1959

Report of the

DEPARTMENT OF MINES

WESTERN AUSTRALIA

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

Cover Picture

View of . . .

COLONIAL BLUE ASBESTOS MINE,
WITTENOOM GORGE,
WESTERN AUSTRALIA.

REPORT OF THE
DEPARTMENT *of* MINES
WESTERN AUSTRALIA
FOR THE YEAR 1959

ERRATA

Annual Report, Department of Mines, 1959
page 78 (top right-hand side)

Assay values, 3rd penetration: The note in brackets should read 9.4 ounces per long ton instead of 9.4 dwts. per long ton as printed.

Assay values 4th penetration: The note in brackets should read 5.1 ounces per long ton instead of 5.1 dwts. per long ton as printed.

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1960

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To the Hon. Minister for Mines.

Sir,

I have the honour to submit the Annual Report of the Department of Mines of the State of Western Australia for the year 1959, together with reports from the officers controlling Sub-Departments, and Comparative Tables furnishing statistics relative to the Mining Industry.

I have the honour to be, Sir,

Your obedient Servant,

A. H. TELFER,

Under Secretary for Mines.

Perth, 1960.

TABLE OF CONTENTS

STATE OF WESTERN AUSTRALIA

Report of the Department of Mines for the Year 1959

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 1959.

The estimated value of the mineral output of the State for the year was £11,935,794 (calculating gold at £4 4s. 11.45d. per fine ounce), an increase of £1,236,450 in value compared with the preceding twelve months.

The estimated value of the exchange premium paid to gold producers by the Mint amounted to £A9,859,644. added to which, the overseas gold sales premium of £A1,167 received by the Gold Producers' Association from sales of West Australian Gold distributed in May, 1959, brought the gross value of all minerals to £A21,796,605, an increase of £A1,225,904 when compared with the total for the previous year and constituted an all time record.

The estimated value of the gold received at the Perth Branch of the Royal Mint and exported in gold-bearing material was £A13,540,762, but with the additional overseas gold sales premium mentioned above, totalled £A13,541,929, being the third highest annual value recorded for that mineral. The estimated gold value equalled 62.123 per cent of the value of all minerals for 1959.

(See footnote to Table (1) (a), Part II).

Other minerals realised; coal, £2,356,534; asbestos, £1,628,542; manganese, £1,020,824; iron ore (for pig iron), £808,644; iron ore (for export), £666,601; pyrites (for sulphur), £371,989; ilmenite concentrates, £353,076; copper ore and concentrates, £230,078; cupreous ore (fertiliser), £184,006; tin concentrates, £154,729; lead ores and concentrates £89,003; silver. £79,913; clays, £61,951; talc, £58,085; gypsum, £54,207; beryl, £48,052; zircon concentrates, £41,129; tantocolumbite concentrates, £9,833; rutile concentrates, £8,424; monazite concentrates, £7,210; felspar, £6,352; glauconite, £5,103; glass sand, £4,555; leucoxene concentrates, £3.930; ochre, £1,040; bentonite, £532; quartz grit, £260; and magnesite, £74.

The value of minerals other than gold and coal produced during 1959 reached another all time high of £5,898,142, and it is interesting to note that the value of such minerals for the five year period (1955-1959) totalled £21.696 million, which eclipsed the £20.438 million accumulated over the previous fifty-five year period (1899-1954).

Dividends paid by gold mining companies amounted to £A2,093,984, an increase of £A26,158 when compared with the previous year (see Table 6, Part II).

To the end of 1959. the total amount distributed by gold mining companies was £A62,383,544.

To the same date the progressive value of the mineral production of the State amounted to £341,802,096, of which gold accounted for £258,174,663 (based on the normal value of £4 4s. 11.45d. per fine ounce): but the premium on the sale of gold during years 1920-1924, increasing exchange premium since 1930, payments under the Gold Bounty Act, 1930, plus additional premiums from overseas sales distributed between 1952 and 1959, increase the total value of gold and mineral production by £172,287,248, making a gross progressive value of £514,089,344.

GOLD

The quantity of gold reported as being received at the Perth Branch of the Royal Mint (864,286.87 fine ounces), together with that contained in gold-bearing material exported for treatment (2,321.99 fine ounces), totalled 866,608.86 fine ounces, which was 578.63 fine ounces less than the previous year, and the third higest figure since 1941 (vide Table 1 (a) of Part II).

Similarly, the total gold yield for the year reported directly to the Department by the producers was 860,969.16 fine ounces, a decrease of 13,849.79 fine ounces, and also constituted the third highest reported gold yield since 1941 (see Table 3 of Part II).

The variation between the two annual totals is principally due to the fact that the gold reported as being received at the Mint and Exported for treatment, is not necessarily produced during the calendar year under review, a certain quantity being always in the transitory stage from the producer at the end of the year, The former total is accepted as the official gold 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 its respective ore tonnage can be applied.

The calculated average value of the ore treated as a whole increased slightly from 24.614 shillings per ton in 1958 to 24.730 shillings per ton in 1959, calculating gold at the old rate of £4 4s. 11.45d. per fine ounce, but the exchange premium rate of 267.84 per cent. would more than treble this estimate (increasing it to 90.921 shillings per ton on current value). For East Coolgardie Goldfield (which produced 59.28 per cent. of the State's gold yield), the calculated average value of ore treated decreased slightly from 22.467 shillings to 22.019 shillings per ton. The estimates for Murchison (Hill 50 G.M. N.L.), Mt. Margaret (Sons of Gwalia Ltd.), Dundas (Central Norseman Gold Corporation N.L.), and Yilgarn (Great Western Cons. N.L.) were 48.177s. (49.014s.); 20.552s. (18.587s.); 47.066s. (50.298s.); 15.023s. (14.972s.) respectively. Figures for 1958 being shown in parentheses.

The tonnage of ore reported to have been treated in 1959 viz. 2,959,202 tons, was 61,870 tons less than the previous year, and constituted 68.95 per cent of the State record tonnage established in 1940.

The following tonnage increases were reported from the respective Goldfields—Peak Hill 726, East Murchison 165, Murchison 26,276, Yalgoo 269, North—East Coolgardie 178, Dundas 493; those yields showing a reduction in tonnage being Kimberley 30, Pilbara 507, West Pilbara 13, Mt. Margaret 402, North Coolgardie 533, Broad Arrow 614, East Coolgardie 34,066, Coolgardie 4,480, Yilgarn 49,314 and Outside Proclaimed Goldfields 19.

After a lengthy period of successive annual increases, the East Coolgardie Goldfield failed for the first time since 1945 to exceed the higher tonnage figure established for each previous year, when the reported figure for 1959 fell short of the 1958 total by 34,066 tons. The slightly higher output of 15,361 tons and 3,929 tons shown by North Kalgurli (1912) Ltd. and Lake View & Star Ltd., respectively, was offset by the lower tonnages reported by Great Boulder Pty. G.M.'s Ltd. (34,287 tons), and Gold Mines of Kalgoorlie (Aust.) Ltd. (15,631 tons), and practically accounted for the deficiency in the Goldfield. An even grade of ore was maintained by all except the latter Company which was slightly lower than the previous year.

A small increase of 493 tons occurred in the Dundas Goldfield, where, although the output of the Central Norseman Gold Corporation N.L. showed a slight improvement, its average grade of ore treated fell from 11.834 dwts. to 9.727 dwts. per ton.

In the Murchison Goldfield, Hill 50 G.M. N.L. contributed an extra 22,390 tons to the overall increase of 26,276 tons reported from the Goldfield, whilst the Eclipse G.M. improved its output by 2,840 tons and raised its average grade of ore for the year from 20.72 dwts. to 32.07 dwts. per ton.

Although actual output from the Great Western Consolidated N.L. declined by 65,867 tons from the six groups operated, the Yilgarn Goldfield only showed a deficit of 43,314 tons; such partial recovery being caused by the Company mentioned, which, as part of its active project of investigating low grade lateritic deposits, assisted other leaseholders in the mining and treatment of similar material in the vicinity.

As gold mining in this State is one of the chief industries which develop and maintain inland settlements, any means of stabilising mining operations must be of special significance to its economy, and also to the State as the chief gold producer in the Commonwealth. Therefore the successful efforts to date of the principal producers, in effecting numerous improved operating techniques etc. to offset the constantly rising costs, especially over the last few years, must be regarded as most commendable.

The evident loyalty of the various working forces in the industry has long been taken for granted owing to many trouble-free years of co-operation.

West Australian gold included in sales on open dollar markets by the Gold Producers' Association Ltd. during October and November 1958, totalled 133,133.16 fine ounces; the extra premium received therefrom in excess of the Mint Value, amounted to £A1,167 an overall average of 2.103 pence per fine ounce. This amount, less expenses, was distributed to the producer members during the year and approximated 1.475 pence per fine ounce.

Subsidy payments made by the Commonwealth Goverment during the year under the Gold Mining Industry Assistance Act 1954, totalled £A652,268, of which £A624,026 went to Large Producers and £A28,242 to Small Producers in this State.

PART II.—MINERALS.

During the year Royalty totalling £61,085 was collected under legislation passed in 1958 to provide payment of royalty on certain prescribed minerals, obtained on or after 1st July, 1958, from land held under the Mining Act.

Gold was excluded from royalty liability, and payment on copper lead, and mineral beach sands, temporarily suspended on account of the depressed state of the market. Payment of royalty on iron ore (used for pig-iron recovery) has been held in abeyance.

Royalty has been collected on coal production practically from inception and on iron ore (for export) from 1951.

COMPARATIVE MINERAL STATISTICS

	1958	1959	Variation
GOLD—			
Reported to Department (Mine Production):			
Ore (tons)	3,021,072	2,959,202	— 61,870
Gold (fine ozs.)	874,819	860,969	— 13,850
Average Grade (dwts. per ton)	5·791	5·819	+ 0·028
Persons Engaged:			
(a) Effective Workers (excluding Absentees)	5,352	5,273	— 79
(b) Total Pay Roll	Not recorded	5,769	Not available
Dividends	2,067,826	2,093,984	+ 26,158
Mint and Export (Realised Production):			
Gold (fine ozs.)	867,187	866,609	— 578
Estimated Value (including overseas Gold Sales Premium) (£A)	13,554,934	13,541,929	— 13,005
COAL—			
Reported to Department (Mine Production):			
Tons	870,882	911,434	+ 40,552
Value (£A)	2,280,649	2,356,534	+ 75,885
Persons Engaged:			
Effective Workers (excluding Absentees)	1,072	1,011	— 61
OTHER MINERALS—			
Reported to Department:			
Value (£A)	4,735,118	5,898,142	+ 1,163,024
Persons Engaged:			
Effective Workers	1,068	1,192	+ 124
TOTAL ALL MINERALS—			
Value (£A)	20,570,701	*21,796,605	+ 1,225,904
Persons Engaged:			
Effective Workers	7,492	7,476	— 16

Excluding Oil Search which engaged an average of 151 men in the field during 1958 and 149 men in the field during 1959.

*All time record.

Note of Interest—Value of Minerals other than Gold and Coal during five year period (1955–1959) totalled £A21·696 million and eclipsed the £20·438 millions of value accumulated over the previous fifty-five year period (1899–1954).

Particulars for the year are shown hereunder.

