565·78	677·82	....
		Voided leases	....	....	....	....	....	29·26	9,580·43	833,004·03	312,004·33	851·39
		Sundry claims	....	....	210·50	59·33	....	122·27	2,626·24	59,842·90	29,484·76	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	....	....	....	....	....	....	....	2,621·25	*5,106·19	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	....
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	....	....	....	*357·21	....	....	....	125·26	*34,009·26	4·20
		Empress Battery	....	....	....	*5·15	....	....	....	....	*42·13	....
		Various Works	....	....	....	....	....	....	....	56·06	*18,902·94	10·04
		Reported by Banks and Gold Dealers	·33	....	....	....	....	2,280·59	114·28	8·00	64·95	·22
		Totals	**·33**	....	**28,898·75**	**8,107·95**	**220·13**	**2,557·82**	**20,433·75**	**1,657,506·15**	**728,542·11**	**4,036·14**
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	(907)	Brown's Reward	....	....	....	....	....	....	....	....	300·00	75·91	....
	(907, etc.)	Brown's Reward Leases	....	....	....	....	....	....	....	....	4,540·55	3,800·16	....
	1113, 1220	Fields Find Central Leases	....	....	10·00	8·23	·43	....	....	10·00	8·23	·43
	1113	Field's Find	....	....	....	....	....	....	....	44·00	17·96	·10
	1220	Field's Find Central	....	....	....	....	....	....	....	5·00	3·53	....
	1119	Field's Find Central West	....	....	10·00	2·47	....	....	....	140·50	36·50	·80
	(1114), 1119	Field's Find Central West Leases	....	....	....	....	....	....	....	4,625·00	1,074·53	56·69
	1207	Rose Marie	....	....	....	32·36	....	....	....	394·67	233·30	....
		Voided leases	....	....	....	....	....	....	226·72	40,635·41	28,671·03	....
		Sundry claims	....	....	·10	6·31	....	5·77	188·67	5,455·85	1,775·93	....
Goodingnow	1063	Ark	....	....	325·00	706·45	....	....	1·23	2,056·00	1,557·56	....
	1102	Astor	....	....	360·00	92·31	....	....	....	6,325·25	3,280·85	....
	1198	Astor South	....	....	....	....	....	....	....	498·50	114·17	....
	1025	Carnation	....	....	442·00	225·90	....	....	....	18,679·55	13,802·53	....
	1206	Orchid	....	....	....	....	....	....	....	157·50	33·74	....
	1145	Oversight	....	....	....	....	....	....	....	2,053·35	709·40	....
	1208	Oversight South	....	....	1,037·00	412·75	....	....	8·03	2,935·00	1,214·21	....
		Voided leases	....	....	....	....	....	146·70	280·63	50,161·06	46,775·43	....
		Sundry claims	....	....	....	....	....	152·96	169·70	10,193·25	5,090·58	....
Gullewa	1189	King Solomon's Mine	....	....	....	....	....	....	....	315·00	135·89	5·79
	1189	(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	....	....	....	....	....	1·03	44·72	1,123·35	494·25	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	Revival	....	....	....	....	....	....	....	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	....	....	107·00	25·63	....	....	30·88	829·00	206·46	....
Pinyalling	1217	Broken Doll....	....	19·69	....	....	....	....	219·99	5·55	133·20	....
		Voided leases	....	....	....	....	....	....	93·80	2,296·35	959·50	....
		Sundry claims	....	....	2·50	108·14	....	3·13	134·09	1,465·50	952·14	....

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 1951.					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.
YALGOO GOLDFIELD—continued.												
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	....
	From Goldfields generally :—											
	Sundry Parcels treated at :											
		State Battery, Payne's Find	....	....	....	1·94	....	....	....	38·50	*4,531·86	....
		State Battery, Warriedar	....	....	....	....	....	....	....	....	*6,503·21	....
		State Battery, Yalgoo	....	....	....	....	....	....	....	....	*1,193·63	....
		Various Works	....	....	....	....	....	9·42	....	664·00	*3,325·00	99·84
		Reported by Banks and Gold Dealers	·25	....	....	14·46	....	944·94	58·32	....	48·90	·20
		Totals	**·25**	**19·69**	**2,293·60**	**1,636·95**	**·43**	**1,785·46**	**3,201·31**	**440,530·28**	**262,670·03**	**1,500·61**
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	2,145·30	1,990·31	....

Linden	539F	Democrat	....	....	165·00	185·17	....	....	1·19	4,894·00	8,085·29	....
	554F	Devon	....	....	....	....	....	....	....	11·50	13·39	....
	553F	Local Lady	....	....	245·50	176·15	....	....	....	3,056·25	2,988·79	....
	(521F)	North Democrat	....	....	5·50	12·89	....	....	....	3,127·75	6,123·11	....
	529F	Second Fortune	....	....	....	....	....	....	....	517·00	282·05	....
		Voided leases	....	....	....	....	....	7·53	565·78	61,143·31	48,602·67	·68
		Sundry claims	....	....	45·00	20·16	....	132·11	244·96	19,142·85	13,732·93	....
Mt. Margaret	M.A. 12	The United Aborigines Mission	....	....	....	....	....	113·08	18·87	403·00	133·14	·09
		Voided leases	....	....	....	....	....	12·13	1·89	8,900·39	5,291·51	12·55
		Sundry claims	....	....	....	....	....	25·22	111·18	1,779·60	658·99	....
Mt. Morgans	399F, etc.	Morgans Gold Mines, Ltd.	....	....	....	....	....	....	....	4,504·30	13,784·24	....
	399F, etc.	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	....	....	....	....	....	36·41	398·78	5,012·57	3,322·61	....
Murrin Murrin	....	Voided leases	....	....	....	....	....	10·43	231·35	136,940·22	104,029·97	29·60
		Sundry claims	....	....	....	....	....	51·15	557·24	6,425·33	4,433·63	....
Redcastle	557F	Trixie	....	5·59	12·00	7·77	....	....	5·59	158·00	39·31	....
		Voided leases	....	....	....	....	....	4·49	436·54	4,107·20	4,043·41	....
		Sundry claims	....	....	....	....	....	....	113·84	1,133·57	636·03	....
Yundamindera	....	Voided leases	....	....	....	....	....	....	110·93	78,485·85	49,894·35	5·82
		Sundry claims	....	....	50·00	18·26	....	3·01	271·93	6,674·35	4,789·19	....
	From District generally :—											
	Sundry parcels treated at:											
	Anniversary Battery	....	....	....	....	....	....	....	....	10·00	18·70	....
	Hillend Cyanide Plant	....	....	....	....	....	....	....	....	....	*556·95	....
	Rymer's Cyanide Plant	....	....	....	*22·20	....	....	....	....	....	*1,184·42	....
	Turbett's Cyanide Plant	....	....	....	....	....	....	....	....	....	*1,232·20	....
	State Battery Linden (B. Dellar)	....	....	....	*107·44	....	....	9·16	293·29	*15,449·34	....
	Various Works	....	....	....	....	....	....	....	....	1,257·81	*5,587·82	99·97
	Reported by Banks and Gold Dealers	....	16·62	....	....	....	....	3,007·10	141·84	10·30	95·75	·68
	Totals	....	**16·62**	**5·59**	**523·00**	**550·04**	....	**3,420·61**	**9,349·31**	**1,209,891·71**	**714,796·91**	**5,781·64**

MOUNT MALCOLM DISTRICT.

Cardinia	1795C	Rangoon	....	....	....	19·37	....	....	6·49	250·00	*168·59	....
	1805C	Wanghi	....	....	....	....	....	....	....	280·00	18·28	....
		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	(1786C)	Puzzle	....	....	70·00	46·34	....	....	....	2,776·00	2,808·30	....
		Voided leases	....	....	....	....	....	....	945·65	36,103·03	32,335·98	33·18
		Sundry claims	....	....	....	....	....	11·21	332·13	4,626·80	4,432·31	....
Dodger's Well	....	Voided leases	....	....	....	....	....	....	57·90	1,373·30	1,936·52	....
		Sundry claims	....	....	....	....	....	·95	28·32	1,440·25	904·23	....

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 1951.					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.*												
Lake Darlot	(1814C)	British King	....	....	29·00	14·31	....	....	....	54·00	17·55	·33
	1834C	Monte Christo	....	....	1,037·00	67·33	....	....	....	1,037·00	67·33	....
	(1820C)	The Dragon	....	....	160·00	71·13	....	....	....	927·00	545·54	....
		Voided leases	....	....	....	....	....	....	4,482·18	69,935·46	51,468·37	7·23
		Sundry claims	....	....	95·00	37·04	....	67·68	557·70	8,018·34	5,302·74	7·60
Leonora	1829C	Jessie Alma	....	....	64·00	17·18	....	....	454·52	606·50	1,805·52	....
	1788C	Little Gwalia	....	....	380·00	217·09	....	....	....	1,180·00	303·69	....
	1579, etc.	Sons of Gwalia, Ltd.	....	....	73,825·00	19,185·81	1,586·24	....	....	5,558,095·53	2,235,841·34	158,444·48
	1579, etc.	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	....	....	39·00	23·25	....	37·73	358·00	18,256·25	11,625·86	....
Mt. Malcolm	....	Voided leases	....	....	....	....	....	11·65	47·07	62,656·53	47,563·43	....
		Sundry claims	....	....	52·00	17·56	....	5·75	33·39	4,423·47	2,687·65	·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	....
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	....
Websters Find	....	Voided leases	....	....	....	....	....	30·30	....	22,167·50	14,377·65	....
		Sundry claims	....	....	....	....	....	36·84	695·68	2,356·15	1,530·56	....
Wilson's Creek	....	Voided leases	....	....	....	....	....	....	....	333·50	168·27	....
		Sundry claims	....	....	....	....	....	·70	4·24	316·00	261·12	....
Wilson's Patch	....	Voided leases	....	....	....	....	....	....	99·38	28,863·35	13,050·19	1·05
		Sundry claims	....	....	22·00	17·81	....	4·68	50·57	1,594·16	1,407·27	....

From District generally :—												
Sundry parcels treated at :												
State Battery Darlot (S. K. Millbank)	....	....	8·00	·87	....	....	....	18·00	*786·34	....		
Reefer Cyanide Plant	....	....	....	....	....	....	....	20·00	*3,122·05	22·38		
Various Works	....	....	....	....	....	....	....	789·50	*2,2175·93	135·97		
Reported by Banks and Gold Dealers	9·08	2·96	....	....	....	3,467·20	252·83	21·50	51·57	....		
Totals	**9·08**	**2·96**	**75,781·00**	**19,735·09**	**1,586·24**	**3,815·18**	**14,492·61**	**6,256,399·19**	**2,718,132·39**	**160,312·49**		

MOUNT MARGARET DISTRICT.

Burtville	**2446T ....**	Boomerang	....	....	79·25	297·22	38·37	....	....	1,387·00	7,734·19	437·40
	2516T	Golden Bell	....	....	129·50	193·57	....	....	....	129·50	193·57	....
	2138T	Nil Desperandum	....	....	33·25	189·79	....	....	5·30	1,637·37	3,621·01	....
		Voided leases	....	....	....	....	....	4·89	413·80	70,225·58	108,449·75	480·10
		Sundry claims	....	....	40·25	21·12	....	2·65	208·27	7,351·16	5,463·03	....
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
Eagles Nest	**....**	Voided leases	....	....	....	....	....	....	145·34	534·50	1,238·22	....
		Sundry claims	....	....	....	....	....	24·07	487·05	1,046·35	360·11	....
Erlistoun	**2508T ....**	Morgood	....	....	....	....	....	....	....	110·00	62·69	....
	2500T	Westralia	....	....	....	*63·58	....	....	....	....	*65·14	....
		Voided leases	....	....	....	....	....	10·07	393·41	156,555·65	101,309·48	4,327·81
		Sundry claims	....	....	6·25	4·91	....	1,181·65	148·23	5,517·09	3,742·02	....
Euro	**....**	Voided leases	....	....	....	....	....	....	65·14	91,821·50	37,678·25	....
		Sundry claims	....	....	48·00	14·37	....	4·87	73·04	1,361·50	811·69	....
Laverton	**(2216T) ....**	Beria Main Lode	....	....	209·00	13·86	....	....	4·74	6,849·35	1,567·24	
	2514T	Gladiator	....	....	15·75	4·36	....	....	....	15·75	4·36	....
	2245T, etc.	Lancefield Leases	....	....	6,293·25	445·13	15·68	....	....	25,614·00	3,586·48	15·68
	2245T	Lancefield Extended West	....	....	....	....	....	....	....	881·25	846·77	....
	2489T	Wedge	....	....	....	....	....	....	....	222·00	21·19	....
	2478T	Lancefield, North	....	....	....	....	....	....	....	2,235·25	438·99	....
	2499T	Pinnacles	....	....	21·75	2·12	....	....	....	75·75	9·53	....
	T.L. 2T, etc.....	United Gold Recoveries Pty., Ltd.	....	....	....	*862·25	1,242·65	....	....	....	*3,040·26	3,193·70
		Voided leases	....	....	....	....	....	28·59	2,024·11	2,068,713·27	811,646·08	56,923·16
		Sundry claims	....	....	16·50	12·23	....	215·58	1,475·35	17,194·75	9,107·49	....
Mt. Barnicoat	**2512T ....**	White Horse	....	....	172·50	570·44	....	....	....	393·00	1,033·14	....
		Voided leases	....	....	....	....	....	....	23·08	1,913·00	1,018·20	....
		Sundry claims	....	....	42·00	4·85	....	....	·68	1,309·75	1,087·77	....
Mt. Shenton	**....**	Voided leases	....	....	....	....	....	....	....	15·00	26·65	....
		Sundry claims	....	....	....	....	....	....	....	279·25	209·67	....

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 1951.					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 MARGARET DISTRICT—*continued.*												
		From District generally :—										
		Sundry parcels treated at :										
		State Battery, Laverton	....	....	....	*1,208·56	45·88	....	....	97·50	*12,871·46	61·52
		Cable's Cyanide Plant, L.T.T. 978H	....	....	....	....	....	....	....	....	*1,335·70	....
		J. Shepherd's Plant, M.A. 23T	....	....	....	....	....	....	....	....	*99·55	....
		Various Works	....	....	....	....	....	....	....	159·50	*17,961·14	·24
		Reported by Banks and Gold Dealers	....	....	....	....	....	2,516·21	108·08	....	26·76	....
		Totals	....	....	**7,107·25**	**3,908·36**	**1,342·58**	**3,993·93**	**9,319·98**	**2,497,937·64**	**1,161,374·76**	**65,469·37**

North Coolgardie Goldfield.

MENZIES DISTRICT.

Comet Vale	5732Z	Central Coonega	....	....	9·00	5·34	....	....	....	92·00	25·50	....
	5756Z	Sand Duke	....	....	....	....	....	....	....	....	4·10	·31
	5754Z	Sand Queen	....	....	....	·24	....	....	....	412·50	67·15	·70
		Voided leases	....	....	....	....	....	....	419·74	266,639·72	193,083·79	5,351·38
		Sundry claims	....	....	....	....	....	....	40·19	1,895·91	995·96	....
Goongarrie	5740Z	Gull's Blow	....	....	61·00	15·13	....	....	....	318·25	132·03	....
		Voided leases	....	....	....	....	....	·94	1,385·26	29,838·79	18,085·64	....
		Sundry claims	....	....	15·00	15·04	....	46·46	2,054·17	2,683·27	3,101·26	....
Menzies	5543Z	Black Swan	....	....	....	....	....	....	....	1,000·63	1,633·52	9·08
	5736Z	Bodington	....	14·91	....	....	....	....	17·73	73·00	52·97	....
	5511Z	First Hit	....	....	380·00	585·23	19·34	....	....	2,335·75	5,511·48	21·25
	5511Z, etc.	First Hit G.M.s (1934), Ltd.	....	....	....	....	....	....	....	68,473·70	49,060·96	6,676·23
	5542Z	Good Block Lease	....	....	....	....	....	....	7·32	1,491·00	2,319·67	....
	5747Z	Guy Fawkes	....	....	20·00	9·12	....	....	....	58·00	31·15	....
	5714Z	Lady Harriet, North	....	....	....	....	....	....	....	21·00	4·01	....
	5549Z	Lady Harriet	....	....	....	....	....	....	....	548·00	164·46	....
	5520Z	Mignonette	....	....	40·00	18·22	....	....	....	518·50	364·14	....
	5749Z	Woolgar	....	....	135·00	96·72	....	....	....	326·00	243·63	....
		Voided leases	....	....	....	....	....	45·42	1,125·41	934,362·50	725,924·48	13,586·39
		Sundry claims	....	·35	216·50	42·37	....	49·50	597·90	32,906·94	24,908·84	776·49

Mt. Ida	5701Z, etc.	Moonlight Wiluna Gold Mine, Ltd.	....	....	23,976·00	11,402·13	284·71	....	....	35,187·00	17,011·91	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	....	11·17	14·00	33·92	....	48·14	417·36	15,979·91	8,183·82	·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		....	....	....	*367·87	....	....	....	279·50	*18,421·61	30·00
	Mt. Ida State Battery (A. Grey)		....	....	....	*139·78	....	....	....	1,866·25	*7,239·80	·05
	Yundaga Treatment Works (J. E. Roberts)		....	....	....	*5·88	·03	....	....	....	*5·88	·03
	B. W. Sander's Cyanide Plant		....	....	....	22·96	....	....	....	....	*85·24	46·39
	Gold Tailings, Ltd.		....	....	....	....	....	....	....	....	*345·87	5·84
	Various Works		....	....	....	....	....	....	....	2,528·30	*38,465·51	2,979·85
	Reported by Banks and Gold Dealers		3·52	....	....	·30	....	1,446·22	382·80	35·00	8·02	....
	Totals		**3·52**	**26·43**	**24,866·50**	**12,760·25**	**304·08**	**1,636·68**	**6,540·09**	**1,501,115·94**	**1,204,845·14**	**31,269·65**

ULARRING DISTRICT.

Davyhurst	1016U, etc.	Western Mining Corporation, Ltd.	....	....	10,140·00	4,283·47	....	....	....	10,857·00	4,536·56	....
	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	....	....	9·00	5·76	....	....	208·48	13,649·94	5,683·94	....
Morley's	1101U	Emerald	....	....	309·00	234·25	....	....	26·24	1,168·00	1,459·15	....
	(1094U)	First Hit	....	....	93·00	163·35	....	....	....	1,610·25	4,450·52	....
	1081U	Mabel Gertrude	....	....	57·00	91·16	....	....	....	1,339·00	1,281·93	....
	1089U	Paramount	....	....	....	....	....	....	....	2,331·50	2,268·52	....
	1078U	Rabbit	....	....	....	....	....	....	265·66	765·50	1,214·60	....
	1074U	Two Chinamen	....	....	....	....	....	....	3,466·48	1,589·50	3,844·90	10·54
		Voided leases	....	....	....	....	....	....	122·80	601·50	885·19	....
		Sundry claims	....	....	....	....	....	2·16	932·23	1,567·25	2,398·17	....
Mulline	1107U	Ajax West	....	....	708·00	658·85	....	....	1·37	1,976·25	2,604·32	....
	1070U	Riverina	....	....	185·00	32·20	....	....	....	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	....	....	....	....	....	10·82	198·67	10,660·89	8,730·95	1·10
Mulwarrie	1153U	Fourmile	....	....	10·00	41·90	....	....	....	38·50	220·25	....
	1113U	Oakley	....	....	290·50	625·99	....	....	....	1,470·00	1,982·45	....
		Voided leases	....	....	....	....	....	....	165·29	19,480·68	26,369·21	38·47
		Sundry claims	....	....	4·00	17·70	....	·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	....

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 1951. 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.
NORTH COOLGARDIE GOLDFIELD—*continued.*												
ULLARING DISTRICT—*continued.*												
		From District generally :—										
		Sundry Parcels treated at :										
		State Battery, Mulline	....	....	....	....	....	....	....	639·99	*16,459·89	....
		State Battery, Mulwarrie	....	....	....	....	....	....	....	613·18	*6,564·16	....
		E. Rowe's Plant	....	....	....	....	....	....	....	....	*21·65	....
		Two Chinamen Battery	....	....	30·00	*240·59	....	....	....	30·00	*788·87	....
		Waihi Battery	....	....	....	*118·62	....	....	....	5·00	*974·18	....
		Waihi-Golden Pole Cyanide Plant	....	....	....	....	....	....	....	....	*936·58	....
		Prior to Amalgamation	....	....	....	....	....	....	....	....	*5,032·24	....
		Various Works	....	....	....	....	....	....	15·82	233·15	*1,784·67	....
		Reported by Banks and Gold Dealers	....	....	....	....	....	112·68	63·08	100·00	23·48	....
		Totals	....	....	**11,835·50**	**6,513·84**	....	**129·39**	**6,738·48**	**391,342·85**	**360,560·75**	**6,109·07**
NIAGARA DISTRICT.												
Desdemona	....	Voided leases	....	....	....	....	....	....	7·12	9,809·00	7,555·81	12·04
		Sundry claims	....	....	....	....	....	....	8·99	2,225·45	892·48	....
Kookynie	928G	Altona	....	....	749·00	1,205·07	....	....	....	1,791·50	2,396·68	....
	911G	Cosmopolitan South	....	....	240·00	127·09	....	....	....	1,983·00	941·47	....
	933G	New Gladstone	....	....	260·00	93·74	....	....	....	260·00	93·74	....
		Voided leases	....	....	....	....	....	3·35	347·30	744,917·21	394,601·81	5,375·97
		Sundry claims	....	·84	....	....	....	56·74	106·18	8,860·55	6,562·43	·18
Niagara	....	Voided leases	....	....	....	....	....	....	104·54	85,876·50	52,365·05	....
		Sundry claims	....	....	159·00	154·36	....	28·10	97·22	14,645·16	82,57·78	....
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 :										
		Owen Bros. Plant	....	....	....	....	....	....	....	....	*31·91	....
		Grafter Battery	....	....	....	....	....	....	....	....	*137·63	....
		A. Vickery Treatment Syndicate	....	....	....	*966·40	79·81	....	....	....	*966·40	79·81
		Niagara State Battery (Ward)	....	....	....	....	....	....	....	....	*10·08	....
		Various Works	....	....	....	....	....	....	....	1,220·50	16,226·67	41·17
		Reported by Banks and Gold Dealers	....	....	....	....	....	1,591·87	823·66	....	63·53	....
		Totals	....	·84	**1,408·00**	**2,546·66**	**79·81**	**1,712·66**	**1,819·99**	**930,107·77**	**518,504·20**	**5,683·41**

YERILLA DISTRICT.

Edjudina		1011R, etc.	Paget Gold Mines of Edjudina, 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	....	1·63	5·00	2·03	....	....	28·52	6,892·58	4,808·40	....
Patricia		....	Voided leases	....	....	....	....	....	....	....	4,158·50	5,396·40	25·40
			Sundry claims	....	....	....	....	....	....	....	47·00	20·78	....
Pinjin		....	Voided leases	....	....	....	....	....	....	48·34	17,463·30	10,742·77	....
			Sundry claims	....	....	7·00	4·21	....	....	154·86	5,642·59	3,475·75	....
Yarri		1320R	Margaret	....	....	796·00	268·92	....	....	....	1,148·00	370·95	....
		1327R	Nil Desperandum	....	....	204·00	57·22	....	....	....	204·00	57·22	....
		1126R, etc.	Porphry (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	....	....	389·50	107·13	....	·87	5·93	16,376·05	5,968·18	·04
Yerilla		....	Voided leases	....	....	....	....	....	....	3,107·25	16,481·43	12,925·74	13·93
			Sundry claims	....	....	....	....	....	19·30	54·93	2,742·58	1,567·83	....
Yilgangie		1176R	Western Mining Corporation	....	....	1,923·00	1,709·84	278·13	....	....	6,240·75	6,506·17	564·79
			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	....	....	36·00	21·19	....	121·67	98·20	3,302·30	2,020·38	·63
		From District generally :—											
		Sundry Parcels treated at :											
		State Battery, Yarri		....	....	....	*240·87	....	....	....	271·50	*8,382·00	9·65
		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	....	**1·63**	**3,360·50**	**2,411·41**	**278·13**	**1,311·91**	**3,774·42**	**262,198·28**	**151,616·48**	**1,423·60**

Broad Arrow Goldfield.

Bardoc		....	Voided leases	....	....	....	....	....	....	2,335·41	85,370·59	55,699·50	203·60
			Sundry claims	....	....	324·00	91·81	....	54·95	1,194·11	16,455·28	7,998·80	....
Black Flag		2229W	Bellevue	....	....	59·50	154·82	....	....	44·80	680·50	1,281·89	....
			Voided leases	....	....	....	....	....	27·18	405·90	48,233·79	28,152·20	....
			Sundry claims	....	....	220·75	51·73	....	712·92	251·59	7,869·46	4,801·96	....
Broad Arrow		(2267W)	Bulletin South	....	....	48·50	16·44	....	....	....	48·50	16·44	....
		2039W	Golden Arrow	....	....	....	....	....	....	....	5,657·50	830·70	....
		2254W	Grace Darling Extended	....	....	574·00	279·76	....	....	....	1,274·50	642·19	....
		1771W	North Duke	....	....	....	....	....	....	1,670·51	236·80	634·35	....
			Voided leases	....	....	....	....	....	70·32	8,782·21	147,268·59	117,422·16	20·23
			Sundry claims	....	....	209·25	62·09	....	1,007·72	3,044·51	32,027·14	16,479·20	·11

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 1951.					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.
BROAD ARROW GOLDFIELD—continued.												
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	....	....	47·25	23·50	....	....	40·31	1,205·12	361·74	·05
Christmas Reef	2262W....	Gull's Neck	....	....	....	....	....	....	25·31	....	....	....
	2175W....	New Mexico	....	....	....	....	....	....	....	1,058·35	3,376·21	....
	2253W....	New Mexico South	....	....	131·00	375·59	....	....	....	131·00	375·59	....
		Voided leases	....	....	....	....	....	....	29·68	794·77	216·24	....
		Sundry claims	....	....	14·00	18·26	....	....	427·37	2,882·64	2,629·27	....
Fenbark	2188W....	Golden Penny	....	....	3·00	15·60	....	....	....	2,753·50	610·43	....
		Voided leases	....	....	....	....	....	....	4·42	3,897·75	2,080·79	....
		Sundry claims	....	....	98·75	12·55	....	....	51·96	2,945·77	982·44	....
Grant's Patch	2261W....	Bent Tree	....	....	309·50	74·09	....	....	....	563·50	116·76	....
	2242W....	Lady Agnes	....	....	176·00	39·56	....	....	2·11	1,060·50	365·86	....
	(2227W)	Magpie	....	....	271·75	91·25	....	....	....	657·00	668·50	....
	1962W, etc.	Ora Banda Amalgamated Mines, N.L.	....	....	....	22·11	....	....	....	168,179·25	62,673·68	175·00
		Prior to transfer to present holders	....	....	....	....	....	....	....	12,424·50	9,540·07	....
	2208W....	Wentworth	....	....	115·00	55·92	....	....	....	1,920·75	669·76	....
	2224W....	Whippole	....	....	75·50	27·08	....	....	12·20	756·60	348·14	....
		Voided leases	....	....	....	....	....	....	258·52	14,783·10	4,672·25	....
		Sundry claims	....	....	45·25	22·85	....	....	356·66	5,915·79	2,954·03	....
Ora Banda	2270W....	Gimlet South	....	....	932·75	148·97	....	....	....	932·75	148·97	....
	M.A. 41, T.A. 42 W	Associated Northern Ora Banda, N.L.	....	....	....	....	....	....	....	2,786·50	457·22	21·07
		Prior to transfer	....	....	....	....	....	....	....	315,958·95	123,252·22	1,664·70
		Voided leases	....	....	....	....	....	....	845·72	103,738·57	27,372·53	....
		Sundry claims	....	39·09	102·50	14·31	....	....	375·85	12,967·50	4,309·18	....
Paddington	(2266W)	Colac	....	....	178·00	29·72	....	....	....	268·00	45·46	....
	2122W....	Pakeha	....	....	573·00	248·36	4·66	....	....	3,840·65	1,438·98	4·66
	2263W....	Try Again	....	....	....	....	....	....	....	32·75	7·19	....
		Voided leases	....	....	....	....	....	5,566·30	463·31	189,669·41	84,534·17	
		Sundry claims	....	....	150·00	8·76	....	1,714·16	291·43	16,387·73	9,124·63	18·96
												....

Riche's Find	2271W....	Merry Dance	....	....	4·50	98·63	....	....	....	4·50	98·63	....
	2257W....	Yalbalgo	....	....	20·00	96·29	....	....	....	96·00	424·59	....
		Voided leases	....	....	....	....	....	....	7·01	7,471·59	5,363·45	71·36
		Sundry claims	....	....	142·00	86·35	....	....	282·51	1,900·80	1,997·70	·13
Siberia	....	Voided leases	....	....	....	....	....	1·07	2,649·28	28,928·97	31,751·34	....
		Sundry claims	....	....	266·50	85·08	....	289·06	1,233·18	20,977·29	12,812·35	....
Smithfield	2264W....	King of Kings	....	....	517·75	77·37	....	....	....	517·75	77·37	....
		Voided leases	....	....	....	....	....	....	....	4,700·71	1,174·69	....
		Sundry claims	....	....	47·75	34·71	....	....	123·37	3,042·09	1,165·58	....
		From Goldfield generally :—										
		Sundry Parcels treated at :										
		State Battery, Ora Banda	....	....	....	*926·72	....	....	....	128·05	*21,522·55	....
		Golden Arrow Battery	....	....	....	*140·42	....	....	....	36·00	*3,955·82	....
		Ora Banda Tailings Syndicate, Retreatment Works	....	....	....	....	....	....	....	....	*38·64	....
		Minnie Palmer Battery and Cyanide Plant	....	....	....	....	....	....	....	....	*3,082·62	....
		Various Works	....	....	....	....	....	2,275·66	1·24	16,967·02	*46,360·24	3,103·45
		Reported by Banks and Gold Dealers	1·57	....	....	....	....	9,981·13	131·39	61·68	90·35	....
		Totals	**1·57**	**39·09**	**5,657·75**	**3,430·70**	**4·66**	**21,944·65**	**27,076·87**	**1,312,259·30**	**718,309·54**	**5,283·32**

North-East Coolgardie Goldfield.

KANOWNA DISTRICT.

Gindalbie	1540X	Lady Betty	....	....	152·25	70·52	....	....	1,132·05	835·00	1,317·33	....
		Voided leases	....	....	....	....	....	....	19·94	44,322·53	39,596·70	38·31
		Sundry claims	....	....	....	....	....	....	716·52	4,995·02	2,795·10	....
Gordon	....	Voided leases	....	....	....	....	....	....	682·54	53,900·58	20,072·51	517·61
		Sundry claims	....	....	....	....	....	....	177·38	2,105·70	1,185·63	....
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	....	....	493·00	140·46	....	....	....	1,180·00	367·17	....
	(1575X)	New Main Reef South	....	....	106·25	48·15	....	....	....	106·25	48·15	....
	1574X	Snowdrop	....	....	21·75	19·65	....	....	....	21·75	19·65	....
		Voided leases	....	....	....	....	....	24·94	4,516·76	685,429·10	380,429·56	2,482·24
		Sundry claims	....	5·41	118·00	55·31	....	118·94	2,163·30	25,615·02	11,580·41	1·50
Mulgarrie	....	Voided leases	....	....	....	....	....	....	1,216·63	6,902·26	4,197·98	....
		Sundry claims	....	....	....	....	....	....	16·78	1,261·75	631·40	....
Six Mile	....	Voided leases	....	....	....	....	....	....	1,603·72	559·00	767·72	....
		Sundry claims	....	....	....	....	....	....	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	1·24	....	....	....	....	105,999·98	36·91	·50	104·96	....
		Totals	**1·24**	**5·41**	**891·25**	**334·09**	....	**106,498·98**	**13,515·01**	**1,001,964·76**	**624,329·41**	**3,039·73**

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 1951.					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-EAST COOLGARDIE GOLDFIELD—continued.												
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	....	....	22·00	4·69	....	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	....	....	**22·00**	**4·69**	....	**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	....	....	47·50	4·42	....	....	....	692·25	80·51	....
		Voided leases	....	....	....	....	....	....	....	803·10	385·19	....
		Sundry claims	....	....	30·75	3·37	....	....	13·01	4,948·27	1,664·47	....
Boorara	5486E	Olympian	....	....	....	....	....	....	....	1,675·25	937·05	3·01
	6310E	Roma	....	....	303·00	39·36	....	....	....	303·00	39·36	....
		Voided leases	....	....	....	....	....	....	459·07	306,930·82	171,842·83	408·36
		Sundry claims	....	....	21·00	7·08	....	·49	145·56	3,157·09	1,457·42	....
Boulder	6145E	Boomerang	....	....	....	....	....	....	....	77·00	8·00	....
	5690E	Boulder Perseverance, Ltd.	....	....	135,474·62	33,125·94	11,311·31	....	....	2,580,849·46	965,900·22	310,878·16
		Prior to transfer to present holders	....	....	....	....	....	....	....	3,306,942·88	1,841,159·00	203,821·43
	5472E	Golden Key	....	....	....	....	....	18·27	24·33	432·25	165·02	....
	5159E, etc.	Gold Mines of Kalgoorlie, Ltd.	....	....	167,899·00	46,843·03	8,372·80	....	....	1,963,804·30	539,304·96	141,852·71
	5466E	South Star	....	....	....	....	....	....	233·46	4,237·43	1,494·78	....
		Prior to transfer	....	....	....	....	....	....	5·22	1,835·75	748·78	....
	5159E, etc.	Lake View South (G.M.K.), Ltd.	....	....	....	....	....	....	....	62,278·38	21,536·66	....
		Prior to transfer	....	....	....	....	....	....	545·23	527,790·53	568,643·05	4,844·50

	5853E, etc.	Paringa Junction North Leases	....	....	....	....	....	....	7·82	1,686·79	701·11	....
	5696E, etc.	Great Boulder Pty. Gold Mines, Ltd.	....	....	325,924·00	86,985·60	37,860·95	....	1·53	9,766,208·97	5,212,054·08	1,066,642·75
	5845E	Happy Returns	....	....	2,002·00	362·39	....	....	....	5,561·25	1,065·55	....
	5345E, etc.	Kalgoorlie Enterprise Mines, Ltd.	....	....	56,049·53	16,897·37	1,780·70	....	....	756,335·87	234,980·54	22,802·29
		Prior to transfer	....	....	....	....	....	....	....	15,320·68	8,957·01	....
	4476E, etc.	Lake View and Star, Ltd.	....	....	614,051·00	155,044·57	34,525·72	....	....	9,894,915·30	3,143,485·84	306,043·92
		Prior to transfer	....	....	....	....	....	....	8·49	15,792,500·38	9,149,223·80	1,348,055·82
	6230E	New Look	....	....	106·25	9·00	....	....	....	256·75	22·68	....
	5431E, etc.	North Kalgurli (1912), Ltd.	....	....	255,314·69	59,395·49	11,242·00	....	111·55	2,838,542·36	898,765·88	227,775·52
	5405E, etc.	North Kalgurli (1912) (Croesus Pty. Group)	....	....	....	....	....	....	51·20	90,159·00	19,261·22	....
	5891E	(New Croesus)	....	....	....	....	....	....	....	193·00	48·74	....
	5700E, etc.	Prior to transfer	....	....	....	....	....	43·99	....	4,018,436·01	2,815,911·21	97,625·03
	5446, etc.	North Kalgurli United Mines, Ltd.	....	....	....	....	....	....	....	4,661·51	928·18	232·93
		Prior to transfer	....	....	....	....	....	....	....	131·74	76·74	....
	5853E	(Paringa Junction)	....	....	....	....	....	....	....	123·75	17·77	....
	5854E	(Paringa Junction, North)	....	....	....	....	....	....	....	60·50	10·64	....
	5855E	(Paringa Junction, South)	....	....	....	....	....	....	....	1,473·25	228·42	....
	5434E, etc.	Paringa Mining & Exploration Co., Ltd.	....	8,231·00	2,811·11	1,797·33	....	....	1,127,686·30	261,616·60	24,040·13
		Prior to transfer	....	....	....	....	....	1·07	·79	57,618·03	24,452·83	....
	6095E	Raymond	....	....	140·25	31·30	....	....	....	255·75	49·19	....
	5695E, etc.	South Kalgurli Consolidated, Ltd.	....	....	98,594·86	24,425·57	147·15	....	....	2,914,145·49	1,085,698·03	26,346·12
		Prior to transfer	....	....	....	....	....	....	....	1,344,254·70	531,792·77	17,722·97
		Voided leases	....	....	....	....	....	109·90	11,998·250	626,681·98	473,933·34	6·83
		Sundry claims	....	....	75·75	22·61	....	24·58	210·25	11,615·74	4,289·79	....
Cutter's Luck	....	Voided leases	....	....	....	....	....	45·87	133·58	74·50	239·19	....
		Sundry claims	....	....	61·50	4·96	....	8·11	501·65	922·90	384·71	....
Feysville	6260E	Brittania	....	....	302·00	30·92	....	....	....	302·00	30·92	....
		Voided leases	....	....	....	....	....	....	110·93	561·30	394·24	....
		Sundry claims	....	....	....	....	....	....	199·00	1,200·10	640·27	....
Hampton Plains	P.P.L. 170	A. D. Cragan	....	....	8·50	1·25	....	....	....	8·50	1·25	....
	P.P.L. 1	Consolidated Gold Areas, N.L.	....	....	1,080·75	91·07	....	....	....	141,784·98	37,178·45	5,835·85
	P.P.L. 23	Mutooroo	....	....	....	....	....	....	....	50·75	10·45	....
	P.P.L. 279	Mutooroo	....	....	....	....	....	....	....	6,151·88	1,087·26	....
	P.P.L. 9	Consolidated Gold Areas, N.L.	....	....	....	....	....	....	....	215·75	4·27	....
	P.P.L. 420	Hampton Xmas Gift	6·72	37·57	73·75	84·16	....	6·72	37·57	73·75	84·16	....
	P.P.L. 12	Junction Extended	....	....	....	....	....	....	....	3,581·75	527·74	....
	P.P.L. 55	R. J. Beavis	....	....	....	....	....	....	....	36·25	7·41	....
	P.P.L. 62	R. Ninnis	....	....	....	....	....	....	....	9·00	·95	....
	P.P.L. 81	Villers Brettaneaux	....	....	....	....	....	....	....	3,562·02	1,435·55	....
	P.P.L. 86	Golden Hope, N.L.	....	....	....	....	....	....	....	5,964·00	2,006·14	....
	P.P.L. 153	Lone Pine	....	....	....	....	....	....	....	6·50	2·08	....
	P.P.L. 161	A. and D. Erceg	....	....	....	....	....	....	....	16·00	2·42	....
	P.P.L. 175	F. C. Schoppe	....	....	1,188·50	228·17	....	....	....	3,956·25	623·94	....
	P.P.L. 177	Great Northern	....	....	....	....	....	....	....	97·00	17·81	·23
	P.P.L. 192	Golden Hope, North	....	....	....	....	....	....	....	353·00	201·02	....
	P.P.L. 211	Beavis & Murray	....	....	265·50	19·55	....	....	....	265·50	19·55	....
	P.P.L. 227	J. McGrath	....	....	....	....	....	....	....	215·75	47·87	....
	P.P.L. 289	Mount Martin	....	....	126·50	34·35	....	....	....	299·50	77·19	....
	P.P.L. 289	Mount Martin	....	....	....	....	....	....	....	....	*157·41	....