Mineral	Amount per ton s. d.	Royalty Collected £ s. d.
Asbestos	1 6	1,167 2 6
Beryl	2 0	6 9 6
Clay	6	1,013 19 0
Coal	3	10,378 4 6
Felspar	6	31 19 6
Glass Sand and Quartz Grit	6	171 15 0
Gypsum	6	943 13 3
Iron Ore (export only)	1 6	41,874 9 0
Manganese	1 6	2,528 3 5
Phosphatic Guano	1 6	8 2 0
Pyrites	1 0	2,935 5 2
Tanto-Columbite Conc.	*	11 1 9
Tin Conc.	2 0	15 8 0
Total		61,085 12 7

* One-half per centum of the realised F.O.B. Value.

Considerable activity was again displayed this year in the investigation of the manganese deposits in the Pilbara Goldfield. A very thorough survey of these deposits was commenced by Rio Tinto (Australia) Ltd. and the Company set up a field headquarters, including a field laboratory at the Ragged Hills deposit. This Company is interested in all minerals and this investigation is part of a general survey of the mineral potential of the Pilbara and West Pilbara Goldfields.

Work has continued by other interests on large reservations granted to them for the purpose of prospecting for nickel, bauxite, gypsum and evaporites, and some encouraging results have been obtained in connection with the bauxite and gypsum deposits.

The Department has intensified its activities in the survey of our iron deposits and drilling was carried out at the Tallering Peak deposits, and Geological examinations made with a view to drilling at Koolyanobbing, Mt. Goldsworthy and Weld Range.

COAL.

Coal production from Collie amounted to 911,434 tons valued at £2,356,534. This represents an increase in tonnage of 40,552 tons and in value of £75,885.

OIL.

Several new companies joined the search for oil during the year and have taken up areas adjoining the Wapet Permit to Explore in the Canning Basin and extending south to, and including the Eucla Basin. Drilling operations as well as geophysical and geological surveys have been carried on throughout the year in the Canning and Eucla Basins and in the vicinity of Gingin.

WATER

The Department's drilling programme in the Kalannie District was completed and the drills moved to the Hill River area. Drilling was carried out on Crown Lands to test the extent of the aquifer found in the No. 1 bore at Badgingarra in 1958, and in the two bores put down useful supplies of sub-artesian water were located. Pump tests of these bores will be carried out as soon as the necessary equipment is available.

TABLE 1.—*Quantity and Value of Minerals, other than Gold and Silver, produced during Years* 1958 *and* 1959. *Western Australia.*

Description of Minerals	1958		1959		Increase or Decrease for year compared with 1958	
	Quantity	Value	Quantity	Value	Quantity	Value
	Tons	£A	Tons	£A	Tons	£A
Asbestos (Chrysotile)	1,377·81	38,652	631·66	17,249	— 746·15	— 21,403
Asbestos (Crocidolite)	11,887·10	1,304,725	14,680·17	1,611,293	+ 2,793·07	+ 306,568
Bentonite	37·00	153	133·00	532	+ 96·00	+ 379
Beryl	170·03	31,801	266·71	48,052	+ 96·68	+ 16,251
	lb.		lb.		lb.	
Bismuth	3,310·00	1,475	*Nil*	*Nil*	— 3,310·00	— 1,475
	Tons		Tons		Tons	
Clays (Cement Clay)	13,506·00	13,439	22,321·00	23,055	+ 8,815·00	+ 9,616
Clays (Fireclay)	20,211·96	25,435	26,202·10	33,346	+ 5,990·14	+ 7,911
Clays (White Clay—Ball Clay)	*Nil*	*Nil*	1,005·00	4,020	+ 1,005·00	+ 4,020
Clays (White Clay—Kaolin)	79·00	395	185·00	925	+ 106·00	+ 530
Clays (Brick, Pipe and Tile Clay)	*Nil*	*Nil*	*2,298·00	605	+ 2,298·00	+ 605
Coal	870,882·45	2,280,649	911,434·52	2,356,534	+ 40,552·07	+ 75,885
Copper Ore and Concentrates	1,801·95	54,424	4,408·75	230,078	+ 2,606·80	+ 175,654
Cupreous Ore and Concentrates	7,643·72	114,670	11,858·80	184,006	+ 4,215·08	+ 69,336
Dolomite	196·00	786	*Nil*	*Nil*	— 196·00	— 786
Felspar	680·60	3,093	1,395·80	6,352	+ 715·20	+ 3,259
Glass Sand	6,420·41	4,267	6,827·54	4,555	+ 407·13	+ 288
Glauconite (Recovered)	112·00	5,590	102·00	5,103	— 10·00	— 487
Gypsum	35,514·97	40,134	87,730·55	54,207	+ 2,215·58	+ 14,073
Iron Ore (For Pig)	30,075·00	458,561	57,206·00	808,644	+ 27,131·00	+ 350,083
Iron Ore (For Export)	536,713·00	532,355	672,239·00	666,601	+ 135,526·00	+ 134,246
Lead and Silver/Lead Ores and Concentrates	2,492·43	139,191	1,902·89	89,003	— 589·54	— 50,188
Magnesite	*Nil*	*Nil*	18·50	74	+ 18·50	+ 74
Manganese (Metallurgical, Low and Battery Grades)	61,809·43	960,474	69,979·24	1,020,824	+ 8,169·81	+ 60,350
Mineral Beach Sands (Ilmenite)	82,926·27	448,218	73,627·67	353,076	— 9,298·60	— 95,142
Mineral Beach Sands (Monazite)	*Nil*	*Nil*	109·55	7,210	+ 109·55	+ 7,210
Mineral Beach Sands (Rutile)	*Nil*	*Nil*	297·45	8,424	+ 297·45	+ 8,424
Mineral Beach Sands (Leucoxene)	*Nil*	*Nil*	276·25	3,930	+ 276·25	+ 3,930
Mineral Beach Sands (Zircon)	*Nil*	*Nil*	4,068·34	41,129	+ 4,068·34	+ 41,129
Ochre (Red)	171·00	1,710	104·00	1,040	— 67·00	— 670
Ochre (Yellow)	18·30	183	*Nil*	*Nil*	— 18·30	— 183
Petalite	67·77	293	*Nil*	*Nil*	— 67·77	— 293
Phosphatic Guano	169·65	1,828	*Nil*	*Nil*	— 169·65	— 1,828
Pyrites Ore and Concentrates (for Sulphur)	49,388·64	351,847	53,030·39	371,989	+ 3,641·75	— 20,142
Quartz Grit	90·00	75	312·00	260	+ 222·00	+ 185
	lb.		lb.		lb.	
Semi-Precious Stones (Chrysoprase)	5·00	5	*Nil*	*Nil*	— 5·00	— 5
Semi-Precious Stones (Opaline)	25·00	4	*Nil*	*Nil*	— 25·00	— 4
	Tons		Tons		Tons	
Talc	2,500·67	35,304	4,047·69	58,085	+ 1,547·02	+ 22,781
Tanto/Colombite Ores and Concentrates	6·03	8,550	8·46	9,833	+ 2·43	+ 1,283
Tin	138·20	77,319	249·70	154,729	+ 111·50	+ 77,410
Zinc	20·06	511	*Nil*	*Nil*	— 20·06	— 511
Total	....	6,936,116	....	8,174,763	....	+ 1,238,647

TABLE 1 (a).—*Quantity and Value of Gold and Silver exported and minted during Years* 1958 *and* 1959.

Description of Minerals	1958		1959		Increase or Decrease for year compared with 1958	
	Quantity	Value	Quantity	Value	Quantity	Value
	Fine oz.	£A	Fine oz.	£A	Fine oz.	£A
Gold (Exported and Minted)	867,187·49	†13,554,934	866,608·86	†13,541,929	— 578·63	— 13,005
Silver (Exported and Minted)	200,767·48	79,651	193,561·53	79,913	— 7,205·95	— 3,262
Total	....	13,634,585	....	13,621,842	....	— 12,743
Grand Total	....	20,570,701	....	21,796,605	....	+ 1,225,904

* Incomplete—Figures relate only to production reported to the Department.

† Including Overseas Gold Sales Premium.

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 1959

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

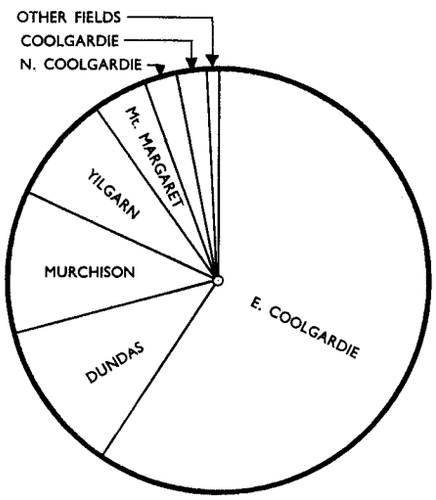


Fig. 2 Gold produced from various Goldfields as given by the Export and Mint Returns