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 1951.					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.*												
	P.P.L. 252	Hampton Properties, Ltd.—Mount Martin	....	....	....	....	....	....	....	14,953·75	5,574·11	....
	P.P.L. 277	New Hope	....	....	320·00	47·28	....	....	17·23	60,814·30	11,101·89	....
	P.P.L. 291	J. E. Trinidad	....	....	159·50	16·58	....	....	....	1,072·50	148·24	....
	P.P.L. 299	Block 45	....	....	472·00	126·49	....	....	....	472·00	126·49	....
	P.P.L. 311	Dawn Hope	....	....	....	....	....	....	....	993·75	89·23	....
	P.P.L. 85	C. E. Andrews	....	....	....	....	....	....	....	59·75	8·79	....
	P.P.L. 207	Andrews & O'Riley	....	....	....	....	....	6·78	....	51·75	9·85	....
	P.P.L. 312	Andrews & O'Riley	....	....	....	....	....	6·12	....	104·50	12·22	....
	P.P.L. 371	Victory	....	....	141·25	19·31	....	....	....	1,901·75	251·63	....
		Sundry claims and leases	....	....	....	....	....	2·68	70·85	46,386·16	8,494·60	....
		Cancelled leases	....	....	....	....	....	4,565·62	203·94	110,492·44	36,077·27	69·60
Kalgoorlie	5927E	A.I.F.	....	....	45·50	5·27	....	....	....	101·25	18·02	....
	6048E	Auld Acquaintance	....	....	....	....	....	....	....	7·50	2·36	....
	5449E	The Broken Hill Pty. Co., Ltd.	....	....	9,324·00	3,326·78	....	....	3·99	487,068·01	179,026·29	1,843·28
		Prior to transfer	....	....	....	....	....	....	....	1,558·49	316·58	....
	5519E, etc.	Barbican Corporation, Ltd.	....	....	....	....	....	....	....	362·00	79·80	....
	5839E	Coronation	....	....	....	....	....	....	....	40·00	9·03	....
	5913E	Devon Consols	....	....	23·00	5·52	....	....	93·19	1,842·71	610·36	....
	5737E	Golden Mile Channel	....	....	....	....	....	....	·97	2,677·25	207·65	....
	5878E	Lady May	....	....	618·50	60·25	....	....	62·05	3,723·75	1,089·30	....
	6091E	Lesanben	....	8·13	17·50	27·45	....	....	152·49	88·50	197·92	....
	4547E, etc.	Mount Charlotte (Kalgoorlie) G.M.s, Ltd.	....	....	18,430·00	2,140·87	110·15	....	....	20,821·50	2,444·87	110·15
		Prior to transfer	....	....	....	....	....	....	5·72	48,292·60	13,930·79	....
	5437E	North End Extended	....	....	....	....	....	....	996·89	367·85	528·94	....
	5852E, etc.	Pedestal Leases	....	....	339·50	58·64	....	....	....	1,277·25	284·99	....
		Prior to transfer	....	....	....	....	....	....	....	1,667·50	481·60	....
	5468E	Phar Lap	....	....	83·00	12·98	....	....	....	580·75	371·78	....
	5415E, etc.	Return Leases	....	....	....	....	....	....	5·64	3,801·25	654·34	....
	5934E, etc.	Sceptre Leases	....	....	....	....	....	....	....	28·00	4·63	....
		Voided leases	....	....	....	....	....	242·48	9,570·27	965,064·45	397,910·58	44,017·12
		Sundry claims	....	....	226·05	33·83	....	232·41	1,122·17	59,713·88	23,032·21	....
Wombola	6051E	Big Bull	....	....	37·00	51·81	....	....	....	450·00	347·87	....
	5688E, etc.	Caledonian Leases	....	....	345·50	241·89	....	....	....	888·50	489·16	....
	5688E	(Caledonian)	....	....	....	....	....	....	....	4,275·00	3,632·98	....
	5967E	(North Caledonian)	....	....	....	....	....	....	1·27	22·25	8·15	....
	5497E, etc.	Daisy Leases	....	....	957·20	564·28	....	....	....	3,654·15	2,326·42	5·92
	5497E	(Daisy)	....	....	....	....	....	....	....	6,282·25	5,031·93	....
	5500E	(Happy-Go-Lucky)	....	....	....	....	....	....	....	2,075·25	1,675·85	....

6032E	Dry Mount	....	....	117·50	24·47	....	....	....	1,120·50	1,121·40	....
4766E	Great Hope	....	....	....	....	....	....	....	96·00	28·09	....
4766E	Pericles G.M.s, Ltd.	....	....	....	....	....	....	358·11	4,728·03	19,305·86	....
5689E, etc.	Haoma Leases	....	....	2,836·00	2,022·71	....	....	....	13,352·50	9,237·24	....
5689E	(Haoma)	....	....	....	....	....	....	....	2,168·00	1,948·36	....
5525E	(Xmas Flat)	....	....	....	....	....	....	....	330·25	264·74	....
(6250E)	Hillbilly	3·80	....	....	....	....	3·80	....	16·50	7·54	....
6312E	Inverness	....	....	302·50	57·40	....	....	....	302·50	57·40	....
6043E	Launa Doone	....	....	39·00	17·37	....	....	....	1,134·00	483·15	....
6043E, etc.	(Launa Doone Leases)	....	....	....	....	....	....	....	32·50	42·76	....
(6224E)	Lucky Strike	....	....	38·50	8·33	....	....	....	109·50	22·12	....
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	Prior to transfer	....	....	....	....	....	....	....	4,614·75	12,615·82	....
6213E	Pauline	....	....	....	....	....	....	....	195·00	196·39	....
6313E	Proprietary	....	....	50·00	18·49	....	....	....	50·00	18·49	....
(6237E)	Proprietary	....	....	25·00	16·11	....	....	....	133·00	204·66	....
5866E	Rosemary	....	....	....	....	....	....	....	53·50	84·73	....
6255E	Spinifex	....	....	282·75	75·46	....	....	....	282·75	75·46	....
	Voided leases	....	....	....	....	....	....	2,106·67	21,848·81	20,395·62	....
	Sundry claims	....	....	183·00	50·98	....	....	711·10	22,766·43	13,906·10	....
From District generally :—											
Sundry parcels treated at :											
Sundry claims	....	....	....	....	....	11,014·57	465·61	5,440·46	2,541·10	....
Broken Hill Proprietary, Kalgoorlie, L.T.T. 1120H	....	....	....	*145·39	....	....	....	....	*669·71	....
Golden Horseshoe (New), Ltd., T.L.'s 101, etc.	....	....	....	*6,559·08	6,030·32	....	....	....	*310,618·44	317,544·05
Pericles Mill, T.L. 773H	....	....	....	*182·53	....	....	....	....	*3,814·65	....
Polkinghorne's Cyanide Plant	....	....	....	....	....	....	....	....	*149·38	....
J. F. Poynton's Plant	....	....	....	....	....	....	....	9·50	6·06	....
State Battery, Kalgoorlie	....	....	15·00	*1,507·79	....	....	....	360·70	*27,662·53	39·40
Various Works	....	....	....	....	....	384·36	64·70	41,125·52	*265,948·28	14,114·46
Reported by Banks and Gold Dealers	26·70	·35	....	528·03	....	16,847·36	9,959·18	355·66	6,093·02	....
Totals	**37·22**	**46·05**	**1,702,800·95**	**444,456·01**	**113,178·43**	**33,565·18**	**40,802·95**	**60,200,526·94**	**29,435504·84**	**4,183,161·54**

BULONG DISTRICT.

Balagundi	1327Y	Homeward Bound	....	....	5·25	15·18	....	....	....	5·25	15·18	....
		Voided leases	....	....	....	....	....	....	2,408·98	1,110·68	1,473·73	12·92
		Sundry claims	....	....	....	....	....	3·51	293·52	777·51	498·71	....
Bulong	1311Y	Blue Quartz	....	....	16·50	49·18	....	....	....	992·25	377·79	....
	1308Y	Southern Cross	....	....	....	....	....	....	1·30	3,183·00	514·76	....
		Voided leases	....	....	....	....	....	107·54	8,524·82	104,806·80	85,230·44	....
		Sundry claims	....	....	212·75	17·67	....	1,655·86	1,607·89	15,507·73	17,571·78	....
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	....

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 1951. 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.												
BULONG DISTRICT—*continued.*												
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	....	....	....	....	....	112·69	51·88	2,608·35	1,037·88	....
Trans Find	P.P.L. 308A, Loc. 41	Dawn of Hope	....	....	....	....	....	....	2·87	1,141·50	328·80	....
		Voided leases	....	....	....	....	....	....	....	1,098·42	876·22	....
		Sundry claims	....	....	....	....	....	....	5·93	808·25	335·33	....
		From District generally :—										
		Sundry Parcels treated at : Various Works	....	....	....	....	....	....	....	6,102·15	*6,675·38	....
		Reported by Banks and Gold Dealers	7·40	....	....	....	....	25,222·72	70·15	·01	28·44	....
		Totals	**7·40**	....	**234·50**	**82·03**	....	**27,403·01**	**16,029·20**	**183,271·80**	**131,427·89**	**12·92**
Coolgardie Goldfield.												
COOLGARDIE DISTRICT.												
Bonnievale	5865	Jenny Wren	....	....	30·75	13·82	....	....	....	30·75	13·82	....
	5622	Lucky Hit	....	3·28	16·25	11·97	....	....	3·28	922·10	472·35	....
	4600	Melva Mae	....	....	....	....	....	....	....	2,193·15	3,543·46	2·35
		Prior to transfer to present holders	....	....	....	....	....	....	....	614·50	1,099·21	11·63
	5767, 5768	Victory Exploration, N.L.	....	....	533·00	182·57	....	....	....	2,506·50	584·69	....
	5767	Red Ridge	....	....	....	....	....	....	....	108·00	53·63	....
		Voided leases	....	....	....	....	....	....	212·48	354,434·97	190,431·94	5·88
		Sundry claims	....	1·90	724·75	264·28	....	....	163·19	7,079·68	4,965·77	....
Bulla Bulling	....	Voided leases	....	....	....	....	....	....	....	776·81	668·19	....
		Sundry claims	....	....	....	....	....	5·21	15·98	1,318·26	561·29	....
Burbanks	5677, etc.	Burbanks-Bonnieville Prospecting Co., Ltd.	....	....	1,146·00	640·70	....	....	....	3,722·00	1,474·19	....
	5443	New Gift	....	....	....	....	....	....	2·00	625·50	228·69	....
	5605	Burbanks Deeps	....	....	....	....	....	....	....	103·00	53·46	....
	5851	Lord Bobs	....	....	23·50	8·16	....	....	....	23·50	8·16	....
		Voided leases	....	....	....	....	....	14·90	372·17	415,782·21	304,621·08	521·06
		Sundry claims	....	8·02	222·25	64·47	....	55·05	487·46	15,234·80	8,743·71	....

Cave Rocks	....	Voided leases	....	....	....	....	....	....	....	....	8,223·16	1,941·42	....
		Sundry claims	....	....	12·25	38·83	....	....	....	50·00	4,278·40	1,058·67	....
Coolgardie	5679	Ada	....	....	99·50	10·78	....	....	....	....	1,229·75	117·89	....
	5868	Brown's El Dorado	....	....	·50	581·02	....	....	....	....	·50	581·02	....
	5297, etc.	Consolidated G.M's. of Coolgardie, Ltd.	....	....	....	....	....	....	....	....	282,560·70	50,610·27	4,812·12
		Prior to transfer to present holders	....	....	....	....	....	....	....	4·55	1,946·35	547·45	3·22
	5653	Gleeson's	....	....	....	....	....	....	....	....	1,925·00	922·37	....
	5844	Jackpot	....	....	....	....	....	....	....	....	413·00	173·69	....
	5643	Lloyd George South	....	....	....	....	....	....	....	....	....	10·25	....
	5743	Moya Jan	....	....	323·25	170·32	....	....	....	....	1,868·75	780·84	....
	(5239), etc.	Phoenix Gold Mines Pty., Ltd.	....	....	....	....	....	....	....	....	240,385·00	66,736·54	2·54
		Prior to transfer	....	....	....	....	....	....	....	2·74	167·56	237·80	....
		Voided leases	....	....	....	....	....	1,301·71	4,668·19	577,450·68	328,458·43	1·02
		Sundry claims	....	....	965·20	1,492·61	....	205·49	2,703·41	68,919·30	26,502·70	....
Eundynie	5624	Eundynie	....	....	....	....	....	....	....	54·00	76·35	....
		Voided leases	....	....	....	....	....	3·70	16·09	31,701·98	16,449·71	1·75
		Sundry claims	....	....	11·50	3·45	....	....	82·28	694·12	468·01	....
Gibraltar	5723	Lloyd George	....	....	....	*52·44	....	....	....	570·00	157·98	....
	5684	Winston Churchill	....	....	....	....	....	....	....	60·00	12·96	....
		Voided leases	....	....	....	....	....	....	33·97	38,592·63	20,097·49	....
		Sundry claims	....	....	13·65	53·68	....	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. 460	Andrews & O'Reilley	....	37·85	....	....	....	....	37·85	....	....	....
	P.P.L. 419	Chatanooka	....	....	....	....	....	....	....	1,267·75	295·73	1·10
	P.P.L. 1328	Daniel Finn	....	....	....	....	....	....	....	19·75	11·18	....
	P.P.L. 338	Dry Hill	....	....	....	....	....	....	....	43·00	58·42	....
	P.P.L. 427	Easter Gift	....	....	....	....	....	....	....	21·75	3·04	....
	P.P.L. 119	Golden Eagle	....	....	....	....	....	....	7·63	2,807·59	2,548·42	....
	P.P.L. 348	Hampton Gold Mining Areas, Ltd.	....	....	....	....	....	....	....	43·75	4·69	....
	P.P.L. 348	Goldfields Australian Development Co., Ltd.	....	....	....	....	....	....	....	78·00	12·89	....
	P.P.L. 334, 448	Hampton Gold Mining Areas, Ltd.	....	....	....	....	....	....	....	....	1,538·25	453·60
	P.P.L. 454	Hampton Gold Mining Areas, Ltd.	....	....	....	....	....	....	....	48·75	7·53	....
	P.P.L. 435	Lady Jess	....	....	....	....	....	....	2·79	151·00	30·47	....
	P.P.L. 355	Lady Marie	....	....	....	....	....	....	....	545·50	118·33	....
	P.P.L. 319	Lady May	....	....	....	....	....	....	....	1,742·25	981·39	....
	P.P.L. 389	Lassie Come Home	....	....	....	....	....	....	....	30·00	6·54	....
	P.P.L. 458	Mac	....	....	....	....	....	....	....	11·00	60·85	....
	P.P.L. 315	Malvern Star	....	....	....	....	....	....	....	16·00	10·14	....
	P.P.L. 436	May	....	....	....	....	....	....	....	4·50	1·35	....
	P.P.L. 429	Maureen Anne	....	....	....	....	....	....	....	14·75	2·15	....
	P.P.L. 430	Melba	....	....	....	....	....	....	....	10·00	3·51	....
	P.P.L. 361	Mistletoe	....	....	....	....	....	....	....	20·00	5·11	....
	P.P.L. 316, 330	New Coolgardie Gold Mines, N.L.	....	....	41,756·00	20,913·79	5,475·42	....	....	97,972·00	46,641·97	9,129·33
	P.P.L. 316	(Surprise G.M.)	....	....	....	....	....	....	....	7,189·00	3,425·59	....
	P.P.L.	(Barbara)	....	....	....	....	....	....	....	2,157·75	1,655·63	....
	P.P.L. 437	Two Crows	....	....	....	....	....	....	....	15·00	5·57	....