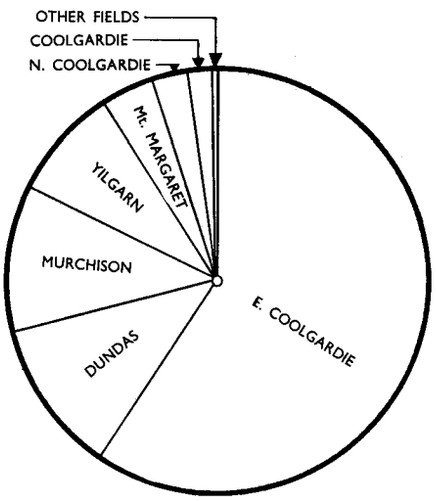


Fig. 3 Value of Gold and other Minerals

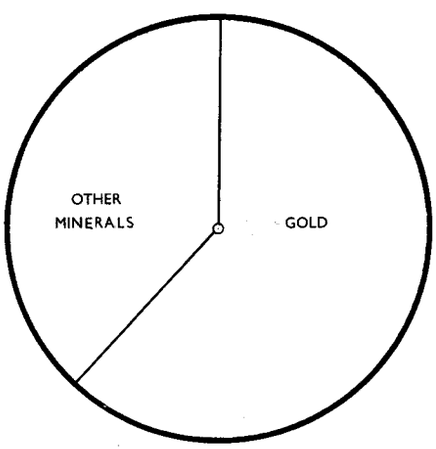


Fig. 4 Value of Minerals other than Gold

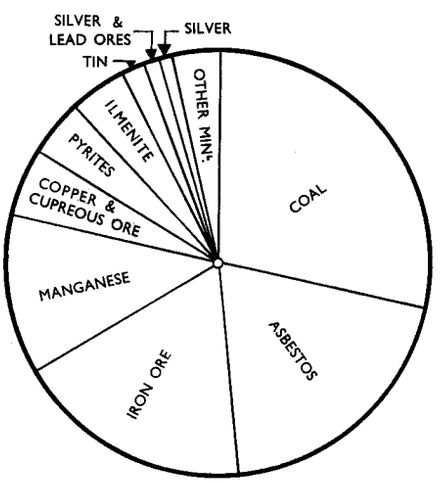


Fig. 5 Areas of land leased for Goldmining on various Goldfields

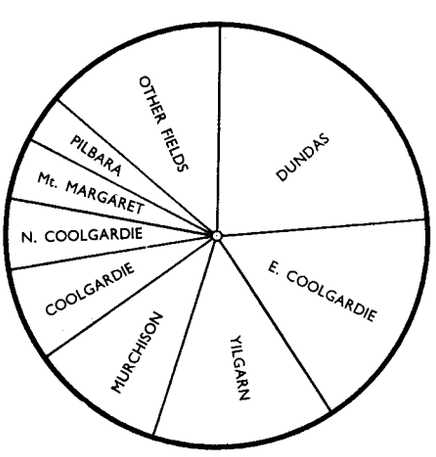


Fig. 6 Output of Gold in the States of Australia and the Dominion of New Zealand

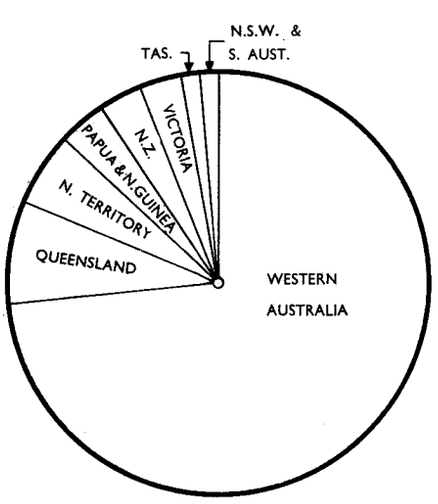
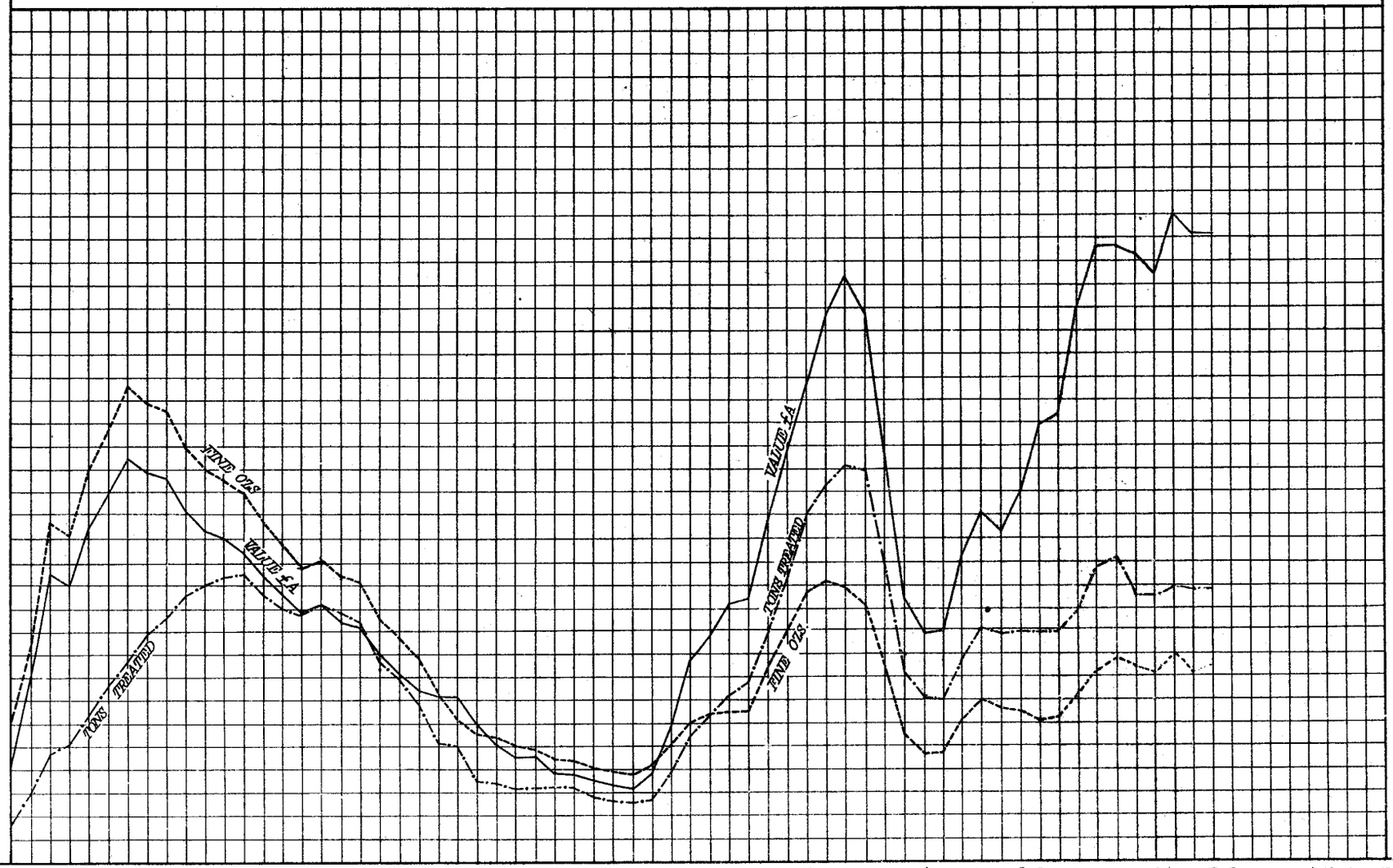


DIAGRAM OF GOLD OUTPUT

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	3600,000	18000,000
	3400,000	17,000,000
8,000,000	3,200,000	16,000,000
	3,000,000	15000,000
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	6000,000
	1,000,000	5000,000
2,000,000	800,000	4000,000
	600,000	3000,000
1,000,000	400,000	2000,000
	200,000	1,000,000

VALUE £A	FINE OUNCES	TONS TREATED
18000,000	3600,000	9000,000
17000,000	3400,000	
16,000,000	3200,000	8000,000
15,000,000	3000,000	
14,000,000	2800,000	7000,000
13,000,000	2600,000	
12,000,000	2400,000	6000,000
11,000,000	2200,000	
10,000,000	2000,000	5000,000
9000,000	1800,000	
8000,000	1600,000	4000,000
7000,000	1400,000	
6000,000	1200,000	3000,000
5000,000	1000,000	
4000,000	800,000	2000,000
3000,000	600,000	
2000,000	400,000	1000,000
1000,000	200,000	

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

YEAR

TABLE 2.

Value of Total Exports and Mineral Exports from Western Australia, as compared with Total Value of Mineral Production as from 1900.

Year	Total Exports †	Mineral Exports (exclusive of Coal)	Total Mineral Production
	£	£	£
1900	6,852,054	5,588,299	6,179,535
1901	8,515,623	6,789,133	7,439,470
1902	9,051,358	7,530,319	8,094,616
1903	10,324,732	8,727,060	8,971,937
1904	10,271,489	8,625,676	8,686,757
1905	9,871,019	7,731,954	8,555,841
1906	9,832,679	7,570,305	7,905,506
1907	9,904,860	7,544,992	7,669,468
1908	9,518,020	7,151,317	7,245,002
1909	8,860,494	5,906,673	7,056,079
1910	8,299,781	4,795,654	6,522,263
1911	10,606,863	7,171,638	6,105,853
1912	8,941,008	5,462,499	5,768,567
1913	9,128,607	4,608,188	6,036,115
1914	8,406,182	3,970,182	5,534,273
1915	6,291,934	2,969,502	5,478,149
1916	10,878,153	6,842,621	4,893,417
1917	9,323,229	5,022,694	4,629,028
1918	6,931,834	2,102,923	4,265,577
1919	14,279,240	6,236,585	4,061,600
1920	15,149,323	3,096,849	4,233,915
1921	10,331,405	1,373,810	3,470,597
1922	11,848,025	2,875,402	3,041,113
1923	11,999,500	3,259,476	2,747,108
1924	13,808,910	1,424,319	2,776,791
1925	13,642,852	173,126	2,393,890
1926	14,668,184	1,597,698	2,371,863
1927	15,805,120	472,041	2,202,438
1928	16,911,932	996,099	2,128,179
1929	16,660,742	1,802,709	2,087,893
1930	19,016,639	6,370,396	2,287,376
1931	14,266,650	4,333,421	3,353,923
1932	16,771,465	5,657,870	4,721,620
1933	18,098,214	5,328,869	5,239,498
1934	16,784,705	5,759,324	5,908,881
1935	17,611,547	5,698,721	6,132,811
1936	19,564,716	7,130,381	7,818,684
1937	21,594,942	9,026,313	9,210,079
1938	24,220,864	10,417,458	10,906,527
1939	23,244,509	11,969,562	12,331,659
1940	25,800,562	12,480,721	13,228,660
1941	24,536,777	12,411,316	12,398,141
1942	20,681,284	8,476,622	9,509,646
1943	18,014,340	6,539,295	6,401,594
1944	19,453,001	(a) 1,282,867	5,737,096
1945	20,170,624	205,587	5,910,518
1946	26,342,125	211,890	7,693,951
1947	42,389,125	4,162,892	8,862,292
1948	57,779,996	342,646	8,584,843
1949	58,197,775	465,124	9,629,300
1950	78,804,864	531,245	11,489,897
1951	115,880,457	7,479,601	12,706,228
1952	101,620,138	7,952,834	17,126,506
1953	106,678,014	13,239,076	19,358,268
1954	79,955,207	5,342,462	19,953,665
1955	113,044,633	17,145,741	18,893,161
1956	142,852,512	9,531,471	19,447,510
1957	148,128,361	12,483,343	21,007,393
1958	123,624,508	5,464,465	20,570,701
1959	134,999,983	4,536,105	21,796,605

† Including Ship's Stores.

(a) Full value and use of gold, not always exported, as utilised by the Commonwealth Treasury in the financing of Australian Trade Economy from 1944, not available.

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.)	
	1958	1959	1958	1959	1958	1959
	Fine oz.	Fine oz.	%	%	Shillings	Shillings
1. Kimberley	50	38	·006	·005	14·250	....
2. West Kimberley	....	....	....	....	....	....
3. Pilbara	1,004	1,071	·115	·125	33·910	45·294
4. West Pilbara	15	11	·002	·001	31·139	33·636
5. Ashburton	....	....	....	....	....	....
6. Gascoyne	6	43	....	·006	....	....
7. Peak Hill	638	436	·073	·051	16·609	9·289
8. East Murchison	817	732	·093	·085	108·113	77·076
9. Murchison	81,984	95,361	9·371	11·072	49·014	48·177
10. Yalgoo	9	61	·001	·008	....	19·154
11. Mt. Margaret	31,010	34,192	3·545	3·972	18·587	20·552
12. North Coolgardie	21,027	22,458	2·404	2·609	42·589	46·184
13. Broad Arrow	2,385	1,663	·273	·193	40·447	32·152
14. North-East Coolgardie	322	385	·037	·045	36·274	35·095
15. East Coolgardie	529,768	510,382	60·557	59·280	22·467	22·019
16. Coolgardie	14,867	17,393	1·699	2·021	40·137	54·748
17. Yilgarn	81,740	73,302	9·344	8·511	14·972	15·023
18. Dundas	108,331	101,643	12·383	11·806	50·298	47·066
19. Phillips River	812	1,366	·093	·159	....	....
20. Outside Proclaimed Goldfields	34	432	·004	·051	152·059	....
Totals and Averages	874,819	860,969	100·000	100·000	24·614	24·730

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

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

TABLE 4.

Average Quantities of Gold Ore raised and treated, and Gold produced therefrom, per man employed on the several Goldfields of the State, during 1958 *and* 1959.

Goldfield	1958				1959			
	Tons of Gold Ore raised and treated		Fine ounces of Gold produced therefrom		Tons of Gold Ore raised and treated		Fine ounces of Gold produced therefrom	
	Per man employed underground	Per man employed above and underground	Per man employed underground	Per man employed above and underground	Per man employed underground	Per man employed above and underground	Per man employed underground	Per man employed above and underground
	Tons	Tons	Fine oz.	Fine oz.	Tons	Tons	Fine oz.	Fine oz.
1. Kimberley	....	....	....	....	....	....	....	....
2. West Kimberley	....	....	....	....	....	....	....	....
3. Pilbara	179·36	36·46	71·71	14·55	282·64	30·44	99·36	16·23
4. West Pilbara	....	....	....	....	....	....	....	....
5. Ashburton	....	....	....	....	....	....	....	....
6. Gascoyne	....	....	....	....	....	....	....	....
7. Peak Hill	544·50	297·00	106·33	58·00	798·60	399·30	87·20	43·60
8. East Murchison	64·20	25·68	81·70	54·46	80·70	32·28	73·20	29·28
9. Murchison	935·38	433·46	539·08	249·95	1,194·71	552·31	676·32	312·66
10. Yalgoo	....	....	....	....	134·50	44·83	30·50	10·17
11. Mt. Margaret	914·90	513·80	200·06	112·35	961·96	550·23	232·60	133·04
12. North Coolgardie	558·24	247·74	280·36	124·42	590·50	250·52	320·33	136·11
13. Broad Arrow	167·03	70·58	79·50	33·59	137·41	64·66	51·97	24·46
14. North-East Coolgardie	150·80	53·85	64·40	23·71	155·33	51·78	64·17	21·39
15. East Coolgardie	1,154·55	640·97	305·16	169·41	1,141·51	632·50	295·70	163·85
16. Coolgardie	297·01	162·29	140·25	76·63	270·04	142·13	173·93	91·54
17. Yilgarn	1,511·61	740·13	266·25	130·36	1,425·26	684·41	251·90	120·96
18. Dundas	756·49	431·77	447·64	255·50	768·05	424·92	425·28	235·28
19. Phillips River	....	....	....	....	....	....	....	....
20. Outside Proclaimed Goldfields	....	....	....	....	....	....	....	....
Total Averages	1,063·75	564·47	308·03	164·08	1,064·46	562·27	309·70	163·59

TABLE 5.

Output of Gold from the several States of Australia, the Northern Territory, Papua, and Mandated Territory of New Guinea, and the Dominion of New Zealand, during 1959.

State	Output of Gold	Value*	Percentage of Total	
			Output of Commonwealth	Output of Australasia
	Fine oz.	£	%	%
Western Australia	866,609	3,681,118	76·195	73·753
Victoria	35,742	151,903	3·143	3·042
New South Wales	13,269	56,393	1·167	1·129
Queensland	91,496	388,858	8·045	7·787
Tasmania	20,260	86,105	1·781	1·724
South Australia	16	68	....	....
Territory of Papua and New Guinea	46,819	198,980	4·116	3·985
Northern Territory	63,143	268,357	5·553	5·375
New Zealand	37,662	160,063	....	3·205
	1,175,016	4,984,845	100·000	100·000

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

TABLE 6.

Dividends, etc., paid by Western Australian Mining Companies during 1959, *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	
		1959	Grand Total to end of 1959
		£	£
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.	600,000	5,040,626
	Various Companies	....	2,764,945
Mt. Margaret	Sons of Gwalia Ltd.	....	2,075,050
	Various Companies	....	958,286
North Coolgardie	Moonlight Wiluna G.M's. Ltd.	....	15,000
	Various Companies	....	712,551
Broad Arrow	do. do.	....	92,500
North-East Coolgardie	do. do.	....	129,493
East Coolgardie	Gold Mines of Kalgoorlie (Aust.) Ltd.	202,265	2,194,353
	Great Boulder Proprietary G.M's. Ltd.	218,750	8,715,650
	Lake View and Star Ltd.	437,500	(*b*) 8,930,750
	North Kalgurli (1912) Ltd.	180,469	2,588,435
	Various Companies	....	(*a*) 19,496,816
Coolgardie	do. do.	....	410,000
Yilgarn	do. do.	....	(*c*) 1,205,556
Dundas	Central Norseman Gold Corporation, N.L.	455,000	4,127,500
	Various Companies	....	786,162
	Totals	£2,093,984	£62,383,544

(*a*) Excluding £45,091 in bonuses and profit-sharing notes in years 1935–1936 by Boulder Perseverance Ltd., and £55,000 Capital returned in year 1932 and £42,000 in bonuses and profit-sharing notes in year 1934 by Golden Horseshoe (New) Ltd.

(*b*) Excluding £75,000 in bonuses and profit-sharing notes and £93,750 Capital returned in 1932–1935.

(*c*) Excluding £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 1959.

Goldfield, District or Mineral Field	1959		Increase or Decrease as compared with 1958	
	Quantity	Value	Quantity	Value
	Tons	£A	Tons	£A
ASBESTOS (Chrysotile)—				
West Pilbara	597·31	16,528	— 610·48	— 18,380
Pilbara	34·35	721	— 135·67	— 3,022
ASBESTOS (Crocidolite)—				
West Pilbara	14,680·17	1,611,293	+ 2,793·07	+ 306,568
BENTONITE—				
Outside Proclaimed Goldfields	133·00	532	+ 96·00	+ 379
BERYL—				
Ashburton	5·24	964	+ 5·24	+ 964
Coolgardie	14·04	2,454	— 6·19	— 1,379
Gascoyne	45·51	8,470	+ 27·17	+ 4,643
Pilbara	199·09	35,636	+ 68·69	+ 11,694
Yalgoo	2·60	488	+ 1·54	+ 290
Outside Proclaimed Goldfields	0·23	40	+ 0·23	+ 40
BISMUTH—	lb.		lb.	
Gascoyne	....	....	— 3,310·00	— 1,475
CLAYS (Cement Clay, Fireclay, White Clays, Brick, Pipe and Tile Clay)—	Tons		Tons	
Outside Proclaimed Goldfields	52,011·10	61,950	+ 18,214·14	+ 22,682
COAL—				
Collie Coalfields	911,434·52	2,356,534	+ 40,552·07	+ 75,885
COPPER ORE AND CONCENTRATES—				
Peak Hill	....	....	— 68·49	— 949
Phillips River	4,408·75	230,078	+ 2,682·04	+ 176,813
West Pilbara	....	....	— 6·75	— 210
CUPREOUS ORE AND CONCENTRATES—				
Peak Hill	6,187·47	73,923	+ 1,562·93	+ 22,049
Yalgoo	112·56	2,221	+ 69·47	+ 1,584
Pilbara	4,902·72	96,086	+ 3,188·74	+ 58,194
West Pilbara	263·71	5,141	+ 38·46	+ 156
Murchison	152·10	1,808	+ 66·30	+ 40
East Murchison	155·15	1,745	— 582·64	— 7,416
Mt. Margaret	20·66	178	+ 20·66	+ 178
Phillips River	64·43	2,904	— 146·74	— 5,433
Gascoyne	....	....	— 2·10	— 16
DOLOMITE—				
Murchison	....	....	— 196·00	— 786
FELSPAR—				
Coolgardie	1,393·00	6,338	+ 720·00	+ 3,276
Outside Proclaimed Goldfields	2·80	14	— 4·80	— 16
GLASS SAND—				
Outside Proclaimed Goldfields	6,827·54	4,555	+ 407·13	+ 288
GLAUCONITE—				
Outside Proclaimed Goldfields	102·00	5,103	— 10·00	— 487
GYPSUM—				
Yilgarn	23,553·00	17,733	+ 1,600·00	+ 1,189
Dundas	11,168·70	33,495	+ 6,184·98	+ 18,602
Outside Proclaimed Goldfields	3,008·85	2,979	— 5,569·40	— 5,718
IRON ORE (for pig)—				
Yilgarn	57,206·00	808,644	+ 27,131·00	+ 350,083
IRON ORE (for Export)—				
West Kimberley	672,239·00	666,601	+ 135,526·00	+ 134,246
LEAD ORE CONCENTRATES—				
Northampton	1,440·52	69,629	— 872·40	— 61,620
SILVER LEAD ORES AND CONCENTRATES—				
Ashburton	41·50	2,336	— 67·95	— 4,891
Pilbara	420·87	17,039	+ 350·81	+ 16,324
MAGNESITE—				
Phillips River	18·50	74	+ 18·50	+ 74

TABLE 7—*continued*

Quantity and Value of Minerals, other than Gold and Silver, reported to the Mines Department during 1959—*continued.*

Goldfield, District or Mineral Field	1959		Increase or Decrease as compared with 1958	
	Quantity	Value	Quantity	Value
	Tons	£A	Tons	£A
MANGANESE—				
Pilbara	39,266·84	662,219	+ 16,894·35	+ 272,737
Peak Hill	30,705·80	358,573	— 8,695·11	— 212,261
East Coolgardie	7·60	32	— 28·40	— 126
MINERAL BEACH SANDS (ILMENITE)—				
Outside Proclaimed Goldfields	73,627·67	353,076	— 9,298·60	— 95,142
MINERAL BEACH SANDS (MONAZITE)—				
Outside Proclaimed Goldfields	109·55	7,210	+ 109·55	+ 7,210
MINERAL BEACH SANDS (RUTILE)—				
Outside Proclaimed Goldfields	297·45	8,423	+ 297·45	+ 8,423
MINERAL BEACH SANDS (LEUCOXENE)—				
Outside Proclaimed Goldfields	276·25	3,930	+ 276·25	+ 3,930
MINERAL BEACH SANDS (ZIRCON)—				
Outside Proclaimed Goldfields	4,068·34	41,129	+ 4,068·34	+ 41,129
OCHRE (RED)—				
Murchison	104·00	1,040	— 67·00	— 670
OCHRE (YELLOW)—				
Murchison	....	....	— 18·30	— 183
PETALITE—				
Coolgardie	....	....	— 67·77	— 293
PHOSPHATIC GUANO—				
Outside Proclaimed Goldfields	....	....	— 169·65	— 1,827
PYRITES ORE AND CONCENTRATES—				
East Coolgardie	14,121·39	69,270	+ 3,647·75	+ 20,763
Dundas	38,909·00	302,719	— 6·00	— 621
QUARTZ GRIT—				
Collie Coalfield	312·00	260	+ 222·00	+ 185
SEMI-PRECIOUS STONES—	lb.		lb.	
CHRYSOPRASE—East Coolgardie	....	....	— 5·00	— 5
OPALINE—East Coolgardie	....	....	— 25·00	— 4
TALC—	Tons		Tons	
Outside Proclaimed Goldfields	4,047·69	58,085	+ 1,547·02	+ 22,781
TANTO-COLUMBITE—				
Pilbara	3·10	4,343	— 0·93	— 2,580
Greenbushes	5·36	5,490	+ 3·36	+ 3,862
TIN—				
Greenbushes	22·95	12,818	+ 8·71	+ 6,384
Pilbara	226·75	141,911	+ 102·79	+ 71,025
ZINC (Metallic)—				
Pilbara	....	....	— 20·06	— 511

TABLE 8

Total Coal output from Collie Coalfield during **1958** *and* **1959**, *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—								
1958	779,395	2,053,038	178	842	1,020	4,378	925	764
1959	800,856	2,097,825	153	804	957	5,234	995	836
Open Cut Mining—								
1958	91,487	227,611	52	....	52	1,759	....	1,759
1959	110,578	258,709	54	....	54	2,047	....	2,047
Totals—								
1958	870,882	2,280,649	230	842	1,072	3,786	1,034	812
1959	911,434	2,356,534	207	804	1,011	4,403	1,133	901

* Effective workers only and totally excluding non-workers for any reason whatsoever.