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 1951.					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.*												
Hampton Plains—*continued.*	P.P.L. 462	Bobby Dazzler	....	28·55	·30	220·40	....	....	28·55	·30	220·40	....
		Cancelled leases	....	....	....	....	....	....	403·05	8,518·25	7,798·76	....
		Sundry claims and leases	....	....	63·25	14·23	....	1·63	132·06	1,801·50	813·61	....
Higginsville	5647	Fair Play Gold Mine	....	....	....	....	....	....	....	28,276·00	3,123·82	·02
	5293	Two Boys	....	....	....	*99·54	....	....	....	460·00	*1,277·81	·01
	5293	(Two Boys)	....	....	....	....	....	....	....	6,888·00	3,193·95	....
		Voided leases	....	....	....	....	....	....	373·93	38,141·35	17,438·49	159·50
		Sundry claims	....	....	....	....	....	....	187·25	3,638·26	1,942·64	....
Larkinville	....	Voided leases	....	....	....	....	....	22·77	54·44	2,335·16	3,256·49	....
		Sundry claims	....	....	....	....	....	....	147·20	448·53	1,029·03	....
Logan's	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	....	....	38·00	3·70	....	6·88	128·95	1,919·35	892·31	....
Londonderry	....	Voided leases	....	....	....	....	....	....	95·04	34,155·35	22,238·37	·35
		Sundry claims	....	....	167·25	13·28	....	16·68	38·72	3,366·42	2,480·22	22·42
Mungari	....	Voided leases	....	....	....	....	....	....	17·71	1,872·50	458·43	....
		Sundry claims	....	....	....	....	....	1·77	153·24	2,488·19	705·11	....
Paris	5311, 5500	Lister's Gold Mine	....	....	....	....	....	·88	....	5,360·00	3,506·79	75·95
	5311, 5500	(Lister's Gold Mine)	....	....	....	....	....	....	....	8,582·00	4,423·84	....
	5311, etc.	(Paris Central)	....	....	....	....	....	....	....	113·00	24·16	....
		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	....	....	·12	275·84	....	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	4,158·56	1,453·58	....

Wannaway	....	Voided leases	....	....	....	....	....	....	28·61	1,831·95	1,465·70	....
		Sundry claims	....	....	....	....	....	....	193·79	1,316·37	1,300·33	....
Widgiemooltha	5794	Blue Bird	....	1·40	11·30	11·37	....	....	137·76	40·69	121·62	....
	5663	Bobs	....	....	....	....	....	....	....	16·00	4·94	....
	5834	Harpers	....	....	14·15	16·62	....	....	....	21·15	44·87	....
	5451	Host Group	....	....	....	....	....	....	12·75	1,602·80	524·21	....
		Voided leases	....	....	....	....	....	17·95	1,114·94	22,687·12	11,843·73	·17
		Sundry claims	....	....	91·50	27·64	....	46·49	456·07	16,132·91	6,803·41	·07
		From District generally :—										
		Sundry Parcels treated at :										
		State Battery, Coolgardie	....	....	....	*515·71	....	....	....	771·01	*36,241·40	9·65
		Terrell and Party Plant, T.A. 201	....	....	252·00	*134·16	....	....	....	267·00	*205·71	....
		Australian Machinery & Investment Co., Ltd. Cyanide Plant, T.L. (3) 63H, (5) 127H	....	....	....	....	....	....	....	....	*3,044·44	86·31
		Ajax Treatment Plant, M.A. 97	....	....	....	....	....	....	....	....	*43·26	....
		Lister's Cyanide Plant	....	....	....	....	....	....	....	....	*269·23	....
		Paris Central Cyanide Plant	....	....	....	....	....	....	....	....	*77·64	....
		N. C. Parry Cyanide Plant	....	....	....	....	....	....	....	....	*23·77	....
		Widgiemooltha Battery	....	....	....	....	....	....	....	....	*1,165·31	....
		Various Works	....	....	....	....	....	7·75	....	3,897·61	*28,149·90	223·06
		Reported by Banks and Gold Dealers	17·05	....	....	....	....	14,869·48	718·84	48·25	74·95	·60
		Totals	**17·05**	**81·00**	**46,516·22**	**25,835·38**	**5,475·42**	**16,884·48**	**16,097·17**	**2,582,404·14**	**1,337,573·97**	**15,073·35**

KUNANALLING DISTRICT.

Carbine	970S	Carbine	....	....	....	....	....	....	....	13,820·00	7,047·96	....
	970S	Carbine leases	....	....	....	....	....	....	687·98	51,991·86	39,862·25	....
		Voided leases	....	....	....	....	....	....	....	20,116·00	5,470·81	....
		Sundry claims	....	....	....	....	....	136·08	93·96	6,010·78	2,025·48	....
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	....	....	78·50	36·61	....	3·35	1,034·08	2,725·06	2,031·81	....
Jourdie Hills	....	Voided leases	....	....	....	....	....	....	18·00	28,009·74	19,401·09	28·45
		Sundry claims	....	....	....	....	....	1·86	49·81	1,681·00	824·75	1·05
Kintore	1036S	Newhaven	....	....	579·25	125·35	....	....	....	1,624·75	403·48	....
		Voided leases	....	....	....	....	....	18·70	169·33	54,829·39	39,579·50	677·88
		Sundry claims	....	....	202·15	114·16	....	111·91	102·70	4,522·78	2,501·41	....
Kunanalling	....	Voided leases	....	....	....	....	....	86·13	1,734·92	130,303·61	100,812·73	40·77
		Sundry claims	....	....	73·25	18·97	....	216·53	815·28	14,469·17	9,486·95	....
Kundana	....	Voided leases	....	....	....	....	....	....	....	465·00	68·12	....
		Sundry claims	....	....	....	....	....	....	....	443·50	51·82	....

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 1951.					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.												
KUNANALLING DISTRICT—*continued.*												
		From District generally :—										
		Sundry parcels treated at :—										
		Goldfields Australian Development Plant	....	....	....	....	....	....	....	....	*548·07	....
		Various Works	....	....	....	....	....	42·23	....	1,782·26	5,061·33	....
		Reported by Banks and Gold Dealers	·67	....	....	....	....	865·27	17·93	....	5·85	·49
		Totals	**·67**	....	**933·15**	**295·09**	....	**1,496·34**	**5,630·59**	**361,049·35**	**251,996·53**	**751·39**
Yilgarn Goldfield.												
Blackbornes	....	Voided leases	....	....	....	....	....	....	....	1,282·50	341·37	....
		Sundry claims	....	....	....	....	....	....	....	392·50	81·15	....
Bullfinch	3345, etc.	Copperhead	....	....	....	....	....	....	....	7,427·32	2,076·32	....
	3378, etc.	Copperhead Deeps	....	....	....	....	....	....	....	13,554·65	4,102·83	....
	3337, etc.	Easter Gift Leases	....	....	....	....	....	....	....	1,597·00	472·43	....
		Prior to transfer	....	....	....	....	....	....	48·03	3,594·26	1,169·82	....
	3400	Francis May	....	....	....	....	....	....	7·74	8,683·55	3,341·69	....
	3397	Goldfinch	....	....	....	....	....	....	6·73	6,488·03	2,643·99	....
	4287	Volcano	....	....	35·00	36·85	....	....	....	61·00	70·86	....
	3350	Rising Sun	....	....	....	....	....	....	2·30	37,059·53	10,837·80	....
		Voided leases	....	....	....	....	....	....	10·14	490,361·07	185,489·03	27,958·41
		Sundry claims	....	....	27·00	17·11	....	8·47	37·04	7,375·75	4,013·45	....
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	(Yellowdine Gold Areas, N.L.)	....	....	....	....	....	....	....	7,341·50	7,605·06	....
		Voided leases	....	....	....	....	....	....	179·49	2,308·56	2,131·13	....
		Sundry claims	....	....	23·00	9·90	....	2·50	73·97	2,446·60	1,718·94	....

Evanston	3868, etc.	Evanston Gold, N.L.	....	....	66·00	*140·79	....	....	....	12,399·20	5,530·12	....
		Prior to transfer	....	....	....	....	....	....	....	48,359·30	25,905·04	10·14
	3895	(Blue Peter)	....	....	....	....	....	....	....	1,288·00	285·84	....
	3997	Gravel Pit	....	....	....	....	....	....	79·27	238·80	160·25	....
		Voided leases	....	....	....	....	....	....	....	2,247·76	1,310·63	....
		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	30·58	....	....	....	159·00	240·07	....
	4247	Lily of the Valley	....	....	....	....	....	....	....	160·00	33·50	....
	2994, etc.	Radio Leases	....	....	830·00	840·94	20·37	....	2·70	25,135·80	46,375·37	628·44
		Voided leases	....	....	....	....	....	....	36·34	36,545·92	28,509·40	10·99
		Sundry claims	....	....	4·00	12·31	....	4·58	237·85	6,631·27	4,908·99	1·02
Greenmount	72PP	Black and White	....	....	65·00	5·68	....	....	....	105·00	10·36	....
		Voided leases	....	....	....	....	....	45·99	21·62	125,022·64	31,575·09	944·50
		Sundry claims	....	....	....	....	....	·46	4·27	3,048·58	809·31	....
Holleton	37PP	Brittania	....	....	310·00	285·23	....	....	....	1,466·00	1,404·25	....
		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	4324	Mount Hope	....	....	43·00	4·53	....	....	....	43·00	4·53	....
	3414	Pilot	....	....	....	....	....	....	....	19,446·12	2,948·68	....
		Voided leases	....	....	....	....	....	....	74·78	132,617·55	36,457·49	1·00
		Sundry claims	....	....	20·00	2·67	....	18·67	44·35	4,582·02	1,413·71	....
Kennyville	3875	Victoria	....	....	506·00	86·48	....	....	....	5,019·00	1,117·43	·63
		Voided leases	....	....	....	....	....	....	18·76	55,876·63	21,625·66	·59
		Sundry claims	....	....	87·00	13·68	....	....	5·06	8,585·50	2,298·31	....
Koolyanobbing	....	Voided leases	....	....	....	....	....	....	·99	1,768·05	972·77	....
		Sundry claims	....	....	....	....	....	·26	1·21	656·10	329·20	....
Marvel Loch	3987, etc.	Burbridge Gold Mines, N.L.	....	....	....	*24·86	....	....	....	185,172·00	15,191·81	....
	3987	(Grand National)	....	....	....	....	....	....	....	19,739·00	2,647·30	....
	4243	Christmas Gift	....	....	....	....	....	....	1·82	23·00	37·07	....
	3957	Comet	....	....	324·00	12·98	....	....	....	1,523·50	690·50	6·85
	13PP	Cricket	....	....	....	....	....	....	....	1,655·00	929·17	....
	4039	Cromwell	....	....	....	....	....	....	....	370·00	56·29	....
	3942, etc.	Edwards Reward Leases	....	....	4,150·00	1,796·14	....	....	....	42,517·50	19,570·04	....
	3942	(Edwards Reward)	....	....	....	....	....	....	....	2,080·00	2,016·32	....
	3943	Sunshine	....	....	....	....	....	....	....	3,866·00	2,384·79	....
	4034	Firelight	....	2·68	397·75	37·27	....	....	2·68	6,653·75	940·03	....
	4291	Four Threes	....	....	....	....	....	....	....	204·00	16·24	....
	3724	France's Firniss	....	....	855·25	255·55	....	....	....	11,643·75	5,093·03	....
	4254	Golden Cube	....	....	37·00	13·03	....	....	....	79·00	17·16	....
	3718	Kurrajong	....	....	....	....	....	....	....	9,221·00	3,271·73	....
	3914	May	....	....	....	....	....	....	....	145·00	45·86	....
	4230	May Queen	....	....	....	*7·44	....	....	....	276·00	40·48	....
	3970	Mountain Queen	....	....	....	....	....	....	....	1,201·00	451·85	....

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 1951.					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 GOLDFIELD—continued.												
Marvel Loch—*continued.*	3390, etc.	N.G.M., Ltd.	....	....	....	....	....	....	....	4,369·22	409·06	2·00
		Prior to transfer	....	....	....	....	....	....	....	2,675·00	459·60	....
	(4229)	Scorpio	....	....	345·00	19·32	....	....	....	723·00	54·88	....
	4068	Try Again	....	....	189·00	29·36	....	....	....	4,915·00	566·83	....
	4035	Undaunted	....	....	....	....	....	....	....	792·00	102·70	....
	4251	Union Jack	....	....	905·00	85·94	...	....	....	1,585·00	142·51	....
		Voided leases	....	....	....	....	....	....	1,494·77	641,145·76	186,602·91	2,466·10
		Sundry claims	....	....	159·75	37·33	....	11·35	230·20	34,887·11	13,136·16	·02
Mount Jackson		Voided leases	....	....	....	....	....	....	180·85	55,166·78	39,927·52	2,313·77
		Sundry claims	....	....	....	....	....	6·44	52·87	10,935·95	4,879·54	70·74
Mt. Palmer	M.L. 4	Yellowdine Gold Development Pty., Ltd. (in liquidation)	....	....	27·00	26·72	....	....	....	27·00	26·72	....
		Voided leases	....	....	....	....	....	....	....	306,408·40	158,486·81	....
		Sundry claims	....	....	....	....	....	1,643·48	18·19	450·25	387·14	....
Mt. Rankin	3555	No Trumps	....	....	....	....	....	....	....	5,562·37	853·06	....
		Voided leases	....	....	....	....	....	3·84	5·20	496·00	122·17	....
		Sundry claims	....	....	....	....	....	....	....	491·00	117·59	....
Parkers Range	(4191)	Centepede	....	....	12·00	13·56	....	....	17·85	1,065·50	601·28	....
	4174	Constance Una	....	....	190·00	291·64	....	....	....	829·50	1,849·20	·06
	(4332)	Despair	....	....	108·00	50·93	....	....	....	108·00	50·93	....
	4201	Scots Greys	....	....	76·50	38·76	....	....	....	562·50	134·92	....
		Voided leases	....	....	....	....	....	·42	248·90	60,111·35	29,730·12	26·40
		Sundry claims	....	....	64·75	27·02	....	6·59	303·93	11,635·55	5,109·35	·08
Southern Cross	4082	Day Dawn	....	....	....	....	....	....	....	86·00	9·16	....
	4018	Frasers	....	....	....	....	....	....	....	1,376·50	164·49	....
	3944	Nil Desperandum	....	....	....	....	....	....	....	1,533·00	216·77	....
	3444, etc.	Western Mining Corporation	....	....	....	....	....	....	....	568·00	92·63	....
		Prior to transfer	....	....	....	....	....	....	....	22,621·25	4,145·66	1·26
		Voided leases	....	....	....	....	....	4·89	261·35	454,906·68	215,351·50	364·41
		Sundry claims	....	....	10·00	1·44	....	95·90	647·22	8,173·66	2,624·65	....
Westonia	4326	Consols	....	....	414·00	277·96	....	....	....	414·00	277·96	....
	4252	Corio	....	....	92·00	35·10	....	....	....	320·00	148·40	9·80
		Voided leases	....	....	....	....	....	....	4·06	595,704·64	380,726·05	5,094·27
		Sundry claims	....	....	4·10	2·17	·25	9·51	64·96	4,159·76	2,715·96	·72

From Goldfield generally :—													
Sundry parcels treated at :—													
Butcher Bird Battery	....	....	....	....	....	....	....	....	....	....	....	*170·06	....
Centenary Cyanide Plant	....	....	....	....	....	....	....	....	....	....	....	*472·85	....
Copperhead Plant	....	....	....	....	....	....	....	....	....	....	....	*16,809·79	....
Holleton Cyanide Plant	....	....	....	....	....	....	*34·24	....	....	....	....	*733·92	48·05
Holleton, East, G.M.L. 4169	....	....	....	....	....	63·00	*43·98	....	....	....	223·00	79·92	·15
State Battery Marvel Loch	....	....	....	....	....	26·00	*174·66	....	....	....	26·00	*189·40	....
Howlett's Battery	....	....	....	....	....	....	....	....	....	....	110·00	*13,405·34	....
Invermay Battery	....	....	....	....	....	....	....	....	....	....	....	*608·49	3·57
Kurrajong Battery	....	....	....	....	....	....	....	....	....	....	....	*409·57	....
Pilot Cyanide Plant	....	....	....	....	....	....	....	....	....	....	30·00	*3,753·59	....
Queen Ann Battery	....	....	....	....	....	....	....	....	....	....	....	*169·05	....
Radio Deeps Cyanide Plant	....	....	....	....	....	....	....	....	....	....	....	*1,588·67	....
Scots Greys Cyanide Plant	....	....	....	....	....	....	*61·47	....	....	....	....	*382·37	....
Three Boys Cyanide Plant	....	....	....	....	....	....	*225·97	....	....	....	7·00	*3,314·35	....
Wesley Cyanide Plant	....	....	....	....	....	....	....	....	....	....	....	*1,251·05	....
B. Perani's Plant, L.T.T. 1170H	....	....	....	....	....	·20	4·36	....	....	....	38·20	*32·61	....
J. K. Dixon's Plant, L.T.T. 1203H	....	....	....	....	....	12·00	2·58	....	....	....	12·00	2·58	....
Various Works	....	....	....	....	....	....	....	....	....	....	181·28	*62,756·69	53·78
Reported by Banks and Gold Dealers	....	....	1·53	1·28	....	*55·97	....	315·91	71·73	....	....	*86·82	....
Totals	....	....	....	....	**1·53**	**3·96**	**10,501·30**	**5,174·50**	**20·62**	**2,184·24**	**4,540·69**	**3,805,151·75**	**1,705,794·80**	**40,052·49**

Dundas Goldfield.