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

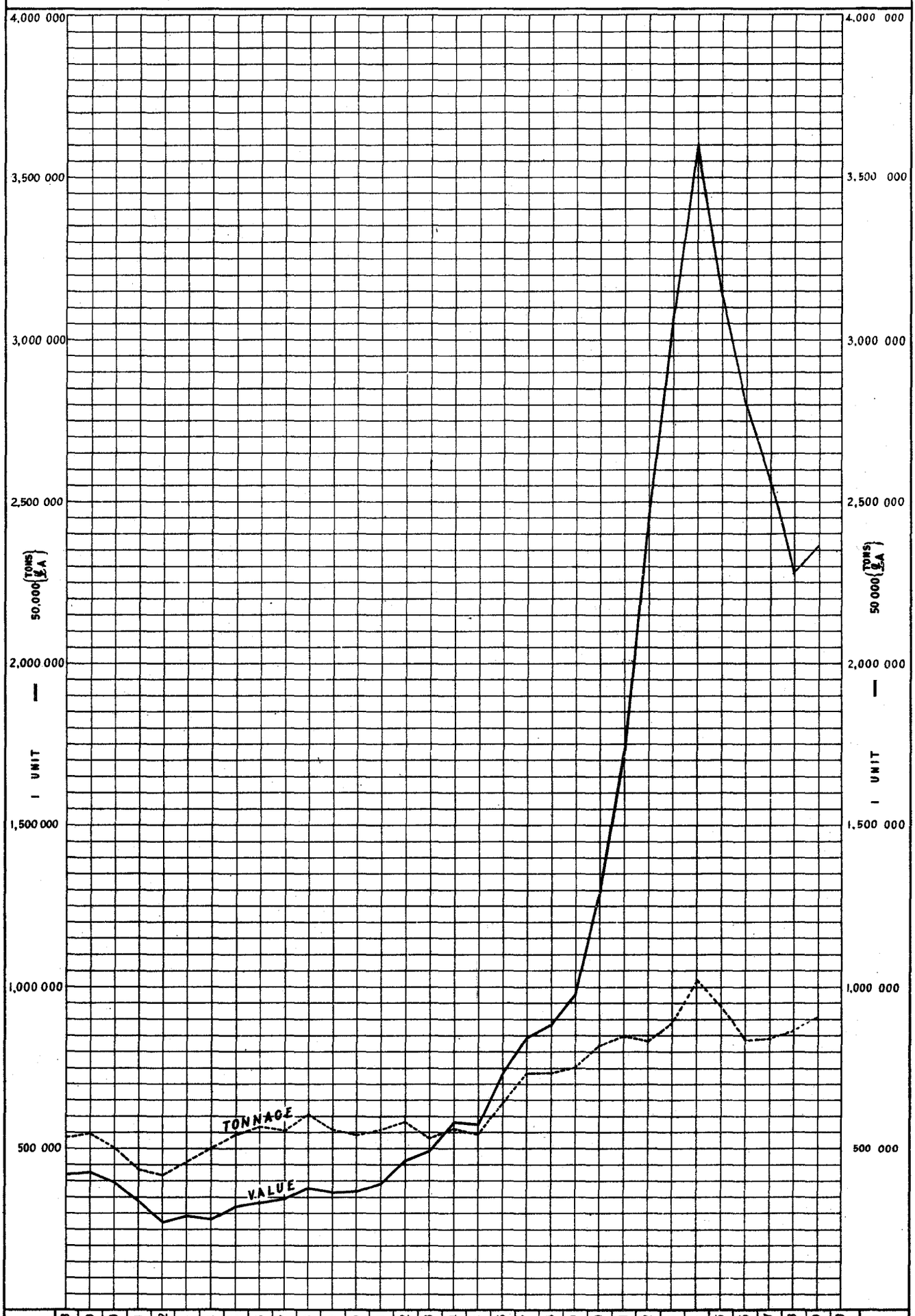
TABLE 9

Total Number and Acreage of Leases, Mineral Claims, Dredging Claims and Prospecting Areas held for Mining on the 31*st December*, 1958 *and* 1959

Leases and other Holdings	1958		1959	
	No.	Acreage	No.	Acreage
Gold Mining Leases on Crown Lands	1,106	20,217	1,099	20,146
Gold Mining Leases on Private Property	25	560	30	653
Mineral Leases on Crown Lands	207	38,783	226	40,337
Mineral Leases on Private Property	13	1,973	12	1,961
Dredging Claims—				
Gold	....	....	....	....
Minerals	147	11,050	137	10,141
Mineral Claims	574	39,338	597	42,787
Prospecting Areas—				
Gold	464	8,078	473	8,340
Minerals	39	877	37	806
Total	2,575	120,876	2,611	125,171

GRAPH OF COAL OUTPUT

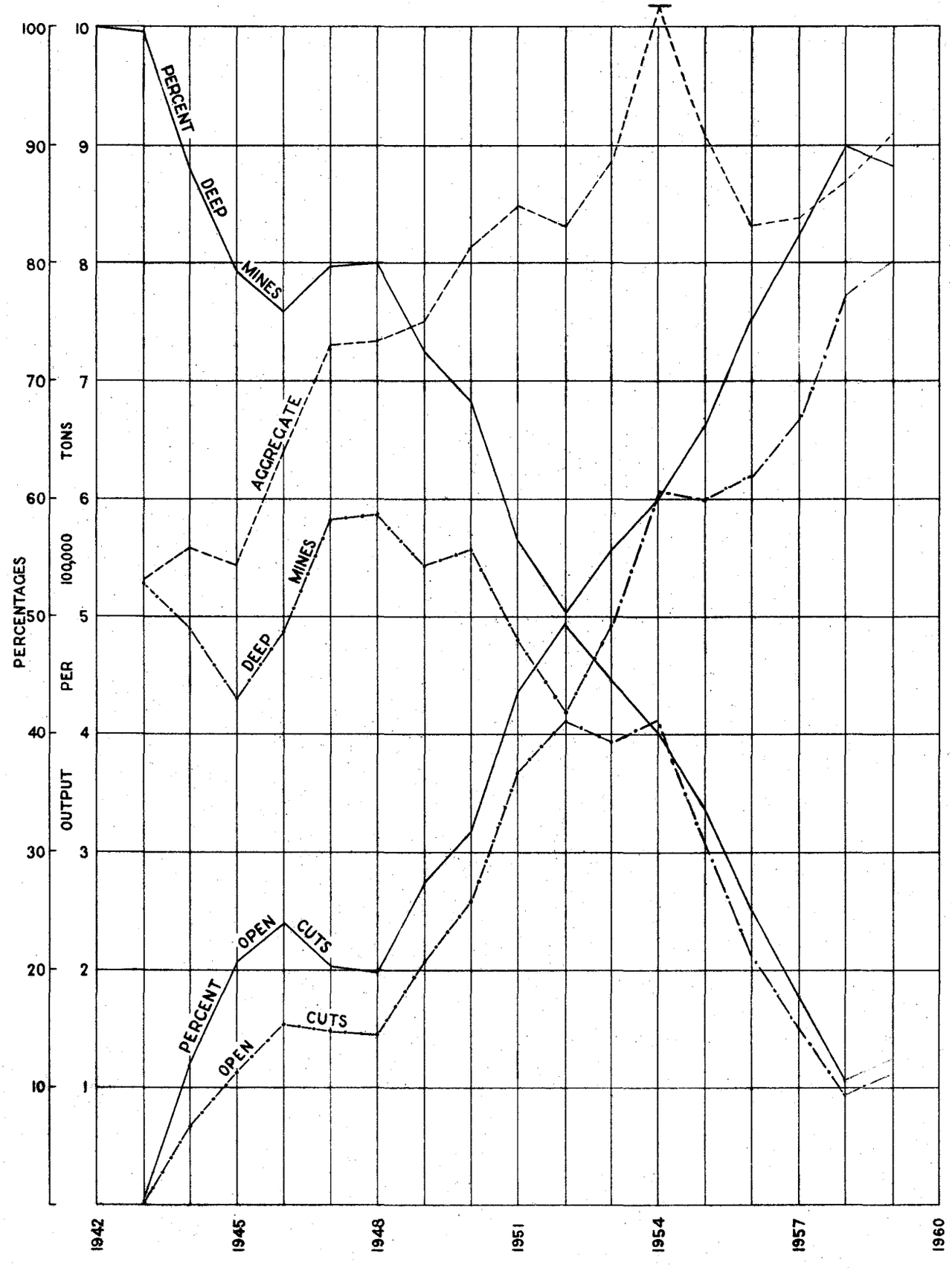
Showing Quantities and Values as reported to Mines Dept.



YEAR	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	YEAR
VALUE £A	420145	426706	394758	336178	270630	289806	278704	318013	331565	340444	375083	362811	364500	389278	461495	489721	583075	577896	730104	840749	880236	972745	1,287749	1,716788	2,457296	3073073	3588888	3,832074	2787606	2553655	2280648	2,356,534		VALUE £A
TONS	528420	544719	501425	432400	416719	458399	500343	537188	565075	553510	604793	557535	539427	566574	581176	531546	583322	543363	642287	730506	737938	750534	814351	848475	830461	886182	1048343	943782	890008	834650	870882	911434		TONS

GRAPH OF TREND IN COAL OUTPUT

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



PART—IV. MEN EMPLOYED

TABLE 10

**Average number of Men reported as engaged in Mining during 1958 and 1959*

Goldfield	District	Total 1958	Total 1959
Kimberley		4	4
West Kimberley		....	....
Pilbara	Marble Bar	52	47
	Nullagine	17	19
West Pilbara		3	2
Ashburton		....	....
Gascoyne		....	....
Peak Hill		11	10
East Murchison	Lawlers	5	7
	Wiluna	2	3
	Black Range	18	15
Murchison	Cue	31	34
	Meekatharra	20	18
	Day Dawn	14	7
	Mt. Magnet	263	246
Yalgoo		6	6
Mt. Margaret	Mt. Morgans	6	5
	Mt. Malcolm	262	246
	Mt. Margaret	8	6
North Coolgardie	Ularring	31	30
	Niagara	7	6
	Yerilla	24	24
	Menzies	107	105
Broad Arrow		71	68
North-East Coolgardie	Kanowna	12	15
	Kurnalpi	2	3
East Coolgardie	East Coolgardie	3,122	3,109
	Bulong	5	6
Coolgardie	Coolgardie	175	172
	Kunanalling	19	18
Yilgarn		627	606
Dundas		424	432
Phillips River		2	2
State Generally		2	2
Total, Gold Mining		5,352	5,273
Minerals Other than Gold—			
Asbestos		324	352
Barytes		1	....
Bentonite		1	....
Beryl		28	38
Clays		9	8
Coal		1,072	1,011
Copper		120	135
Cupreous Ore (Fertiliser)		53	59
Felspar		3	5
Glass Sand		2	3
Glauconite		3	2
Gypsum		15	18
Iron Ore		122	166
Lead		47	47
Manganese		86	97
Mineral Beach Sands (Ilmenite, etc.)		89	97
Pyrites		114	117
Talc		4	4
Tanto-Columbite		3	1
Tin		45	43
Total, Other Minerals		2,140	2,203

*Effective workers only and totally excluding non-workers for any reason whatsoever.

PART V.–ACCIDENTS.

TABLE 11.