Buldania	....	Voided leases	....	....	....	....	....	....	....	....	3·02	846·05	708·99	....
	....	Sundry claims	....	....	....	....	....	....	....	....	39·25	1,324·27	861·36	·72
Dundas	....	Voided leases	....	....	....	....	....	....	1·88	28·02	6,103·48	2,545·38	155·02
	....	Sundry claims	....	....	....	....	....	....	·76	413·85	2,071·75	1,097·94	18·32
Norseman	1596	Abbotshall	....	....	....	....	....	....	....	....	2,511·45	1,096·71	754·37
	1468	Bronzewing	....	....	....	22·50	3·43	1·60	....	33·89	4,035·75	2,518·87	154·78
	1422, 1468	Onkaparinga Leases	....	....	....	....	....	....	....	....	698·00	831·67	3·62
	1617	Caesar	....	....	....	....	....	....	....	....	54·00	42·72	....
	1288, etc.	Central Norseman Gold Corporation, N.L.	....	....	151,322·00	43,868·05	44,002·40	....	....	....	1,531,826·20	524,265·53	462,130·17
		Prior to transfer	....	....	....	....	....	....	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 Mine, N.L.)	....	....	....	....	....	....	....	567·50	516·08	54·61
	1721	Hopetoun	....	....	110·00	10·22	....	....	....	269·00	29·65	....
	1718	Iron Duke	....	....	101·75	48·24	....	....	....	396·50	131·17	....
	1835	Mount Barker	....	....	80·50	14·24	·87	....	....	91·50	16·95	1·09
	1719	Mt. Benson	....	....	....	....	....	....	....	11·50	2·94	....
	1315, etc.	Norseman Gold Mines, N.L.	....	....	....	....	....	....	....	964,099·00	240,900·95	353,206·54
		Prior to transfer	....	....	....	....	....	....	....	20,657·00	3,909·50	4,981·00
	1823	Sun	....	....	393·50	183·15	7·14	....	....	421·75	192·12	7·66
	1624	Valhalla	....	....	....	....	....	....	....	604·00	403·13	21·46
	(1838)	Venture	....	....	15·00	2·47	·28	....	....	15·00	2·47	·28
		Voided leases	....	....	....	....	....	14·27	10,567·26	897,770·97	591,713·96	37,099·28
		Sundry claims	....	....	125·25	48·01	·47	1,052·09	3,393·11	46,959·95	22,135·94	199·56

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 1951.					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.
DUNDAS GOLDFIELD—continued.												
Peninsula	....	Voided leases	....	....	....	....	....	....	24·29	9,603·39	6,102·61	12·20
		Sundry claims	....	....	....	....	....	....	....	217·25	119·32	·97
		Goldfield generally :—										
		Sundry parcels treated at :—										
		State Battery, Norseman	....	....	....	75·67	....	....	....	417·89	*25,189·59	1,051·13
		Princess Royal Cyanide Plant, L.T.T .1118H....	....	....	....	19·27	6·55	....	....	....	*84·13	24·31
		Princess Royal Cyanide Plant (L.T.T. 1022H)	....	....	....	....	....	....	....	47·00	*123·29	106·89
		Prior to transfer	....	....	....	....	....	....	....	....	*2,002·84	1,612·57
		H. B. Harris' Plant, L.T.T. 1221	....	....	10·50	1·22	·06	....	....	10·50	1·22	·06
		Various Works	....	....	....	....	....	....	54·52	703·14	*12,892·66	844·52
		Reported by Banks and Gold Dealers	....	....	....	....	....	1,181·77	48·76	47·50	18·62	·70
		Totals	....	....	**152,181·00**	**44,273·97**	**44,019·37**	**2,250·77**	**16,269·29**	**3,568,745·37**	**1,491,907·90**	**879,836·40**
Phillips River Goldfield.												
Hatter's Hill	274	Beulah	....	....	65·00	4·10	....	....	....	65·00	4·10	....
	269	Jimmy Bob	....	....	35·0	35·87	....	....	....	35·00	35·87	....
		Voided leases	....	....	....	....	....	....	4·38	1,499·55	1,182·75	....
		Sundry claims	....	....	....	....	....	74·91	21·69	5,225·60	2,720·90	26·09
Kundip	263	Hillsborough	....	....	....	....	....	....	....	258·00	59·09	18·59
		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 Goldfield generally :—										
		Sundry parcels treated at :—										
		Cordingup Copper Smelter L.T.T. 1079H	....	....	....	†4·29	1·65	....	....	....	†*46·08	8·89
		Cordingup Cyanide Plant	....	....	....	....	....	....	....	....	*909·37	4·36

		Floater Cyanide Works	....	....	....	....	....	....	....	12·00	*245·95	....
		Hatters Hill Cyanide Plant	....	....	....	*19·18	....	....	....	....	*361·37	....
		Kundip Cyanide Plant	....	....	....	....	....	....	....	15·00	15·25	....
		Various Works	....	....	....	....	....	....	....	....	*1,932·66	496·46
		Reported by Banks and Gold Dealers	....	....	....	....	....	164·69	12·14	....	4·76	....
		Totals	....	....	**100·00**	**63·44**	**1·65**	**607·11**	**818·28**	**130,485·53**	**103,285·53**	**16,020·14**

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	....	....	....	....	....	....	....	....	1,261·75	308·00	....
Northampton	....	Sundry leases and claims	....	....	....	....	172·22	....	....	....	....	1,084·65
Ongerup	....	Sundry claims	....	....	....	....	....	....	1·58	·33	1·74	....
	From State generally :—											
	Sundry parcels treated at :—											
	Fremantle Smelters, Ltd.	....	....	....	....	....	....	....	....	....	*1,879·08	1,109·06
	Miscellaneous voided leases and sundry claims	....	....	....	....	....	245·83	3·07	210·35	45·19	....
	Various Works	....	....	....	....	....	....	....	27·00	*7,130·67	30,412·67
	Sundry Specimens	....	....	....	....	....	4·24	56·85	....	....	....
	Reported by Banks and Gold Dealers	7·65	10·58	....	5·37	344·27	1,097·48	884·85	....	299·75	404·26
	Totals	**7·65**	**10·58**	....	**5·37**	**516·49**	**1,414·80**	**990·36**	**4,315·83**	**11,416·72**	**33,025·82**

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 1951.

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	....	....	....	....	....	....	....	44·72	74·20	....	·99	119·91	....
West Kimberley	....												
Pilbara	Marble Bar	7·88	....	7,377·80	5,353·71	5,361·59	2,670·60	92·26	95·57	16,994·10	8,965·70	9,153·53	2,670·60
	Nullagine	84·38	95·57	9,616·30	3,611·99	3,791·94	....						
West Pilbara	....	....	....	....	....	....	....	....	7·97	25·00	13·18	21·15	115·96
Ashburton	....	....	....	....	....	....	....	....	....	....	6·52	6·52	4,682·07
Gascoyne	....												
Peak Hill	....	....	....	....	....	....	....	....	....	460·00	270·59	270·59	....
East Murchison	Lawlers	7·56	48·09	505·00	273·81	329·46	·15	7·56	48·09	826·00	833·95	889·60	·15
	Wiluna	....	....	101·00	390·08	390·08	....						
	Black Range	....	....	220·00	170·06	170·06	....						
Murchison	Cue	14·67	5·42	37,124·75	51,681·08	51,701·17	18,845·46	44·62	5·81	406,360·75	63,368·18	63,418·61	19,091·49
	Meekatharra	15·89	·39	5,102·00	3,016·85	3,033·13	....						
	Day Dawn	13·73	....	935·25	562·30	576·03	25·90						
	Mt. Magnet	·33	....	28,898·75	8,107·95	8,108·28	220·13						
Yalgoo	....	....	....	....	....	....	....	·25	19·69	2,293·60	1,636·95	1,656·89	·43
Mt. Margaret	Mt. Morgans	16·62	5·59	523·00	550·04	572·25	....	25·70	8·55	83,411·25	24,193·49	24,227·74	2,928·82
	Mt. Malcolm	9·08	2·96	75,781·00	19,735·09	19,747·13	1,586·24						
	Mt. Margaret....	....	....	7,107·25	3,908·36	3,908·36	1,342·58						
North Coolgardie	Menzies	3·52	26·43	24,866·50	12,760·25	12,790·20	304·08	3·52	28·90	41,470·50	24,232·16	24,264·58	662·02
	Ularring	....	....	11,835·50	6,513·84	6,513·84	....						
	Niagara	....	·84	1,408·00	2,546·66	2,547·50	79·81						
	Yerrilla	....	1·63	3,360·50	2,411·41	2,413·04	278·13						
Broad Arrow	....	....	....	....	....	....	....	1·57	39·09	5,657·75	3,430·70	3,471·36	4·66
N.E. Coolgardie	Kanowna	1·24	5·41	891·25	334·09	340·74	....	1·24	5·41	913·25	338·78	345·43	....
	Kurnalpi	....	....	22·00	4·69	4·69	....						
East Coolgardie	East Coolgardie	37·22	46·05	1,702,800·95	444,456·01	444,539·28	113,178·43	44·62	46·05	1,703,035·45	444,538·04	444,628·71	113,178·43
	Bulong	7·40	....	234·50	82·03	89·43	....						
Coolgardie	Coolgardie	17·05	81·00	46,516·22	25,835·38	25,933·43	5,475·42	17·72	81·00	47,449·37	26,130·47	26,229·19	5,475·42
	Kunanalling	·67	....	933·15	295·09	295·76	....						
Yilgarn	....	....	....	....	....	....	....	1·53	3·96	10,501·30	5,174·50	51,179·99	20·62
Dundas	....	....	....	....	....	....	....	....	....	152,181·00	44,273·97	4,473·97	44,019·37
Phillips River	....	....	....	....	....	....	....	....	....	100·00	63·44	63·44	1·65
Outside Proclaimed Goldfields		....	....	....	....	....	....	7·65	10·58	....	5·37	23·60	516·49
		....	....	....	....	....	....	292·96	474·87	2,471,679·32	647,476·98	648,244·81	193,716·81

TABLE III.

Return showing total production reported to the Mines Department, and respective Districts and Goldfields from whence derived, to 31st December, 1951.

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	....	....	....	....	....	....	....	8,673·77	2,104·82	22,589·40	17,119·55	27,898·14	113·68
West Kimberley	....	....	....	....	....	....	....	1·30	24·68	1·00	2·49	28·47	5,350·65
Pilbara	Marble Bar	15,070·55	4,428·90	316,757·17	312,810·30	332,309·75	9,818·86	25,267·07	6,405·94	429,638·05	424,103·81	455,776·82	9,925·41
	Nullagine	10,196·52	1,977·04	112,870·88	111,293·51	123,467·07	106·55						
West Pilbara	....	....	....	....	....	....	....	6,312·90	363·89	24,660·96	24,192·96	30,869·75	1,574·87
Ashburton	....	....	....	....	....	....	....	9,261·27	479·40	6,678·75	2,709·92	12,450·59	23,689·58
Gascoyne	....	....	....	....	....	....	....	693·44	51·57	387·00	517·29	1,252·30	....
Peak Hill	....	....	....	....	....	....	....	3,374·41	5,300·33	622,704·43	296,756·50	305,431·24	2,361·42
East Murchison	Lawlers	6,904·30	2,343·19	2,010,662·92	822,271·55	831,519·04	26,290·27	8,761·77	22,112·36	12,612,151·83	3,644,848·00	3,675,722·13	59,065·68
	Wiluna	222·36	1,247·37	8,873,130·94	1,870,760·82	1,872,230·55	10,281·34						
	Black Range	1,635·11	18,521·80	1,728,357·97	951,815·63	971,972·54	22,494·07						
Murchison	Cue	5,063·64	8,424·29	5,577,079·99	1,222,343·06	1,235,830·99	217,693·20	25,144·56	57,842·72	11,530,147·98	4,619,524·86	4,702,512·14	396,108·12
	Meekatharra	14,308·81	17,645·56	2,266,486·21	1,296,195·25	1,328,149·62	5,042·31						
	Day Dawn	3,214·29	11,339·12	2,029,075·63	1,372,444·44	1,386,997·85	169,336·47						
	Mt. Magnet	2,557·82	20,433·75	1,657,506·15	728,542·11	751,533·68	4,136·14						
Yalgoo	....	....	....	....	....	....	....	1,785·46	3,201·31	440,530·28	262,670·03	267,656·80	1,500·61
Mt. Margaret	Mt. Morgans	3,420·61	9,349·31	1,209,891·71	714,796·91	727,566·83	5,781·64	11,229·72	33,161·90	9,964,228·54	4,594,304·06	4,638,695·68	231,562·50
	Mt. Malcolm	3,815·18	14,492·61	6,356,399·19	2,718,132·39	2,736,440·18	160,312·49						
	Mt. Margaret	3,993·93	9,319·98	2,497,937·64	1,161,374·76	1,174,688·67	65,469·37						
North Coolgardie	Menzies	1,636·68	6,540·09	1,501,115·94	1,204,845·14	1,213,021·91	31,269·65	4,790·64	18,872·98	3,084,764·84	2,235,526·57	2,259,190·19	44,485·73
	Ularring	129·39	6,738·48	391,342·85	360,560·75	367,428·62	6,109·07						
	Niagara	1,712·66	1,819·99	930,107·77	518,504·20	522,036·85	5,683·41						
	Yerilla	1,311·91	3,774·42	262,198·28	151,616·48	156,702·81	1,423·60						
Broad Arrow	....	....	....	....	....	....	....	21,944·65	27,076·87	1,312,259·30	718,309·54	767,331·06	5,283·32
N.E. Coolgardie	Kanowna	106,498·98	13,515·01	1,001,964·76	624,329·41	744,343·40	3,039·73	119,333·01	21,813·92	1,015,334·83	642,840·36	783,987·29	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	33,565·18	40,802·95	60,200,526·94	29,435,504·84	29,509,872·97	4,183,161·54	60,968·19	56,832·15	60,383,798·74	29,566,932·73	29,684,733·07	4,183,174·46
	Bulong	27,403·01	16,029·20	183,271·80	131,427·89	174,860·10	12·92						
Coolgardie	Coolgardie	16,884·48	16,097·17	2,582,404·14	1,337,573·97	1,370,555·62	15,073·35	18,380·82	21,727·76	2,943,453·49	1,589,570·50	1,629,679·08	15,824·74
	Kunanalling	1,496·34	5,630·59	361,049·35	251,996·53	259,123·46	751·39						
Yilgarn	....	....	....	....	....	....	....	2,184·24	4,540·69	3,805,151·75	1,705,794·80	1,712,519·73	40,052·49
Dundas	....	....	....	....	....	....	....	2,250·77	16,269·29	3,568,745·37	1,491,907·90	1,510,427·96	879,836·40
Phillips River	....	....	....	....	....	....	....	607·11	818·28	130,485·53	103,285·53	104,710·92	16,020·14
Outside Proclaimed Goldfields		....	....	....	....	....	....	1,414·80	990·36	4,315·83	11,416·72	13,821·88	33,025·82
		....	....	....	....	....	....	332,379·90	299,981·22	111,902,017·90	51,952,334·12	52,584,695·24	5,952,009·06

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, 1951; 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 1948	22,422·06	14,138·27	36,560·33	153,164·62	351,623·03	504,787·65
1948	....	438·32	438·32	1,864·05	4,630·05	6,494·10
1949	....	272·06	272·06	1,766·22	4,113·43	5,879·65
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
Total	22,422·06	16,088·94	38,511·00	159,996·27	370,343·03	530,339·30
		(*a*) West Pilbara.			**Ashburton.**	
Prior to 1948	4,351·11	26,760·61	31,111·72	4,104·96	6,120·06	10,225·02
1948	....	....	....	....	11·00	11·00
1949	....	....	....	....	60·46	60·46
1950	....	108·72	108·72	....	56·19	56·19
1951	....	13·12	13·12	....	5·75	5·75
Total	4,351·11	26,882·45	31,233·56	4,104·96	6,253·46	10,358·42
		(*b*) Gascoyne.			**(*c*) Peak Hill.**	
Prior to 1948	304·55	1,068·17	1,372·72	41,102·76	205,474·23	246,576·99
1948	....	....	....	....	847·41	847·41
1949	....	....	....	....	285·80	285·80
1950	....	....	....	....	398·30	398·30
1951	....	....	....	....	144·89	144·89
Total	304·55	1,068·17	1,372·72	41,102·76	207,150·63	248,253·39
		East Murchison.			**Murchison.**	
Prior to 1948	259,033·70	2,994,852·13	3,253,885·83	1,574,088·96	3,079,640·95	4,653,729·91
1948	5·33	16,546·16	16,551·49	726·92	99,099·78	99,826·70
1949	31·91	7,185·88	7,217·79	366·15	85,443·83	85,809·98
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
Total	259,190·83	3,022,012·07	3,281,202·90	1,576,335·92	3,400,194·82	4,976,530·74
		(*d*) Yalgoo.			**(*e*) Mt. Margaret.**	
Prior to 1948	13,618·20	192,706·32	206,324·52	693,359·61	3,687,493·27	4,380,852·88
1948	17·77	1,177·31	1,195·08	683·02	22,691·66	23,374·68
1949	....	682·09	682·09	297·27	28,609·32	28,906·59
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
Total	13,650·56	196,436·04	210,086·60	694,543·11	3,790,805·47	4,485,348·58
		(*f*) North Coolgardie.			**(*g*) Broad Arrow.**	
Prior to 1948	263,299·12	1,997,131·00	2,260,430·12	122,546·56	422,353·06	544,899·62
1948	62·57	5,140·50	5,167·07	24·26	3,569·00	3,593·26
1949	48·29	5,098·20	5,146·49	47·87	4,015·49	4,063·36
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
Total	263,439·24	2,023,806·83	2,287,246·07	122,626·97	436,563·13	559,190·10
		(*f*) North-East Coolgardie.			**(*f*) East Coolgardie.**	
Prior to 1948	235,888·01	458,110·64	693,998·65	7,024,731·00	22,491,957·15	29,516,688·15
1948	4·18	386·07	390·25	709·52	448,958·23	499,667·75
1949	1·50	96·02	97·52	792·52	445,291·23	446,083·75
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
Total	235,893·69	458,893·28	694,786·97	7,030,193·63	24,245,907·41	31,276,101·04
		(*h*) Coolgardie.			**Yilgarn.**	
Prior to 1948	662,977·57	1,198,027·40	1,861,004·97	219,638·12	1,516,851·36	1,736,489·48
1948	54·14	8,070·99	8,125·13	268·15	10,529·09	10,797·24
1949	118·73	13,355·55	13,474·28	172·67	6,563·75	6,736·42
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
Total	663,300·14	1,263,470·12	1,926,770·26	220,317·04	1,545,150·98	1,765,468·02
		(*i*) Dundas.			**(*j*) Phillips River.**	
Prior to 1948	169,989·58	1,265,758·27	1,435,747·85	40,606·91	62,768·16	103,285·07
1948	65·92	37,609·08	37,675·00	....	28·44	28·44
1949	257·69	42,540·32	42,798·01	3·21	34·56	37·77
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
Total	170,787·39	1,429,146·70	1,599,934·09	40,650·82	62,811·42	103,462·24
		¶ Donnybrook.			**Outside Proclaimed Goldfields.**	
Prior to 1948	282·21	557·53	839·74	22,174·93	37,711·34	59,886·27
1948	....	....	....	167·89	634·98	802·87
1949	....	....	....	269·11	604·49	873·60
1950	....	....	....	112·32	809·49	921·81
1951	....	....	....	44·87	656·24	701·11
Total	282·21	557·53	839·74	22,769·12	40,416·54	63,185·66

(*a*) Prior to 1st May, 1898, included with Pilbara, and from 12th July, 1929 to 16th 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. ¶ Abolished, 4th March, 1908.

TABLE V.

Total Output of Gold Bullion, Concentrates, etc., entered for Export and Received at the Perth Branch of the Royal Mint.

FROM 1st JANUARY, 1886.

Year.	Export.	Mint.	Total.	Estimated Value.
	Fine ozs.	Fine ozs.	Fine ozs.	£A.
1886	270·17	....	270·17	1,147
1887	4,359·37	....	4,359·37	18,518
1888	3,124·82	....	3,124·82	13,273
1889	13,859·52	....	13,859·52	58,871
1890	20,402·42	....	20,402·42	86,664
1891	27,116·14	....	27,116·14	115,182
1892	53,271·65	....	53,271·65	226,284
1893	99,202·50	....	99,202·50	421,385
1894	185,298·73	....	185,298·73	787,099
1895	207,110·20	....	207,110·20	879,749
1896	251,618·69	....	251,618·69	1,068,808
1897	603,846·44	....	603,846·44	2,564,977
1898	939,489·49	....	939,489·49	3,990,697
1899	1,283,360·25	187,244·41	1,470,604·66	6,246,732
1900	894,387·27	519,923·59	1,414,310·86	6,007,610
1901	923,686·96	779,729·56	1,703,416·52	7,235,654
1902	707,039·75	1,163,997·60	1,871,037·35	7,947,661
1903	833,685·78	1,231,115·62	2,064,801·40	8,770,719
1904	810,616·04	1,172,614·03	1,983,230·07	8,424,226
1905	655,098·88	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	651,338·35	5,558,873
1935	9,868·71	639,180·38	649,049·09	5,702,149
1936	55,024·58	791,183·21	846,207·79	5,373,539
1937	71,646·91	928,999·84	1,000,646·75	8,743,755
1938	113,620·06	1,054,171·13	1,167,791·19	10,363,023
1939	98,739·88	1,115,497·76	1,214,237·64	11,842,964
1940	71,680·47	1,119,801·08	1,191,481·55	12,696,503
1941	65,925·94	1,043,391·96	1,109,317·90	11,851,445
1942	15,676·48	832,503·97	848,180·45	8,865,495
1943	6,408·34	540,067·08	546,475·42	5,710,669
1944	1,824·99	464,439·76	466,264·75	4,899,997
1945	5,029·38	463,521·34	468,550·72	5,010,541
1946	6,090·14	610,873·52	616,963·66	6,640,069
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
Total	11,546,262·38	42,543,959·02	54,090,221·40	324,823,648

	1950. £A.	1951. £A.
Estimated total par value of above production	227,093,964	229,760,598
Premiums received on sales of gold during 1920–1924 and 1930–1950 (approximate)	88,004,341	95,063,050
Estimated Total	£A305,098,305	£A324,823,648
Gross estimated value of gold won (including £161,448, bonus paid under the Commonwealth Bounty Act, 1930)	£A315,259,753	£A324,985,096

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 1951, 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 1948	....	....	5,762·50	121,196	‡38,427·33	741,729	7,883·66	3,870·93	157,298
1948	....	....	1,778·30	49,430	214·00	4,494	....	....	....
1949	....	....	1,447·80	43,417	32·75	982	....	....	....
1950	1·50	9	84·45	1,822	....	....	....	....	....
1951	....	....	....	....	....	....	....	....	....
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. Goldfield. † By-product of Gold Mining. ‡ Includes 1·13 tons Arsenic valued at £24 from Yilgarn Goldfield.

Period.	Antimony.*						Asbestos.	
	Pilbara Goldfield.			Total.			Pilbara Goldfield.	
	Conc.	Metal.	Value.	Conc.	Metal.	Value.	Quantity.	Value.
	tons.	tons.	£	tons.	tons.	£	tons.	£
Prior to 1948	741·00	304·72	20,457	†8,650·89	4,189·21	178,355	1,227·41	56,013
1948	114·16	41·90	3,582	114·16	41·90	3,582	....	....
1949	21·68	9·49	954	21·68	9·49	954	....	....
1950	92·19	40·25	3,514	92·19	40·25	3,514	....	....
1951	....	....	....	....	....	....	109·50	1,861
Total	**969·03**	**396·36**	**28,507**	**8,878·92**	**4,280·85**	**186,405**	**1,236·91**	**57,874**

* By-product of Gold Mining. † Includes 26·23 tons Conc. containing 13·56 tons Metal valued at £600 from West Pilbara Goldfield.

Period.	Asbestos.						Barytes.	
	West Pilbara Goldfield.		Outside Proclaimed Goldfield.		Total.		North-East Coolgardie Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	4,680·46	172,183	216·86	2,560	*6,143·08	231,756	10·00	50
1948	678·61	33,588	284·24	4,173	962·85	37,761	....	....
1949	1,297·14	125,332	....	....	1,297·14	125,332	....	....
1950	1,230·15	152,677	....	....	1,230·15	152,677	....	....
1951	2,009·66	223,778	....	....	2,119·16	225,639	....	....
Total	**9,896·02**	**707,558**	**501·10**	**6,733**	**11,752·38**	**773,165**	**10·00**	**50**

* Includes 10·10 tons valued at £959 from Ashburton Goldfield and 8·25 tons valued at £41 from East Coolgardie Goldfield.

Period.	Barytes—*continued.*				Bentonite.		Beryl Ore.	
	Outside Proclaimed Goldfield.		Total.		Outside Proclaimed Goldfield.		Pilbara Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	....	....	10·00	50	754·38	1,886	818·30	24,358
1948	....	....	....	....	268·75	806	30·17	1,767
1949	....	....	....	....	150·00	450	....	....
1950	16·00	56	16·00	56	213·00	599	4·74	442
1951	5·00	18	5·00	18	449·00	1,347	65·18	7,973
Total	**21·00**	**74**	**31·00**	**124**	**1,835·13**	**5,088**	**918·39**	**34,540**

Table VI.—*Minerals other than Gold*—continued.

Period.	Beryl Ore—*continued.*							
	Murchison Goldfield.		Coolgardie Goldfield.		West Kimberley Goldfield.		Outside Proclaimed Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	24·53	928	76·79	2,477	....	....	86·37	2,544
1948	....	....	4·68	267	....	....	....	....
1949	....	....	....	....	3·50	297	16·95	1,200
1950	....	....	....	....	....	....	12·19	989
1951	....	....	16·14	2,291	....	....	9·45	910
Total	**24·53**	**928**	**97·61**	**5,035**	**3·50**	**297**	**124·96**	**5,643**

Period.	Beryl Ore—*continued.*		Bismuth.		Clays, (Cement, Pottery and Fireclay).			
	Total.		Outside Proclaimed Goldfield.		Collie Mineral Field.		Outside Proclaimed Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	lb.	£	tons.	£	tons.	£
Prior to 1948	1,005·99	30,307	5,506·40	1,800	1,050·80	738	17,722·25	11,871
1948	34·85	2,034	....	....	....	....	4,858·50	4,113
1949	20·45	1,497	....	....	....	....	10,047·00	11,813
1950	16·93	1,431	....	....	....	....	6,439·00	4,936
1951	90·77	11,174	187·00	84	....	....	47,547·00	20,668
Total	**1,168·99**	**46,443**	**5,693·40**	**1,884**	**1,050·80**	**738**	**86,613·75**	**53,401**

Period.	Clays (Cement, Pottery and Fireclay)—*continued.*		Coal.		Copper Ore.			
	Total.		Collie Coalfield.		Pilbara Goldfield.			
					Marble Bar District.		Nullagine District.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	18,773·05	12,609	19118027·89	13,936,863	32·87	386	14·00	480
1948	4,858·50	4,113	732,938·42	880,236	....	....	....	....
1949	10,047·00	11,813	750,594·06	972,245	....	....	....	....
1950	6,439·00	4,936	814,351·53	1,287,749	....	....	....	....
1951	47,547·00	20,668	848,474·86	1,716,788	5·80	77	7·50	....
Total	**87,664·55**	**54,139**	**22264386·76**	**18,793,881**	**38·67**	**463**	**21·50**	**480**

Period.	Copper Ore—*continued.*							
	Ashburton Goldfield.		Peak Hill Goldfield.		Mt. Margaret Goldfield.		Phillips River Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	353·07	6,431	1,043·35	32,632	47,860·52	230,846	95,831·64	589,040
1948	....	....	....	....	....	....	....	....
1949	1·30	13	8·19	498	....	....	40·00	119
1950	....	....	....	....	....	*107	48·00	76
1951	23·70	493	....	....	1·30	50	4·83	138
Total	**378·07**	**6,937**	**1,051·54**	**33,130**	**47,861·82**	**231,003**	**95,924·47**	**589,373**

* 2·54 tons Copper Matte.

Period.	Copper Ore—*continued.*		Cupreous Ore (Fertiliser).					
	Total.		West Pilbara Goldfield.		Peak Hill Goldfield.		Yalgoo Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	†253,674·80	1,749,108	....	....	*917·00	6,071	....	....
1948	....	....	....	....	258·65	2,204	....	....
1949	49·49	630	133·98	1,844	113·00	929	7·00	48
1950	48·00	183	821·40	6,160	93·90	2,304	....	....
1951	43·13	758	898·21	10,471	22·00	660	40·00	240
Total	**253,815·42**	**1,750,679**	**1,853·59**	**18,475**	**1,404·55**	**12,168**	**47·00**	**288**

† Includes 109·52 tons valued at £1,709 from West Kimberley Goldfield, 82,745·45 tons valued at £748,482 from West Pilbara Goldfield, 284·31 tons valued at £5,502 from East Murchison Goldfield, 1,042·02 tons valued at £11,290 from Murchison Goldfield, 82·35 tons valued at £811 from Yalgoo Goldfield, 24,026·25 tons valued at £119,497 from Northampton Mineral Field, 171·55 tons valued at £1,889 from Yandanooka Mineral Field, 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, 5·11 tons valued at £56 from Outside Proclaimed Goldfield. No production from 1948 to 1951 inclusive. * Includes 409 tons valued at £2,968 late reported for years 1944, 1945, 1946.

Table VI.—*Minerals other than Gold*—continued.

Period.	Cupreous Ore (Fertiliser)—*continued.* Total.		Diamonds. Pilbara Goldfield. (Nullagine District).		Diatomaceous Earth. Outside Proclaimed Goldfield.		Dolomite. Murchison Goldfield (Mt. Magnet District).	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	carats.	£	tons.	£	tons.	£
Prior to 1948	*917·00	6,071	....	24	90·00	860	418·80	2,072
1948	258·65	2,204	....	....	....	....	107·25	536
1949	253·98	2,821	....	....	540·00	950	49·50	247
1950	†969·85	8,867	....	....	....	....	319·85	1,268
1951	‡1,337·05	16,104	....	....	198·00	2,700	124·25	599
Total	**3,736·53**	**36,067**	....	**24**	**828·00**	**4,510**	**1,019·65**	**4,722**

* Includes 409 tons valued at £2,968 late reported for years 1944, 1945, 1946. † Includes 9·21 tons valued at £64, 38·37 tons valued at £133 and 6·97 tons valued at £206 from Mt. Margaret, Yilgarn and Phillips River Goldfields respectively. ‡ Includes 39·66 tons valued at £494, 268·93 tons valued at £3,079, 12·55 tons valued at £125 and 55·70 tons valued at £1,035 from Ashburton, East Murchison, Mt. Margaret and Phillips River Goldfields respectively.

Period.	Emeralds. Murchison Goldfield (Cue District).		Emery. Outside Proclaimed Goldfield.		Felspar. Coolgardie Goldfield.		Felspar. Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	carats (cut and rough).	£	tons.	£	tons.	£	tons.	£
Prior to 1948	18,373·00	1,609	13·00	130	36,524·30	91,662	*37,052·30	92,712
1948	....	....	....	....	1,011·00	3,538	1,011·00	3,538
1949	....	....	....	....	1,049·00	3,934	1,049·00	3,934
1950	....	....	....	....	1,421·00	5,329	1,421·00	5,329
1951	....	....	....	....	1,806·50	7,390	1,806·50	7,390
Total	**18,373·00**	**1,609**	**13·00**	**130**	**41,811·80**	**111,853**	**42,339·80**	**112,903**

* Includes 528·00 tons valued at £1,050 from Outside Proclaimed Goldfield.

Period.	Gadolinite. Pilbara Goldfield (Marble Bar District).		Glass Sand. Outside Proclaimed Goldfield.		Glauconite. Outside Proclaimed Goldfield.		Graphite. Outside Proclaimed Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	1·00	112	1,380·45	1,630	3,546·50	52,646	18·10	97
1948	....	....	516·90	644	319·00	7,975	....	....
1949	....	....	986·15	1,014	203·50	5,286	....	....
1950	....	....	5,132·25	3,566	323·50	8,735	....	....
1951	....	....	6,172·59	4,417	506·00	15,033	....	....
Total	**1·00**	**112**	**14,188·34**	**11,271**	**4,898·50**	**89,675**	**18·10**	**97**

Period.	Gypsum. Dundas Goldfield.		Gypsum. Yilgarn Goldfield.		Gypsum. Outside Proclaimed Goldfield.		Gypsum. Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	1,989·00	1,232	24,339·50	30,340	136,943·65	166,925	163,272·15	198,497
1948	....	....	15,870·00	24,527	9,651·50	10,646	25,521·50	35,173
1949	10·00	6	15,962·00	11,181	9,935·30	7,423	25,907·30	18,610
1950	....	....	20,446·00	14,372	10,389·40	7,570	30,835·40	21,942
1951	7·00	19	63,816·00	36,571	14,100·00	11,136	77,923·00	46,726
Total	**2,006·00**	**1,257**	**140,433·50**	**116,991**	**181,019·85**	**203,700**	**323,459·35**	**320,948**

Period.	Ilmenite Sand. Outside Proclaimed Goldfield.		Iron Ore (for Pig Iron). Outside Proclaimed Goldfield.		Iron Ore. West Kimberley Goldfield.		Jarosite. Phillips River Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	....	....	....	....	†58,064·35	37,048	9·54	37
1948	....	....	7,222·20	26,165	....	....	....	....
1949	71·95	255	12,524·13	66,296	....	....	....	....
1950	84·00	521	14,895·23	82,682	....	....	....	....
1951	....	....	*19,122·27	181,136	‡10,384·00	10,297	....	....
Total	**155·95**	**776**	**53,763·83**	**356,279**	**68,448·35**	**47,345**	**9·54**	**37**

* Includes 13,629·08 tons valued at £139,215 from Yilgarn Goldfield. † Includes 450 tons valued at £247, 100 tons valued at £300, 84·35 tons valued at £128 and 57,430 tons valued at £36,373 from East Coolgardie, West Pilbara, Yilgarn and Outside Proclaimed Goldfields respectively. ‡ Exported to New South Wales.

Table VI.—*Minerals other than Gold*—continued.

Period.	Kaolin.		Kyanite.		Calcite.		Lead Ore and Concentrates.	
	Outside Proclaimed Goldfield.		Outside Proclaimed Goldfield.		Mt. Margaret Goldfield.		Northampton Mineral Field.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	4,014·48	3,935	3,090·69	15,265	....	....	417,995·42	1,282,688
1948	146·00	292	1,125·00	6,516	....	....	1,345·19	92,492
1949	80·00	160	....	....	....	....	1,834·87	100,899
1950	....	....	....	....	5·00	25	1,035·05	66,389
1951	12·00	19	....	....	....	....	1,521·62	148,068
Total	4,252·48	4,406	4,215·69	21,781	5·00	25	423,732·15	1,690,536

Period.	Lead Ore and Concentrates—*continued.*		Magnesite.					
	Total.		East Coolgardie Goldfield. (Bulong District).		Coolgardie Goldfield.		Outside Proclaimed Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	*418,007·61	1,282,701	1,008·25	1,240	291·65	342	....	....
1948	1,345·19	92,492	....	....	466·75	1,691	495·07	1,485
1949	1,834·87	100,899	26·71	74	21·00	57	1,986·05	4,583
1950	1,035·05	66,389	....	....	40·00	175	1,788·70	3,650
1951	1,521·62	148,068	418·00	1,099	344·25	870	....	....
Total	423,744·34	1,690,549	1,452·96	2,413	1,163·65	3,135	4,269·82	9,718

* Includes 12·19 tons valued at £13 from Outside Proclaimed Goldfield.

Period.	Magnesite—*continued.*		Manganese Ore.		Mica.		Ochre.	
	Total.		Peak Hill Goldfield.		Outside Proclaimed Goldfield.		West Pilbara Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	lb.	£	tons.	£
Prior to 1948	1,299·90	1,582	76·74	436	†31,676·25	2,641	3,542·65	43,873
1948	961·82	3,176	*1,644·85	10,442	....	....	185·00	2,682
1949	2,033·76	4,714	9,420·31	56,289	‡1,253·75	1,343	15·60	225
1950	1,828·70	3,825	11,961·64	65,459	....	....	....	....
1951	762·25	1,969	5,256·52	33,789	....	....	15·60	234
Total	6,886·43	15,266	28,360·06	166,415	32,930·00	3,984	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. ‡ Includes 31·25 lb. Mica valued at £5 from West Kimberley Goldfield.

Period.	Ochre—*continued.*							
	Murchison Goldfield (Cue District).		Pilbara Goldfield.		Yalgoo Goldfield.		East Coolgardie Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	1,453·25	13,404	2·10	15	....	....	35·35	126
1948	381·37	4,109	....	....	....	....	....	....
1949	7·55	38	....	....	11·00	66	10·00	37
1950	186·00	1,860	....	....	....	....	....	....
1951	672·10	7,657	....	....	....	....	....	....
Total	2,700·27	27,068	2·10	15	11·00	66	45·35	163

Period.	Ochre—*continued.*				Petalite.		Phosphatic Guano.	
	North-East Coolgardie Goldfield.		Total.		Coolgardie Goldfield.		Outside Proclaimed Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	10·40	83	*5,079·75	57,609	....	....	10,799·73	59,174
1948	....	....	566·37	6,791	....	....	....	....
1949	....	....	44·15	366	5·19	52	....	....
1950	....	....	186·00	1,860	....	....	....	....
1951	....	....	687·70	7,891	....	....	....	....
Total	10·40	83	6,563·97	74,517	5·19	52	10,799·73	59,174

* Includes 36 tons valued at £108 from Outside Proclaimed Goldfield.

Table VI.—*Minerals other than Gold*—continued.