MEN EMPLOYED IN MINES KILLED AND INJURED IN MINING ACCIDENTS DURING 1958 AND 1959

A.—*According to Locality of Accident*

Goldfield	Killed		Injured		Total Killed and Injured	
	1958	1959	1958	1959	1958	1959
1. Kimberley	....	....	....	....	....	....
2. West Kimberley	....	....	1	3	1	3
3. Pilbara	1	....	1	1	2	1
4. West Pilbara	....	....	14	10	14	10
5. Ashburton	....	....	....	....	....	....
6. Gascoyne	....	....	....	....	....	....
7. Peak Hill	....	....	....	....	....	....
8. East Murchison	....	....	....	....	....	....
9. Murchison	1	....	10	9	11	9
10. Yalgoo	....	....	....	....	....	....
11. Mount Margaret	1	....	18	24	19	24
12. North Coolgardie	....	....	5	5	5	5
13. North-East Coolgardie	....	....	....	....	....	....
14. Broad Arrow	....	....	1	....	1	....
15. East Coolgardie	6	1	278	277	284	278
16. Coolgardie	....	....	2	3	2	3
17. Yilgarn	....	....	44	54	44	54
18. Dundas	1	....	35	38	36	38
19. Phillips River	....	....	19	13	19	13
Mining Districts—						
Northampton	....	....	3	7	3	7
Greenbushes	....	....	....	....	....	....
Collie	....	2	124	123	124	125
South-West	....	....	7	5	7	5
Total	10	3	562	572	572	575

From the above table it will be seen that the number of fatal accidents for the year 1959 was three as against 10 in 1958. The number injured showed an increase of 10. These accidents are classified according to their causes in the reports of the State Mining Engineer, Division II, and the Chief Coal Mining Engineer, Division X.

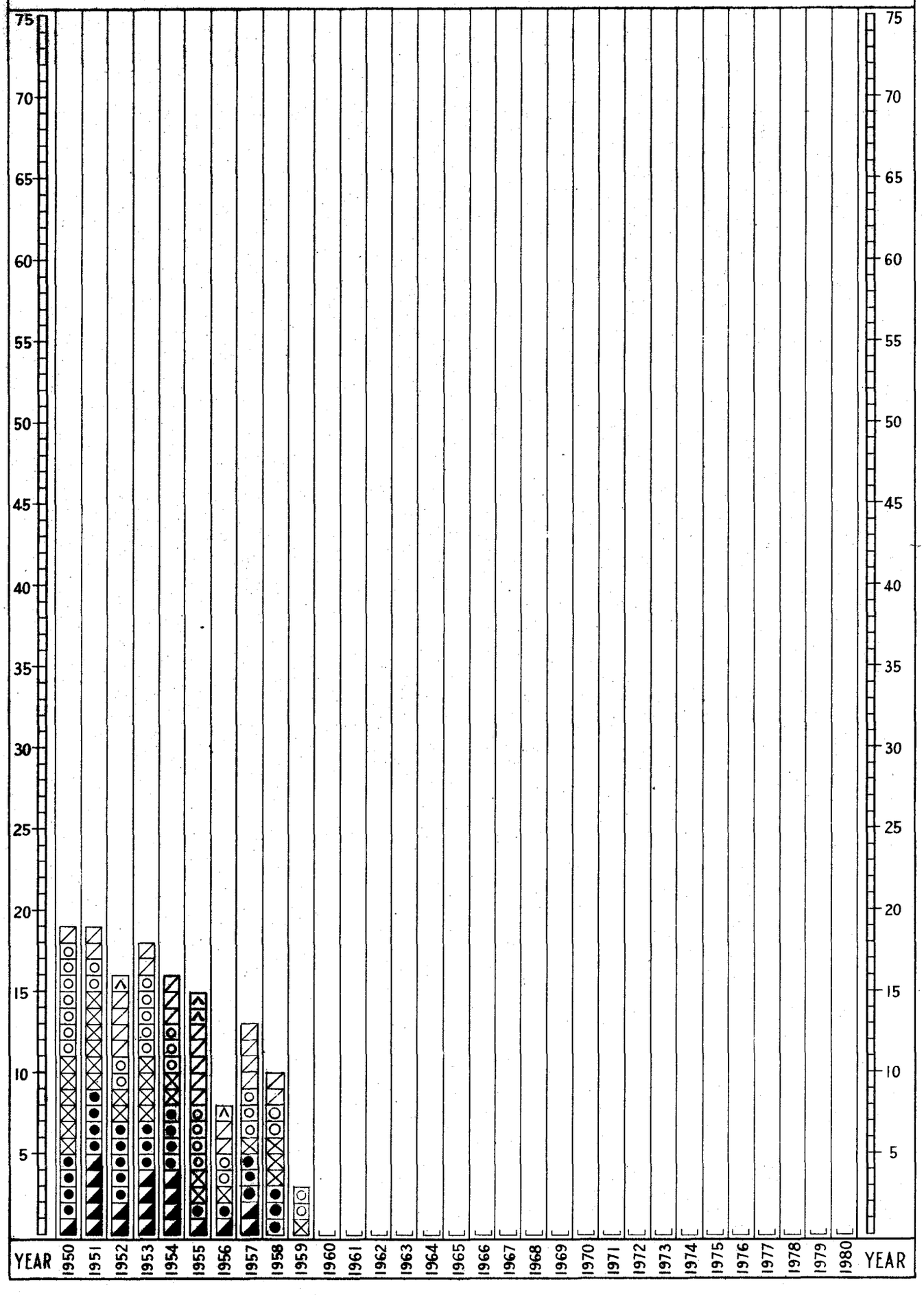
B.—*According to Causes of Accidents*

Cause	1958		1959		Comparison with 1958	
	Fatal	Serious	Fatal	Serious	Fatal	Serious
1. Explosives	....	3 (*a*)	....	2	....	— 1
2. Falls of Ground	3	34	....	39 (*c*)	— 3	+ 5
3. In Shafts	3	18	1	10	— 2	— 8
4. Miscellaneous Underground	2	410	2	390	....	— 20
5. Surface	2	97 (*b*)	....	131 (*d*)	— 2	+ 34
6. Fumes	....	....	....	....	....	....
Total	10	562	3	572	— 7	+ 10

(*a*) Includes one serious accident in a quarry. (*b*) Includes six serious accidents in quarries. (*c*) Includes one serious accident in a quarry. (*d*) Includes four serious accidents in quarries.

DIAGRAM OF ACCIDENTS

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



PART VI.—STATE AID TO MINING.

(a) *State Batteries.*

At the end of the year there were 22 State Batteries including the Northampton Base Metal Plant.

From inception to the end of 1959, gold, tin, tungsten, lead, copper and columbite ores to the value of £17,373,839 have been treated at the State Batteries. Included in the above amount is gold premium of £6,278,064, and premium paid by sales of gold by the Gold Producers Association Ltd., of £40,452. £17,015,149 came from 3,245,398 ton of gold ore, £94,577 from 81,818 tons of tin ore, £18,850 from 3,960 tons tungsten ore, £242,615 from 22,108.5 tons lead ore and £2,648 from 130 tons of copper ore.

During the year 39,048 tons of gold ores were crushed for 17,346 oz. bullion, estimated to contain 14,700 oz. fine gold, equal to 7 dwts. 12 grs. per ton. The average value of sands after amalgamation of 3 dwts. 1 gr. per ton, making the average head value 10 dwts. 13 grs. per ton. Cyanide plants produced 3,142 oz. fine gold, giving a total estimated production for the year of 17,842 oz. fine gold valued at £279,117.

The working expenditure for the year for all plants was 181,868 and the revenue was 41,318 givgin a working loss of £140,550, which does not include depreciation or interest. Since the inception of State Batteries, the Capital expenditure has been £756,511, made up of £576,858 from General Loan Funds; £137,245 from Consolidated Revenue; £28,622 from Assistance to Gold Mining Industry; and £13,786 from Assistance to Metalliferous Mining.

Head Office expenditure including Workers' Compensation Insurance and Pay Roll Tax was £19,050, compared with £19,997 for 1958.

The working expenditure from inception to the end of 1959 exceeds revenue by £1,196,475.

During 1959 deaths occurred of two of our Battery Managers, R. G. Coombe and A. Clayden. Both of these men, although Managers for only a few years, had loyally served the State Batteries Branch for many years.

(b) *Prospecting Scheme.*

During the year 73 men were approved for assistance on the Prospecting Scheme and there were 61 men still in receipt of assistance on the 31st December.

An amount of £12,157 12s. 5d. was spent to maintain prospectors during the year and £2,244 9s. 4d. was received in refunds. Since the inception of the Scheme a total amount of £392,824 19s. 9d. has been expended, and a total of £79,335 7s. 2d. has been refunded over the period. Of the total amount expended £80,346 1s. 9d. was subsidised by the Commonwealth Government.

Assisted prospectors have reported crushings totalling 3,774 tons for a return of 1,119 oz. 4 dwts. The total crushings since the Scheme commenced in 1933 were 108,834 tons 5 cwts. for a return of 52,348 oz. 13 dwts. of gold.

(c) *Drilling Programmes.*

During the year the Department's drills operated at Tallering Peak, Day Dawn, Meekatharra, Coolgardie, Ord River, Broome, Fremantle, Yilgangie and Collie. The drilling projects at Tallering Peak and Day Dawn (Gt. Fingall) were completed during the year. Drilling was commenced at Coolgardie and Meekatharra to prospect for new developments about old mines. Work for the Public Works Department was carried out at the Ord River Dam Site and in connection with Harbour developments at Broome. Some drilling was done for the Railways at Fremantle in connection with the proposed bridge site. The Falling drill was still at Collie in use by Amalgamated Collieries to test a deposit of coal for its possibilities as a future colliery.

(d) *Geological Survey of Western Australia.*

The principal work of the Geological Survey Branch for the year 1959 is covered by the following reports published in Division IV of this Report:—

Report on Water Drilling Operations in the Kalannie District.
Report on Water Supply, West Kimberley Stations.
Activities of the Hydrological Section during 1959.
Report on Iron Deposits, Six Miles North of Roy Hill Station, Nullagine District, Pilbara Goldfield.
Progress Report on the Geological Survey of the Balfour Downs 4-mile Sheet, Pilbara Goldfield, Western Apstralia.
Report on Gold Find P.A. 2417, Approximately 10 Miles East—South-East of Beete Railway Siding, Dundas Goldfield.
Report on the Burnakura Goldmining Prospect G.M.L. 1936N, Murchison Goldfield.
The Search for Oil in Western Australia in 1959.
Progress Report on the Survey of the Widgiemooltha Area, Coolgardie Goldfield.
Report on Diamond Drilling of "Great Fingall" Quartz Reef in Depth, D.D.H. No. F5.
Report on Diamond Drilling of "Great Fingall" Quartz Reef in Depth, D.D.H. No. F6.
Summary Report on Subsidised Diamond Drilling, Heppingstone's Find, Yarrie, North Coolgardie Goldfield.
Historical Summary of Exploratory Diamond Drilling of the "Great Fingall" Quartz Reef in Depth.
Notes on the Geology of Portion of the Mt. Malcolm District, Mt. Margaret Goldfield.
Notes on the Diamond Drilling of the Bandicoot Bar Diversion Damsite, Ord River, East Kimberley Division.
Report on Diamond Drilling of Abandoned Gold Shows, D.D.H. No. C1 Site A1, G.M.L. 336, "Lady Loch" G.M. Coolgardie.
Report on Diamond Drilling of Abandoned Gold Shows D.D.H. No. C2, Site A2, G.M.L. 336, "Lady Loch" G.M., Coolgardie.
Report on the Exploratory Drilling of the Tallering Range Iron Deposits.
Report on Diamond Drilling of Abandoned Gold Shows, D.D.H. No. C3, Site B1, "Forest King" G.M., Late G.M.L. 284, Coolgardie.