Period.	Pyrites.		Sillimanite.		Silver Lead Ore and Concentrates.			
	Dundas Goldfield.		Outside Proclaimed Goldfield.		Kimberley Goldfield.		Pilbara Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	*224,334·56	530,445	....	....	....	....	211·82	4,284
1948	37,499·00	164,203	2·00	13	4·07	196	....	....
1949	31,299·00	125,857	....	....	2·46	161	235·15	11,103
1950	35,213·00	163,514	....	....	....	....	445·22	21,859
1951	46,615·00	296,988	....	....	....	....	301·72	25,692
Total	**374,960·56**	**1,281,007**	**2·00**	**13**	**6·53**	**357**	**1,193·91**	**62,938**

* Includes 74,047·56 tons valued at £45,496 from Mt. Margaret Goldfield.

Period.	Silver Lead Ore and Concentrates—*continued.*							
	West Pilbara Goldfield.		Ashburton Goldfield.		Peak Hill Goldfield.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	106·57	1,529	2,973·78	37,905	....	....	3,292·17	43,718
1948	2·07	62	126·76	6,969	....	....	132·90	7,227
1949	15·32	453	719·92	35,926	5·50	285	978·35	47,928
1950	2·24	75	345·62	21,743	....	....	793·08	43,677
1951	18·14	2,289	648·16	61,559	....	....	968·02	89,540
Total	**144·34**	**4,408**	**4,814·24**	**164,102**	**5·50**	**285**	**6,164·52**	**232,090**

Period.	Silver Lead Zinc Ore and Concentrates.						Soapstone.	
	West Kimberley Goldfield.		Northampton Mineral Field.		Total.		Outside Proclaimed Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	....	....	....	....	....	....	527·00	1,803
1948	713·46	13,599	....	....	713·46	13,599	....	....
1949	33·38	1,456	75·53	2,710	108·91	4,166	....	....
1950	7·83	206	29·83	1,376	37·66	1,582	....	....
1951	49·03	2,568	....	....	49·03	2,568	38·40	125
Total	**803·70**	**17,829**	**105·36**	**4,086**	**909·06**	**21,915**	**565·40**	**1,928**

Period.	Talc.						Tantalite.	
	East Coolgardie Goldfield.		Outside Proclaimed Goldfield.		Total.		Pilbara Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	712·96	2,539	....	....	712·96	2,539	265·07	130,672
1948	72·00	732	....	....	72·00	732	....	....
1949	....	....	181·00	2,375	181·00	2,375	....	....
1950	56·00	210	200·00	2,490	256·00	2,700	....	....
1951	54·70	232	596·47	7,431	651·17	7,663	....	....
Total	**895·66**	**3,713**	**977·47**	**12,296**	**1,873·13**	**16,009**	**265·07**	**130,672**

Period.	Tantalite—*continued.*				Tantalo/Columbite Ore and Concentrates.‡			
	Greenbushes Mineral Field.		Total.		Pilbara Goldfield.		Greenbushes Mineral Field.	
	Quantity.	Value.	Quantity.*	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	11·51	9,079	†279·39	142,260	....	....	....	....
1948	3·78	973	3·78	973	·53	166	....	....
1949	....	....	....	....	....	....	1·16	286
1950	....	....	....	....	2·29	749	4·41	2,109
1951	....	....	....	....	....	....	2·06	2,350
Total	**15·29**	**10,052**	**283·17**	**143,233**	**2·82**	**915**	**7·63**	**4,745**

* Sold on Ta_2O_5 content only with no record maintained of Nb_2O_5 content. † Includes 2·81 tons valued at £2,509 from Coolgardie Goldfield.

‡ Sold on combined unit content of Ta_2O_5 + Nb_2O_5 from 1948.

Table VI.—*Minerals other than Gold*—continued.

Period.	‡ Tantalo/Columbite Ore and Concentrates.		Tin.					
	Total.		Pilbara Goldfield.		Greenbushes Mineral Field.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	....	....	5,967·82	560,953	11,377·77	1,007,042	*17,352·05	1,568,662
1948	·53	166	34·99	12,389	2·00	596	36·99	12,985
1949	1·16	286	31·52	11,980	3·14	1,099	34·66	13,079
1950	6·70	2,858	21·07	8,477	30·34	17,019	51·41	25,496
1951	2·06	2,350	38·31	21,389	22·44	17,854	†61·10	39,493
Total	**10·45**	**5,660**	**6,093·71**	**615,188**	**11,435·69**	**1,043,610**	**17,536·21**	**1,659,715**

* Includes ·60 tons valued at £143, 4·72 tons valued at £360 and ·15 tons valued at £15 from Kimberley, Murchison and Coolgardie Goldfields respectively. Also includes ·60 tons valued at £46 and ·39 tons valued at £103 from Yilgarn and East Murchison Goldfields respectively.

† Includes ·03 tons valued at £18, ·17 tons valued at £117 and ·15 tons valued at £115 from West Pilbara, Kimberley and West Kimberley Goldfields respectively.

‡ Sold on combined unit content of Ta_2O_5 + Nb_2O_5 from 1948.

Period.	Tungsten (Scheelite).					
	Coolgardie Goldfield.		Yilgarn Goldfield.		Total.	
	Concentrates.	Value.	Concentrates.	Value.	Concentrates.	Value.
	tons.	£	tons.	£	tons.	£
Prior to 1948	20·34	4,823	99·88	35,370	*130·91	42,526
1948	·41	196	6·86	3,717	7·27	3,913
1948	·58	219	....	....	·58	219
1950	....	....	....	....	....	....
1951	·10	165	....	....	†·14	215
Total	**21·43**	**5,403**	**106·74**	**39,087**	**138·90**	**46,873**

* Includes ·16 tons valued at £59, 2·99 tons valued at £1,050, 1·01 tons valued at £175, 6·45 tons valued at £1,030 and ·08 tons valued at £19 from Murchison, Yalgoo, Broad Arrow, North Coolgardie and Dundas Goldfields respectively.

† Includes ·04 tons valued at £50 from Mt. Margaret Goldfield.

Period.	Tungsten (Wolfram).					
	Pilbara Goldfield.		Murchison Goldfield.		Total.	
	Ore and Concentrates.	Value.	Ore and Concentrates.	Value.	Ore and Concentrates.	Value.
	tons.	£	tons.	£	tons.	£
Prior to 1948	....	....	238·64	1,148	*268·12	1,682
1948	....	....	....	....	....	....
1949	....	....	....	....	....	....
1950	....	....	....	....	....	....
1951	3·69	7,392	1·23	2,193	4·92	9,585
Total	**3·69**	**7,392**	**239·87**	**3,341**	**273·04**	**11,267**

* Includes 28·48 tons valued at £331, ·72 tons valued at £115 and ·28 tons valued at £88 from West Kimberley, Yalgoo and Broad Arrow Goldfields respectively.

Period.	Vermiculite.						Zinc Ore (Fertiliser).	
	East Coolgardie Goldfield. (Bulong District).		Outside Proclaimed Goldfield.		Total.		Pilbara Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£	tons.	£	tons.	£
Prior to 1948	97·90	689	1,190·55	7,209	†1,308·45	7,958	....	....
1948	*5·00	*28	91·00	546	*96·00	*574	....	....
1949	23·22	155	138·75	832	161·97	987	....	....
1950	....	....	120·00	720	120·00	720	....	....
1951	....	....	54·50	491	54·50	491	10·70	50
Total	**126·12**	**872**	**1,594·80**	**9,798**	**1,740·92**	**10,730**	**10·70**	**50**

* Adjusted figures. † Includes 20 tons valued at £60 from Yilgarn Goldfield.

TABLE VII.

Quantity and Value of Minerals, other than Gold, reported during year 1951.

Number of Lease, Claim, or Area.	Goldfield or Mineral Field.	Registered Name of Producer.	Quantity.	Metallic. Content.	Value.
		ASBESTOS (Chrysotile).	tons.		£A.
Temp. Res. 1305H	Pilbara	Hancock, L. G.	109·50	....	1,186·50
M.C.'s 48, 68	West Pilbara	Hancock, L. G.	617·05	....	27,439·87
		ASBESTOS (Crocidolite).			
M.C.'s 54, etc.	West Pilbara	Australian Blue Asbestos, Ltd.	1,392·61	....	196,338·01
			2,119·16	....	*b* 225,639·38
		BARYTES.			
P.A. 929H (Cranbrook)	O.P.G.	Mitchell & Kleeman	5·00	....	(*a*) 17·50
		BENTONITE.			
M.C.'s 282H, 397H (Marchagee)	O.P.G.	Fennel, W. G.	148·00	....	518·00
M.L.'s 437H, etc. (Marchagee)	O.P.G.	Noonan, E. J.	301·00	....	829·25
			449·00	....	(*a*) 1,347·25
		BERYL (*e*) (*f*).		BeO Long Ton Units.	
M.C. 234	Pilbara	Otway, R. H.	1·18	12·95	170·00
Crown Lands	Pilbara	Watkins, D.	44·75	521·62	5,593·15
		Houghton & Coffin	6·36	81·51	662·25
		Ah Yick, J.	2·79	36·89	281·75
		McAlpine, J.	4·10	50·06	406·70
		Gilbert, J.	1·03	10·13	133·00
		William, V.	4·97	55·33	726·20
M.C. 9	Coolgardie	Giles, A. S.	1·12	15·45	118·00
M.C. 12	Coolgardie	Giles, A. S.	2·05	22·59	172·55
M.L. 80	Coolgardie	Australian Glass Manufacturers Pty., Ltd.	12·97	162·15	2,000·55
P.A. 891H (Yinnietharra)	O.P.G.	Symonds, H.	·55	6·60	81·40
Crown Lands	O.P.G.	Burt, G. H.	8·90	114·84	828·65
			90·77	1,090·12	(*b*) 11,174·20
		BISMUTH (*f*).	lb.	Bi. lb.	
Crown Lands	O.P.G.	Burt, G. H.	187·00	127·91	(*b*) 84·20
		CLAY (Fireclay).	tons.		
M.C.'s 304H, etc. (Clackline)	O.P.G.	Clackline Refractories, Ltd.	6,047·00	....	3,888·00
Private Property (Glen Forrest)	O.P.G.	Darling Range Firebrick Co. Pty., Ltd.	2,087·00	....	1,882·00
			8,134·00	....	5,770·00
		CLAY (Pottery Clay).			
M.C. 109H (Goomalling)	O.P.G.	H. L. Brisbane & Wunderlich, Ltd.	1,100·00	....	3,300·00
		CLAY (Cement Clay).			
Private Property (Maida Vale)	O.P.G.	Swan Portland Cement, Ltd.	(*j*) 38,313·00	....	11,598·06
			47,547·00	....	(*c*) 20,668·06

Table VII.—*Minerals other than Gold*—continued.

Quantity and Value of Minerals, other than Gold reported during year 1951.

Number of Lease, Claim or Area.	Goldfield or Mineral Field.	Registered Name of Producer.	Quantity.	Metallic Content.	Value.
		COAL.	tons.		£A.
M.L.'s 250, etc.	Collie	Amalgamated Collieries of W.A., Ltd.—			
		Co-operative Mine	80,542·80	....	166,962·88
		Proprietary Mine	82,427·04	....	169,290·83
		Cardiff Mine	95,441·20	....	201,539·35
		Stockton Mine	76,712·24	....	159,260·84
		Stockton Open Cut	193,130·49	....	401,732·40
		Black Diamond Open Cut	86,100·45	....	180,770·70
M.L.'s 314, etc.	Collie	Griffin Coal Mining Co., Ltd.—			
		Griffin Mine	56,088·92	....	112,144·05
		Wyvern Mine	71,519·01	....	141,197·55
		Phoenix Mine	6,804·82	....	13,794·23
		Centaur Mine	10,608·89	....	22,999·33
Temp. Res. 1235H	Collie	Western Collieries, Ltd.—			
		Collie Burn Open Cut	89,099·00	....	147,096·00
			848,474·86	.... (*d*)	1,716,788·16
		COPPER (*e*) (*f*).	Concentrates. tons.	Copper. tons.	
M.C. 232	Pilbara	Rogers, D. C.	5·80	·92	77·50
P.A. 687L	Pilbara	Heath, A. G. H.	7·50	·40	....
P.A. 263	Ashburton	Maloney & Simmonds	3·65	1·54	229·85
P.A. 264, 265	Ashburton	Iverson, A. E.	20·05	2·54	263·00
P.A. 1599F	Mt. Margaret	Philiphoff, M.	(*g*) 1·30	·33	50·00
L.T.T. 1079H	Phillips River	Wehr Bros.	(*g*) 4·83	1·09	138·00
			43·13	6·82	(*b*) 758·35
		COPPER FERTILISER.	Ore and Concentrates. tons.	Average Assay. % Cu.	
P.A. 219	West Pilbara	Lee, T.	302·30	13·58	4,556·52
Freehold Property	West Pilbara	Walters, I.	595·91	8·64	5,914·39
M.L. 148	Ashburton	Brindal, A. E.	30·00	10·65	319·67
P.A. 264	Ashburton	Iverson, A. E.	9·66	13·49	174·25
M.C. 34P	Peak Hill	White, A. F.	22·00	25·00	660·00
P.A. 1424	East Murchison	Rooney & Hinde	31·01	9·89	307·78
P.A. 1426	East Murchison	Alac, M.	128·95	11·86	1,775·89
P.A. 1427	East Murchison	A. Poletti & Party	90·97	8·43	843·83
P.A. 1438	East Murchison	Howarth, C. A.	18·00	7·67	151·96
M.C. 7	Yalgoo	Twin Peaks Copper Industries, Ltd.	40·00	3·40	240·00
P.A. 1599F	Mt. Margaret	Philiphoff, M.	12·55	9·92	124·60
P.A. 760	Phillips River	O'Dea, J.	(*g*) 7·50	24·00	230·00
L.T.T. 1079H	Phillips River	Wehr Bros.	48·20	8·42	805·40
			1,337·05	9·95	*ab* 16,104·29
		DIATOMACEOUS EARTH.	(Air Dried.)	Calcined Material tons.	
M.C. 241H (Lake Gnangara)	O.P.G.	H. L. Brisbane & Wunderlich, Ltd.	198·00	132·00	(*c*) 2,700·00
		DOLOMITE.	tons.	Content.	£A.
M.L. 9M	Murchison	Atkinson & Giles	124·25	....	(*a*) 699·00
		FELSPAR.			
M.L.'s 80, etc.	Coolgardie	Australian Glass Manufacturers Co. Pty., Ltd.	1,806·50	....	(*b*) 7,389·58
		GLASS SAND.			
M.C.'s 417H, 418H (Lake Gnangara)	O.P.G.	Australian Glass Manufacturers Co. Pty., Ltd.	5,531·94	....	3,477·73
M.C. 365H (Lake Gnangara)	O.P.G.	Leach, R. J.	500·65	....	750·90
M.C.'s 161, etc., (Lake Gnangara)	O.P.G.	Leach, W. M.	140·00	....	188·00
			6,172·59	....	(*c*) 4,416·63

Table VII.—*Minerals other than Gold*—continued.

Quantity and Value of Minerals, other than Gold, reported during the year 1951.

Number of Lease, Claim or Area.	Goldfield or Mineral Field.	Registered Name of Producer.	Quantity.	Metallic Content.	Value.
		GLAUCONITE.			£A.
			Greensand treated. tons.	Glauconite recovered. tons.	
Private Property (Gingin)	O.P.G.	Brook, G. E.	3,036·00	506·00	(*b*)15,033·00
		GYPSUM.	tons.		
M.C.'s 30, etc.	Yilgarn	Ajax Plaster Co.	6,533·00	....	5,084·30
M.C.'s 9, etc.	Yilgarn	Perth Modelling Works, Ltd.	13,743·00	....	9,717·65
M.L.'s 38, etc.	Yilgarn	Australian Plaster Industries, Ltd.	43,540·00	....	21,769·50
M.C. 12	Dundas	McDonald & Whitfield	7·00	....	19·00
M.C.'s 280H, etc. (Lake Brown)	O.P.G.	H. B. Brady & Co. and Saunders (Jnr.)	8,229·55	....	6,172·15
M.C.'s 395H, etc. (Lake Brown)	O.P.G.	A. H. JOSE & Co.	20·00	....	25·00
M.C.'s 31H, etc. (Baandee)	O.P.G.	Millars Timber & Trading Co.	929·00	....	1,153·50
M.C.'s 126H, etc. (Baandee)	O.P.G.	Perth Modelling Works, Ltd.	4,070·00	....	2,238·50
M.C. 293H (Woolundra)	O.P.G.	Ripper, P.	670·55	....	446·95
M.L. 52PP (Hines Hill)	O.P.G.	Fienler, K. J.	180·90	....	99·50
			77,923·00	....	*a c*46,726·05

Plaster of Paris reported as manufactured during the year being 44,089·75 tons (including 21,044 tons exported Inter-State) from 75,883·00 tons of Gypsum by five Factories.

		IRON ORE (for Pig Iron).			
			Iron Ore. tons.	Pig Iron recovered. tons.	
	Yilgarn	The Charcoal Iron & Steel Industry	13,629·08	8,312·95	139,214·89
Crown Lands (Wundowie)	O.P.G.	The Charcoal Iron & Steel Industry	5,493·19	2,701·41	41,920·76
			19,122·27	11,014·36	*c* 181,135·65
		IRON ORE. (*f*)			
			Iron Ore exported.	Assayed Iron. Content.	
M.L.'s 10, etc.	West Kimberley	Australian Iron & Steel, Ltd.	10,384·00	6,500·38	(*b*)10,297·00
		KAOLIN.			
Private Property (Nyaania)	O.P.G.	Le Vaux, C. W.	12·00	....	(*a*) 19·00

LEAD ORES AND CONCENTRATES.

See foot of Table.

		MAGNESITE.			
M.C. 10Y	East Coolgardie	The Broken Hill Pty. Co., Ltd.....	418·00	....	1,099·00
M.L.'s 87, etc.	Coolgardie	Scahill & Gibbons	344·25	....	870·07
			762·25	....	(*a*) 1,969·07
		MANGANESE. (*f*)			
				Average Assay % Mn.	
M.C.'s 28P, etc.	Peak Hill	The Broken Hill Pty. Co., Ltd.	2,166·00	51·76	14,620·00
M.C.'s 24P, etc.	Peak Hill	Westralian Ores Pty., Ltd.	3,090·52	45·96	19,168·90
			5,256·52	48·36	(*b*)33,788·90
		OCHRE (Red).			
M.L. 239	West Pilbara....	Smith, R. J.	15·60	....	234·00
M.C.'s 26, etc.	Murchison	Murchison Minerals (1951)	572·10	....	6,507·00
M.C. 27	Murchison	Cassidy, J. E.	40·00	....	310·00
			627·70	....	(*a*) 7,051·00

Table VII.—*Minerals other than Gold*—continued.