During the year the following publications were issued:—

Bulletin 105, Pt. 2—The Collie Mineral Field, by G. H. Low, B.Sc.
Bulletin 109—Miscellaneous Reports for 1954.
Bulletin 112—Miscellaneous Reports for 1955.
Annual Progress Report of the Geological Survey of Western Australia for the year 1957—Administrative Section only.

The following reports have been compiled and await publication:—

Mineral Resources Bulletin No. 7—Iron Ores in Western Australia.
Bulletin 113—Miscellaneous Reports for 1956.
Bulletin 114—Miscellaneous Reports for 1957.
Annual Progress Report for 1958.

In course of preparation:

A Bulletin on the Geology of the Nullagine and Marble Bar 4 miles = 1 inch Sheets.
A Mineral Resources Bulletin on the Manganese and Chromite Resources of W.A.
A Mineral Resources Bulletin on the Copper Deposits of W.A.

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.

PART VII.—SCHOOL OF MINES.

(a) Kalgoorlie.

The total number of students enrolled during 1959 was 365—a decrease of 15 by comparison with 1958. The small increase in the number of students enrolled for Associateship Courses noted in last year's report again appeared this year and could now be significant. There was also an increase in the number of students enrolled for Certificate Courses. Generally, there has been in recent years an increase in the standard of the students enrolled.

S. T. Hunter continued to hold a Mines Department Entrance Scholarship. He completed another good year's work and also the final year of his Scholarship. He should complete the Associateship Course in Engineering in 1961. No applications for Scholarships were received during the year.

Twelve students held Chamber of Mines Scholarships and all worked well, three completing the course for which they enrolled. To the end of 1959 seven students had completed Associateship Courses under the Chamber of Mines Scholarship Scheme.

The usual Scholarships and Prizes were awarded at the end of the year and a list of awards is given in Appendix 2 of the Director's Report.

During the year 22 students completed Associateship Courses; 15 students, Certificate Courses; and 10 students, Technicians Courses. The number completing Associateship Courses was greater than any other year.

For the first time for many years a graduation ceremony was held. Diplomas were presented to students by the President of the Chamber of Mines, Mr. R. J. Agnew, at a brief ceremony held at the Students' Association Ball.

In addition to its teaching activities, the School continued to provide a number of other services to the Public. During the year, 398 samples and specimens were received for assay and/or mineral determination from prospectors and others. This was an increase of 137 by comparison with 1958. The increase was almost entirely in samples submitted for gold assay.

The mineral dressing laboratory for student use referred to in last year's report was brought into use early in 1959 and satisfied a long existing need. General repairs and renovations to the buildings were not done during 1959 as planned, and it now appears that these will not be commenced until late 1960.

During the year the Advisory Committee met on nine occasions. Mr. Golding was appointed by the Associates Association to replace Mr. Warman who resigned from the Committee in 1958 because of his departure from Kalgoorlie. Mr. D. J. Tonks replaced Mr. Blown as representative of the Institution of Engineers during Mr. Blown's absence from Kalgoorlie.

Three Reports of Investigations and 481 Certificates were issued by the Kalgoorlie Metallurgical Laboratory during the year. In addition, 245 "free" Assay Certificates were issued to prospectors and others. Three investigations were in progress at the end of the year—two for the Government Geologist and one for industry.

(b) Norseman.

Enrolments totalled 55 for the year. D. R. C. Hunter was appointed as a Cadet on 9/2/59. During the year nine part-time instructors were employed and the Mining Registrar continued as part-time Registrar of the School.

The Reg. Dowson Scholarships for 1959 were awarded to D. R. C. Hunter and to J. Bottegal. C. J. S. Cook was awarded a Robert Falconer prize at the end of the year.

The buildings are in good condition and adequate for the School.

The Advisory Committee continued to meet with Mr. W. L. Dutton as Chairman.

(c) Bullfinch.

The number of students enrolled was 48. Mr. M. H. Lloyd commenced duty as Officer-in-Charge on 9/2/59. Mr Browne continued as part-time Registrar and seven part-time instructors were employed during the year.

P. Powell, a Bullfinch student, was awarded the Associates Prize for 1959.

The buildings, including the quarters, are in satisfactory condition and adequate for the needs of the School.

The Advisory Committee, with Mr. K. E. Denham as Chairman, met once during the year.

PART VIII.—INSPECTION OF MACHINERY.

The Chief Inspector of Machinery reports that the number of useful boilers registered at the end of the year totalled 7,141 against 6,907 for the preceding year, showing an increase of 234 boilers after all adjustments.

Of the 7,141 useful boilers 1,887 were out of use at the end of the year, 4,091 thorough and 1,163 working inspections were made and 5,177 certificates were issued.

Permanent condemnations total 115 and temporary condemnations 4; 69 boilers were transferred beyond the jurisdiction of the Act.

The total number of machinery groups registered was 42,007 against 40,356 for the previous year, showing an increase of 1,651.

Inspections made total 30,410 and 6,097 certificates were granted.

The total miles travelled for the year, were 91,467 against 88,612 miles for the previous year, showing an increase of 2,855. The average miles travelled per inspection were 2.56 as against 2.56 miles per inspection for the previous year.

387 applications were received and dealt with for Engine Drivers and Boiler Attendants' certificates, and 345 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 sections 60 and 63)	15
Second Class Competency (including certificates issued under Regulation 40 and Section 60 of the Act)	18
Third Class Competency (including certificates issued under Regulations 40 and 45 and Sections 60 and 63)	13
Locomotive and Traction Competency (including certificates issued under Regulation 40 and Section 60)	3
Diesel Locomotive "A" Class Certificate of Competency (including certificates issued under Regulation 40 and Sections 53 and 56)	2
Diesel Locomotive "B" Class Certificate of Competency (including certificates issued under Regulation 40 and Section 53 and 56)	4
Internal Combustion Competency (including certificates issued under Regulation 40 and Section 60)	42
Crane and Hoist Competency (including certificates issued under Regulation 40 and Section 60)	133
Boiler Attendant Competency (including certificates issued under Regulation 40 and Section 60)	100
Copies	5
	345

The total Revenue from all sources during the year was £15,495 0s. 7d. as against £15,904 6s. 1d. previous year, showing a decrease of £409 5s. 6d.

The total Expenditure for the year was £34,187 4s. 7d. against £32,166 10s. 5d. for the previous year, showing an increase of £2,020 14s. 2d.

PART IX.—GOVERNMENT CHEMICAL LABORATORIES.

The total number of samples received was 17,483, a small decrease on the number for last year which was 17,870.

The samples received were allocated to the various Divisions of the Laboratories according to the specialised work undertaken by each Division. In some cases work was done on the same sample in more than one Division so that in the table below some samples occur more than once and the total does not agree with the figure quoted

above. This co-operation between Divisions helps to foster the policy that this is one Government Chemical Laboratories and not five separate Divisions, that the problems in one Division may be assisted by specialists from another Division. It is also further support for the value of one centralised chemical laboratory instead of chemical sections in various Government Departments.

Samples were allocated as shown hereunder:—

Agriculture, Forestry and Water Supplies Division	5,505
Food, Drugs and Toxicology and Industrial Hygiene Division	10,104
Fuel Technology Division	387
Industrial Chemistry Division	32
Mineralogy, Mineral Technology and Geochemistry	1,546

Agriculture, Forestry and Water Supply Division.

1,315 soils were received, a more than fourfold increase on 1958. In the case of soils, the number of samples is not necessarily a true indication of the amount of work involved as in some cases as many as 16 different analyses are required on one sample.

There was a reduction of nearly 25 per cent in the number of water samples received in 1959. This could be attributed to two reasons, firstly continuing good seasonal conditions in farming areas and secondly water restrictions in the metropolitan area have brought boring contractors to the more attractive conditions in the city.

Routine examinations of existing and proposed public water supplies were continued.

Although only 89 samples of official Fertiliser Act samples were received in 1959, a total of 120 were analysed and reported, the extra numbers being due to those received late in 1958 which could not be analysed until 1959.

63 official samples of stockfood were received in 1959, 101 silage samples were received and this is an indication of the current interest in making silage as a nutritious supplement for feeding stock in summer. A wide variety of work was also carried out in connection with cereals, wheat, plant nutrition, vegetables, vines, lupins and orchard and garden trees and plants.

Food, Drugs, Toxicology and Industrial Hygiene Division.

As in recent years, most of the work of this Division consisted of chemical examinations for the Departments of Public Health, Police, Agriculture, Public Works, Metropolitan Water Supply Sewerage and Drainage and the Milk Board of W.A., but a wide variety of miscellaneous work was performed for other Government Departments and the general public.

A total of 431 samples of foods of various kinds were examined. Examinations were made of 290 samples from 91 cases in connection with death from suspected poisoning. In 37 cases no poison or drug was detected, while in 54 cases a poisonous substance or other physiologically active drug was identified on analysis.

There was a considerable increase in the number of samples of blood and urine analysed for alcohol content. Of these 183 were samples of blood submitted by the Police in connection with traffic accidents or sudden death from various causes.

Considerable work was also done in connection with animal toxicology, industrial hygiene, sewage control, pollution surveys of the Swan River, Leschenault Inlet and Metropolitan Ocean Beaches and other miscellaneous subjects.

Fuel Technology Division.

During the year 387 samples, analyses and investigations were undertaken. These consisted of analyses and examinations of coal and other fuels; the design and performance of open fires for domestic use; and industrial work.

Industrial Chemistry Division.

The work of this Division can be classified under three headings:—

(1) Technical enquiries.

(2) Physical and chemical testing in connection with developing projects and the examination of material failures.

(3) Research work.

In all, 3,407 technical enquiries were received. Of the enquiries received 38 per cent. had their origin in Government Departments and 62 per cent were from private industry and members of the public.

The answering of these enquiries absorbed an appreciable amount of time, but this expenditure of time appears to be well justified by results.

For physical and chemical testing various Government Departments and the public submitted 32 samples which were examined and reported upon.

Research work was focused principally on four subjects viz: 1. Painting of Karri timber, 2. Cement additives. 3. Scaevola spinescens. 4. Glueing of timber sashes.

Work has continued on the problem of finding a durable painting system for Karri timber.

It is desirable to have some check on the efficiency or otherwise of the various types of additive in cement and concrete for modifying their properties along desired lines, and work has begun on this subject.

The work on the identification and assay of the alkaloids and glycosides of Scaevola spinescens has been continued.

At the request of the Timber Development Association some work has been begun on the relative merits of five different glues for the glueing of window sashes.

In addition to the four main topics of research investigations have been carried out on a number of minor topics.

Mineralogy, Mineral Technology and Geochemistry Division.

The main sources of samples forwarded to this Division were as follows: General Public (free) 779, General Public (pay) 337, Geological Survey Branch 205, State Batteries Branch 133, making a total of 1,546 samples received. Last year the total number of samples received was 1,207.

With the staff now at full establishment, all bench space is fully occupied. While the staff is adequate to handle day by day work from the Public and other Departments, there is a lot more investigational work that could be done if more space and staff were available.

New specimens added to the Division's Mineral Collection numbered 125, all but a dozen being from localities within the State.

By far the greatest number of new mineral localities recorded were in the North-West Division. The South-West was the only other Division from which new occurrences were reported. Green beryl was found five miles south of Mt. Edon and Anthophyllite at Paynes Find.

PART X.—EXPLOSIVES.

The established system of sea-borne supplies from the factory in Victoria to Woodman's Point Explosives Reserve continued without interruption, nine shipments accounting for 99.1 per cent. of the State's importations. Large scale railage is now under investigation and expected to commence in mid 1960.