Quantity and Value of Minerals, other than Gold, reported during year 1951.

Number of Lease, Claim, or Area.	Goldfield or Mineral Field.	Registered Name of Producer.	Quantity.	Metallic Content.	Value.
		OCHRE (Yellow).	tons.		£A.
M.C. 30	Murchison	Zadow & Ball	60·00	....	840·00
			687·70	....	(*a*) 7,891·00
		PYRITES ORE AND CONCENTRATES.		Sulphur recovered. tons.	
G.M.L.'s 1460, etc.	Dundas	Norseman G.M.'s, N.L.	46,615·00	19,820·27	*a*296,988·00
		SILVER.	Fine ozs.		
	By-product from	Gold Mining	188,941·85	....	77,095·89
	„ „	Lead Mining	172·22	....	....
	„ „	Silver/Lead Mining	7,164·22	....	2,023·30
	„ „	Silver/Lead/Zinc Mining	348·63	....	62·20
	„ „	Copper Mining	116·40	....	40·96
			196,743·32	....	79,222·35
		SOAP STONE.	tons.		
P.A. 428H (Bridgetown)	O.P.G.	Mabey & Pearce	38·40	....	(*a*) 124·85
		TALC.			
M.C. 14E.	East Coolgardie	Bean, H.	54·70	....	(*c*) 232·55
Private Property (Three Springs)	O.P.G.	Universal Milling Co., Ltd.	596·47	....	(*a*) 7,430·85
			651·17	....	*a c* 7,663·40
		TANTALITE (TANTALO/COLUMBITE). (*e*) (*i*)	Ore and Concentrates. tons.	Combined Ta_2O_5 + Nb_2O_5. Units.	
M.C.'s 58, etc.	Greenbushes	Spring Valley Tin, Ltd.	(*h*) 2·06	200·04	(*b*) 2,350·00
		TIN. (*e*)			
M.C.'s 58, etc.	Greenbushes	Spring Valley Tin, Ltd.	(*h*) 22·18	....	17,712·00
Sundry Claims	Greenbushes	Sundry Persons	·26	....	142·40
D.C.'s 25, etc.	Pilbara	Johnston, J. A.	26·24	....	14,249·05
M.L.'s 313, 362	Pilbara	Crawford Bros.	·66	....	276·00
Crown Lands	Pilbara	Sundry Persons	11·41	....	6,863·75
Crown Lands	West Pilbara	Sundry Persons	·03	....	18·35
Crown Lands	Kimberley	Bolton & Sherwood	·17	....	116·87
Crown Lands	West Kimberley	Stuart, J. A.	·15	....	115·00
			61·10	....	(*b*)39,493·42
		TUNGSTEN (Scheelite). (*e*) (*f*).	lb.	WO_3 Content. lb.	
P.A. 2548T	Mt. Margaret	Hutchinson & Chase	84·00	42·32	50·70
M.L. 106	Coolgardie	Kent, W.	233·00	151·45	164·00
			317·00	193·77	(*b*) 214·70
		TUNGSTEN (Wolfram). (*e*) (*f*).			
M.C.'s 26L, etc.	Pilbara	McLeod, D. W.	985·00	677·68	903·00
Crown Lands	Pilbara	Thompson, J. E.	358·00	210·23	276·00
Crown Lands	Pilbara	McLeod, D. W.	6,936·00	4,778·89	6,213·00
M.C.'s 37, 38, 39	Murchison	Western Minerals Syndicate	2,759·00	1,636·00	2,193·00
			11,038·00	7,302·80	(*b*) 9,585·00

Table VII.—*Minerals other than Gold*—continued.

Quantity and Value of Minerals, other than Gold, reported during year 1951.

Number of Lease, Claim or Area.	Goldfield or Mineral Field.	Registered Name of Producer.	Quantity	Metallic Content	Value.
		VERMICULITE.	tons.		£A.
M.C. 187H	O.P.G.	Perth Modelling Works, Ltd.	54·50	....	(c) 490·50
		Yearly Disposals—(Perth Modelling Works, Ltd.). Local exfoliation 76·00 tons. producing 60·25 tons of "Gold Flake." Crushed and sized Ore exported from State 21·00 tons.			
		ZINC ORE (Fertiliser).			
M.C. 232	Pilbara	Rogers, D. C.	10·70	Zinc Assay. 11·70%	(b) 50·00

LEAD ORE AND CONCENTRATES. (e) (f).

				Lead.		Silver.		Zinc.	
			tons.	tons.	Value. £A.	Fine ozs.	Value. £A.	tons.	Value £A.
Loc. 833	Northampton	Protheroe Mine	278.08	278.79	b 25,181.65	24.82	....	2.02	....
Loc. 833	Northampton	Anglo-Westralian Mining Pty., Ltd.	783.77	640.70	85,979.55	....	....	....	....
M.L. 31PP, etc.	do.	Northampton Mining & Development Co. Pty., Ltd.	74.70	50.57	6,698.55	52.10	....	....	....
Vic. Loc. 436	do.	Wheel of Fortune Extended	133.54	94.41	13,886.55	....	....	....	....
M.L. 222	do.	Geraldine, North	52.29	35.54	4,946.25	37.28	....	....	....
Loc. 1	do.	Geraldine Mine	6.00	4.05	632.00	....	....	....	....
M.L. 234	do.	Mary Springs	17.56	13.58	2,097.65	6.48	....	....	....
Loc. 334	do.	Wheal Fortune	14.83	10.20	1,277.75	12.33	....	....	....
Loc. 437	do.	Simpson & Hyde	2.73	1.85	255.80	....	....	....	....
M.L. 235	do.	Victory	16.57	11.59	1,454.65	12.48	....	....	....
M.L. 237	do.	Dingo	13.18	8.93	1,094.25	....	....	....	....
M.L. 227	do.	Gabalong Asbestos Co.	9.41	5.75	776.20	....	....	....	....
M.C. 6	do.	Normans Well Syndicate	29.96	19.88	2,736.60	16.73	....	....	....
Loc. 832	do.	Isseka Mining Pty., Ltd.	4.64	2.83	382.85	....	....	....	....
P.A. 244	do.	Woodcock & Party	.74	.48	58.55	....	....	....	....
P.A. 245	do.	Cotic, A. J.	5.79	3.42	458.35	....	....	....	....
Sundry Claims	do.	Sundry Persons	1.83	1.23	150.85	....	....	....	....
			1,521.62	1,185.80	148,068.05	162.22	*	2.02	*

SILVER LEAD ORE AND CONCENTRATES (e) (f).

M.C. 189	Pilbara	Moore, R. O.	292.11	206.39	b24,856.15	2,315.51	624.20	....	....
M.C. 206	do.	Stubbs, S. H.	4.41	3.18	392.60	23.15	5.80	....	....
P.A. 2336	do.	Engstrom O.	5.20	3.64	443.55	27.61	6.80	....	....
M.C. 73	West Pilbara	Leevers & Horn	18.14	12.95	2,288.75	115.88	36.15	....	....
M.L. 122	Ashburton	Gift	393.09	308.46	40,085.75	2,755.03	819.40	....	....
M.L. 118	do.	Bilrose	41.27	29.91	3,740.10	380.70	109.95	....	....
M.L. 140	do.	Beadon	23.08	16.02	2,136.40	109.71	27.35	....	....
M.L. 126	do.	Ridge	10.10	7.81	993.65	50.29	10.75	....	....
M.L. 135	do.	June Audrey	70.51	52.84	7,112.85	571.16	156.25	....	....
M.L. 120	do.	Kooline Queen	14.28	10.16	1,367.10	104.89	27.20	....	....
M.L. 119	do.	Bandy's Peak	9.41	7.27	924.80	46.86	10.00	....	....
M.L. 121	do.	South Kooline	6.01	4.19	514.75	39.06	9.30	....	....
M.L. 136	do.	Big Chief	11.87	4.45	392.15	9.96	....	....	....
M.L. 116, etc.	do.	Ashburton Mining & Minerals Pty., Ltd.	14.44	11.10	1,414.15	15.25	....	....	....
M.C. 2	do.	Ibbotson, R.	42.21	17.17	1,675.40	534.07	163.50	....	....
M.C. 5, etc....	do.	Aerial Mines Pty., Ltd.	1.98	1.29	158.30	5.17	.45	....	....
P.A. 262	do.	Illingsworth, J.	7.09	5.68	735.20	40.14	10.20	....	....
P.A. 230	do.	Joy & Brennan	1.37	1.00	124.60	10.41	3.00	....	....
P.A. 276	do.	James, A.	1.45	1.02	184.00	9.37	3.00	....	....
			968.02	704.53	89,540.25	7,164.22	2,023.30	*	*

* Not payable.

Table VI.—*continued.*

Quantity and Value of Minerals, other than Gold, reported during year 1951.

Number of Lease Claim or Area.	Goldfield or Mineral Field.	Registered Name of Producer.	Quantity.	Metallic Content.				Value.	
				Lead.		Silver.		Zinc.	
			Tons.	Tons.	Value £A.	Fine ozs.	Value £A.	Tons.	Value £A.
SILVER LEAD ZINC ORE AND CONCENTRATES (*e*) (*f*).									
M.C. 29	West Kimberley	Devonian Pty., Ltd.	49.03	22.07	*b* 2,567.75	348.63	62.20	6.95	*

* Not payable.

TIN/TANTALITE/COLUMBITE DISPOSALS REPORTED TO THE DEPARTMENT DURING 1951—PARTICULARS OF THE SEPARATED PRODUCTS BEING INCLUDED IN THE RESPECTIVE MINERALS LISTED IN TABLE VII., ABOVE.

Producer.	Goldfield or Mineral Field.	Material Disposed.						Separation Obtained.				
				Estimated Assay, per cent.				Tantalite Concentrates.			Tin Concentrates.	
		N.D.W. lb.	Material.	$Sn.O_2$	Ta_2O_5.	Nb_2O_5	Combined Ta_2O_5 plus Nb_2O_5	lb.	Combined Ta_2O_5 plus Nb_2O_5. lb.	Value £A.	lb.	Value £A.
Spring Valley Tin Ltd.	Greenbushes	54,826	T/T/C Conc.	59.40	....	....	6.38	4,614	3,497	2,350	49,700	17,712

T/T/C indicates Tin/Tantalite/Columbite.

References.—O.P.G. denotes Outside Proclaimed Goldfield. (*a*) Estimated value, F.O.R. (*b*) Estimated value, F.O.B. (*c*) Estimated value At Works. (*d*) Estimated value Pit Head. (*e*) Only results from shipments finalised during period under review. (*f*) Metallic contents calculated on Assay basis. (*g*) Concentrates. (*h*) Separated from 24.47 tons (54,826 lb.) of Tin/Tantalite/Columbite Concentrates. (*i*) Realised Metallic content. (*j*) Includes 18,676 tons of cement clay valued at **£5,305 late** reported for 1950.

TABLE SHOWING AVERAGE NUMBER OF MEN EMPLOYED ABOVE AND UNDER GROUND IN THE LARGER GOLDMINING COMPANIES OPERATING IN WESTERN AUSTRALIA DURING THE YEARS FROM 1941 TO 1951 INCLUSIVE.

Compiled from the Quarterly Figures furnished by Companies concerned to the Mines Department up to 1942 and Monthly Figures thereafter.

COMPANY.	1942.			1943.			1944.			1945.			1946.			1947.			1948.			1949.			1950.			1951.		
	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.
Boulder Perseverance, Ltd.	144	102	246	117	96	213	116	101	217	127	115	242	178	148	326	195	159	354	185	148	333	171	135	306	173	138	311	115	119	274
Broken Hill Pty. Co., Ltd.	32	54	86	5	....	5	4	....	4	11	2	13	33	82	115	38	95	133	38	84	122	36	73	109	34	68	102	13	12	25
Blue Spec Gold Mines, Ltd.	6	4	10	5	4	9	28	7	35	32	12	44	38	17	55	36	24	60	17	12	29	1	....	1	20	6	26	33	21	54
Big Bell Mines, Ltd.	165	162	327	29	11	40	14	1	15	29	16	45	171	143	314	186	198	384	188	193	381	197	210	407	219	246	465	230	240	470
Burbidge Gold Mines, N.L.	25	2	27	3	....	3	....	....	....	....	....	....	18	....	18	15	4	19	14	4	18	18	4	22	16	4	20	2	....	2
Consolidated Gold Area, N.L.	27	33	60	13	16	29	1	....	1	1	....	1	2	....	2	2	....	2	2	....	2	1	....	1	1	....	1	3	1	4
Comet Gold Mines, Ltd.	59	31	90	54	28	82	47	30	77	42	33	75	43	32	75	17	7	24	7	10	17	9	13	22	11	12	23	13	11	24
Consolidated Gold Mines of Coolgardie, Ltd.	45	53	98	37	44	81	20	23	43	8	1	9	2	....	2	1	....	1	1	....	1	1	....	1	1	....	1	1	....	1
Central Norseman Gold Corporation, N.L.	91	148	239	82	117	199	72	115	187	77	135	212	103	201	304	111	251	362	117	268	385	133	246	379	163	236	399	148	226	374
Coolgardie Gold Mines, Ltd.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	2	3
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, N.L.	33	43	76	33	32	65	29	28	57	34	38	72	38	40	78	36	35	71	9	6	15	....	....	....	....	....	....	....	....	....
Edna May Amalgamated, N.L.	29	35	64	30	35	65	35	36	71	33	34	67	29	42	71	28	33	61	11	9	20	....	....	....	....	....	....	....	....	....
Evanston Gold, N.L.	19	21	40	5	7	12	....	....	....	....	....	....	28	32	60	37	26	63	2	....	2	2	....	2	1	....	1	....	....	....
First Hit Gold Mine	18	12	30	17	15	32	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
Golden Horseshoe (New), Ltd.	41	....	41	39	....	39	38	....	38	39	....	39	45	....	45	46	....	46	45	....	45	43	....	43	41	....	41	39	....	39
Gold Mines of Kalgoorlie, Ltd.	91	108	199	95	96	191	90	98	188	103	114	217	144	171	315	169	158	327	166	173	339	175	179	354	187	180	367	181	191	372
Great Boulder Pty., Ltd.	281	408	689	249	329	578	226	305	531	237	344	581	310	469	779	325	496	821	316	418	734	312	392	704	327	404	731	311	354	665
Great Western Consolidated	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	125	72	197
Hill 50 Gold Mine, N.L.	28	42	70	32	42	74	32	41	73	41	45	86	55	48	103	49	55	104	55	67	122	68	78	146	74	66	140	62	41	103
Kalgoorlie Enterprise, Ltd.	....	74	74	....	55	55	....	53	53	....	74	74	....	99	99	....	118	118	1	105	106	7	103	110	7	95	102	8	85	93
Kalgurli Ore Treatment Co., Ltd.	67	....	67	65	....	65	67	....	67	68	....	68	73	....	73	69	....	69	69	....	69	74	....	74	74	....	74	77	....	77
Lake View and Star, Ltd.	256	323	579	218	186	404	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
Moonlight Wiluna Gold Mines, Ltd.	29	81	110	18	61	79	16	44	60	4	5	9	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Marvel Loch Gold Mines, Syndicate	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1
Moonlight Wiluna Gold Mines, Ltd. (Timoni)	12	15	27	10	10	20	4	2	6	2	....	2	13	11	24	18	20	38	13	20	33	18	18	36	33	32	65	42	42	84
Mountain View Gold, N.L.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7	9	16	11	8	19	10	14	24	11	11	22	13	7	20
Mt. Charlotte (Kalgoorlie) Gold Mines, N.L.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	1	3	18	18	36	24	28	52	10	8	18	2	....	2
North Kalgurli (1912), Ltd.	48	154	202	37	91	128	42	107	149	52	131	183	62	173	235	66	213	279	76	265	341	79	304	383	90	316	406	133	348	481
New Milano, N.L.	20	15	35	6	8	14	1	....	1	2	....	2	2	1	3	2	2	4	2	1	3	1	....	1	1	....	1	....	....	....
*Norseman Gold Mines, N.L.	110	151	261	101	104	205	87	72	159	98	56	154	105	79	184	12	19	31	....	....	....	....	....	....	....	....	....	....	....	....
New Coolgardie Gold Mines, N.L.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	12	9	21	78	64	142	73	125	198	73	120	193
Ora Banda Amalgamated, Ltd.	26	38	64	22	26	48	7	5	12	4	....	4	11	20	31	23	44	67	5	4	9	3	1	4	2	....	2	1	....	1
Paringa Mining and Exploration Co., Ltd.	59	115	174	59	88	147	78	82	160	69	103	172	76	113	189	83	117	200	87	134	221	79	134	213	92	138	230	47	46	93
Phoenix Gold Mines, Ltd.	43	40	83	35	36	71	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
Radio Gold Mines	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	3	8
South Kalgurli Consolidated	131	98	229	67	77	144	43	74	117	51	80	131	80	91	171	103	105	208	107	111	218	110	105	215	120	107	227	124	110	234
Sons of Gwalia, Ltd.	97	163	260	101	125	226	101	115	216	104	106	210	122	160	282	108	128	236	98	109	207	92	143	235	104	151	255	121	129	250
Sunshine Reward Amalgamated Leases	4	5	9	5	6	11	5	5	10	4	3	7	5	7	12	8	9	17	9	10	19	9	14	23	10	9	19	10	7	17
Triton Gold Mine	36	74	110	4	10	14	8	15	23	11	23	34	41	66	107	83	178	261	64	95	159	7	....	7	....	....	....	....	....	....
Wiluna Gold Mines, Ltd.	247	292	539	255	282	537	237	244	481	214	196	410	168	96	264	117	5	122	69	....	69	49	....	49	29	....	29	20	....	20
Western Mining Corporation (New Callion Leases)	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	21	27
Youanmi Gold Mines, Ltd.	10	12	22	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Yellowdine Gold Development, Ltd.	41	47	88	30	28	58	13	9	22	2	....	2	4	....	4	2	....	2	2	....	2	2	....	2	1	....	1	....	....	....
All other Operators	1,447	1,301	2,748	599	495	1,094	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
State Average (incl. Diggers)	3,844	4,279	8,123	2,488	2,591	5,079	2,266	2,348	4,614	2,424	2,394	4,818	3,416	3,545	6,961	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
*Also additional men engaged exclusively on Pyrites Production	....	....	....	6	27	33	7	33	40	5	49	54	4	53	57	78	56	134	79	44	123	62	34	96	60	40	100	77	61	138

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