Although gelatin dynamite, the gelignites and semi-gelatinous explosives of various grades continued to cover the main field, significant advances were made by ammonium nitrate fuel oil mixtures for quarrying and other open-cut work using large-diameter shot holes. The same composition was also applied successfully to geoseismic blasting.

The importance of explosives in gold mining was evident from its consuming 67.3 per cent. of the State's importations. Next in order came quarrying at 7 per cent. followed by coal and asbestos, each using 6.3 per cent. The remainder was used for geoseismic surveying, production of base-metals, roads, water supplies and other miscellaneous purposes.

Laboratory and field tests have been made of 2,690 samples of explosives, 760 samples of fuse and 513 samples of pyrotechnics. Deterioration on a small scale, due to faulty storage and occasional wetting in transit, was detected, but there were no indications of explosives having been detached from the factory other than in sound condition.

Inspections were made over most of the State, except the far north. In a few instances licenses requested return calls, Large consuming districts like Kalgoorlie received the closest attention because of the many problems arising outside the routine inspectional field. Some glaring instances of indifference were detected among small users, often itinerant foreign quarrymen who could not, or would not, understand their obligations.

As for years past, munitioning of service vessels at Fremantle Harbour came under the Branch's inspection, and although a high safety level was maintained by application of the R.A.N.R. authorities' rigid code, the fact remained that explosives and incendiaries were handled within potentially devastating distances of protected works. Several years ago the Commonwealth appeared to appreciate the need for an isolated deep-water jetty for handling these. Failure to take action is deplored.

A draft Explosives and Dangerous Goods Act has been prepared by Crown Law Department on material submitted by the Branch but requires further alterations before it is introduced in the form of a Bill before Parliament. However, it is expected it will be put forward during the 1960 Session.

Investigations were carried out regarding post-explosive toxic gases or fumes as a result of a report of higher average carbon monoxide concentrations by the Mines Inspectorate at Kalgoorlie.

The Sixth Australasian and New Zealand Explosives Conference held at Brisbane was attended and many subjects provided valuable discussions.

The usual frequent consignments of shopgoods or toy class fireworks were examined. Several new contenders for a share in the local market sent advance sample boxes and showed readiness to modify, improve or even withdraw anything to which exception was drawn.

Reconditioning of approach roads, grading within the area and attention to lightning arrestors was undertaken at Kalgoorlie Explosive Reserve. The Woodman's Point Reserve required little attention other than routine maintenance.

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

Under arrangements made with this Department, the State Public Health Department carried out the periodical examinations of mine workers at the Kalgoorlie District Hospital and the mobile x-ray unit visited the North Coolgardie, Mount Margaret, East Murchison, Murchison, Pilbara, West Pilbara, Coolgardie, Dundas, Phillips River and Yilgarn Goldfields and Capel and Esperance outside any proclaimed Gold or Mineral Field.

The examinations under the Mine Workers' Relief Act during the year totalled 5,818, an increase of 104 on the previous year. Examinations under the Mines Regulation Act totalled 1,451. These were in addition to the 5,818 under the Mine Workers' Relief Act. Details of the results of these x-ray examinations are given in the Report of the Superintendtnt in Division IX of the Annual Report.

The 1958 amendment to the Mine Workers' Relief Act to broaden the scope of the Act to include asbestosis was proclaimed in the *Government Gazette* of the 27th February, 1959.

Compensation paid under the Miners' Phthisis Act during the year totalled £13,718 9s. 8d. compared with £14,969 15s. for the previous year. The number of beneficiaries under the Act on the 31st December, 1959, was 127, being 11 ex-miners and 116 widows.

On the 29th July the Department took over a new mobile x-ray unit for the radiological examination of mine workers in outlying districts. This replaced the old Austin unit. The completed unit cost approximately £4,500, and the van was built by students of the Perth Technical College under the supervision of the Public Works Department. The x-ray equipment was installed under the direction of the Public Health Department.

PART XII.– CHIEF COAL MINING ENGINEER'S BRANCH.

The total output of all mines for the year 1959 was 911,434 tons, an increase of 40,552 tons on the production for the previous year, and the second largest output on record. Of the total output the deep mines produced 800,856 tons or 87.86 per cent and 110,578 tons were produced from the open cuts representing 12.14 per cent.

The value of the total output was £2,356,534 and the average cost per ton was 51s. 9d. per ton, as compared with an average cost of 52s. 4d. per ton in 1958.

Once again the State Electricity Commission was the largest consumer, using 449,345 tons. The Collie Power Station used 67,957 tons and the W.A. Government Railways, 295,606 tons.

The Collie Coalfield continues to be the most highly mechanised in Australia, but the adoption of the Retreating System of work throughout could materially improve the efficiency of the field.

PART XIII.– CHIEF DRAFTSMAN.

The staff now numbers 24 and opportunity has been taken to arrange field service for cadets with our contract surveyors on lease surveys in the goldfields and also with geologists on geological survey work in the field.

Contract surveyors completed surveys of 128 mining tenements and other surveys in connection with the mapping programme. Surveys were carried out in the South-West Division and in the following gold and mineral fields: Peak Hill, Murchison, Yilgarn, Greenbushes and Collie.

The examination of the surveyor's plans and diagrams was carried out in the Branch and, in addition, the drawing and computation of boundaries of all existing Permits to Explore for Oil and Licenses to Prospect for Petroleum were completed.

The mapping programme on the Transverse Mercator Projection was continued. The first of the 4 miles to an Inch Geological Map was prepared and printed.

All Branches have made considerable use of the photo-copying facilities available with the Copyrapid machine.

Increased interest in minerals has been reflected by the large numbers of enquiries at the Public counter for information and plans.

STAFF.

This year, again, I would like to take the opportunity of thanking all members of the staff, both at Head Office and at Outstations, for the loyal and efficient manner in which they have carried out their duties.

In this summary of the various activities of the Department, I have commented only on the principal items. Divisions II to XII of this publication contain the detailed reports of the responsible Branch officers.

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

Department of Mines,
Perth.

DIVISION II

Report of the State Mining Engineer for the Year 1959

Under Secretary for Mines:

The Annual Report for this branch has been prepared by the Assistant State Mining Engineer and is based on information supplied by the Inspectors of Mines and the Statistical Branch.

The only staff change was caused by the resignation of Workmen's Inspector Prince, who was succeeded by Mr. T. A. Birch.

The fatal accident rate was the lowest ever recorded there being only one fatal accident for the year.

Ventilation has been carefully watched and I am pleased to report a big improvement in conditions in the mill at Wittenoom Gorge.

The outstanding development in the gold mining industry has been the electrification of several winders at Kalgoorlie. This has resulted in more efficient operation and in much better conditions for the operators.

The general position of the gold mining industry is unchanged. Constantly rising costs have been met by increased efficiency reflected in the smaller numbers of men employed.

The apparent increase in the number of men employed as shown in the tabulations is accounted for by the inclusion of absentees representing those on leave, or sick, or suffering from accidents. This has not been done in previous years.

The metal market generally has been depressed and the production of lead, manganese and beach sands has been curtailed.

Tin and Copper have remained stable and increased production is reported in both cases.

The demand for copper of fertilizer grade continues and known sources have been seriously depleted.

The possibility of an export trade in iron ore is still under discussion and the examination of our iron ore deposits continues.

The production for domestic use is increasing.

Some attempt has been made to develop an export trade in gypsum and magnesite but progress to date is small.

Some increase in the production of blue asbestos is reported and the industrial minerals have mostly shown an increase.

The increase of £1,162,975 in the value of minerals other than gold represents a general increase in the level of production.

E. E. BRISBANE,
State Mining Engineer.

State Mining Engineer.

Mining activities for the year 1959 are described in this report, which is based on information supplied by the Statistician and Inspectors of Mines. The section on drilling written by Inspector Haddow and the report of the Board of Examiners for Mine Managers' and Underground Supervisors' Certificates appear as appendices to this report.

STAFF.

Workmen's Inspector R. J. Prince, who was stationed at Leonora, resigned on the 28th August. The vacancy was filled by Mr. T. A. Birch, who commenced duties as Workmen's Inspector of Mines on the 23rd November.

ACCIDENTS.

Fatal and serious accidents, in metal mines and quarries, reported to the Department are shown below. The corresponding figures for 1958 are shown in brackets.

There were 1 (10) fatal and 449 (438) serious accidents.

In gold mines there were 1 (9) fatal and 402 (389) serious accidents. The number of men employed in such mines was 5,769 (5,352). The accident rate per 1,000 men was thus 0.17 (1.68) for fatal accidents and 69.68 (72.68) for serious accidents.

The man killed was Andrew James Straw, a platman employed at Hamilton Shaft by the Great Boulder Gold Mines Ltd., Fimiston. He suffered multiple injuries when he fell about 130 feet down the shaft from the 3,100 level plat. It would appear that at the time of the accident (3 p.m., 4/12/59) he was reaching for a badly placed bell pull to cancel a previously given signal and was thrown off balance when the cage moved upwards.

There were no fatal quarry accidents during the year under review.

Oil well drilling companies, employing 149 men in the field reported eight serious and 18 minor accidents.

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 mineral mined.

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

TABLE A.

Serious Accidents for 1959.

Class of Accident	West Kimberley	Pilbara	West Pilbara	Murchison	North-ampton	Mount Margaret	North Coolgardie	East Coolgardie	Coolgardie	Yilgarn	Dundas	Phillips River	South-West-	Total
Major Injuries—Exclusive of Fatal—														
Fractures :														
Head	....	....	....	....	....	....	....	1	....	....	....	....	....	1
Shoulder	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Arm	....	....	....	....	1	....	....	7	....	....	1	....	....	9
Hand	....	....	....	....	1	....	....	2	....	2	....	....	1	6
Spine	....	....	1	....	....	1	....	....	....	....	....	....	....	2
Rib	....	....	....	....	....	....	....	3	....	2	1	1	1	8
Pelvis	....	....	....	....	....	1	....	1	....	....	....	....	1	3
Thigh	....	....	....	....	....	....	....	1	....	....	....	....	....	1
Leg	....	....	....	....	....	1	....	6	....	1	....	....	....	8
Ankle	....	....	....	....	....	....	....	4	....	....	....	....	....	4
Foot	....	....	....	....	1	....	....	7	....	3	2	....	....	13
Amputations :														
Arm	....	....	....	1	....	....	....	....	....	....	....	....	....	1
Hand	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Finger	....	....	....	....	....	....	....	1	....	1	1	....	....	3
Leg	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Foot	....	....	....	....	....	....	....	1	....	....	....	....	....	1
Toe	....	....	....	....	....	....	....	....	....	1	....	....	....	1
Loss of Eye	....	....	....	....	1	....	....	....	....	....	....	....	....	1
Serious Internal	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Hernia	....	....	....	....	....	....	....	8	....	....	3	....	....	11
Dislocations	....	....	....	....	....	....	....	....	....	1	....	....	....	1
Other Major	....	....	....	....	....	....	....	....	....	....	1	....	....	1
Total Major	....	....	....	1	1	6	....	42	....	11	9	1	3	75
Minor Injuries—														
Fractures :														
Finger	....	....	....	1	1	2	1	7	....	....	....	....	....	12
Toe	....	....	....	....	....	1	....	6	....	....	....	....	....	7
Head	....	....	....	1	1	1	....	5	....	1	3	....	....	12
Eyes	....	....	....	....	....	....	....	6	....	1	....	....	....	8
Shoulder	....	....	....	....	....	....	....	7	....	2	....	....	....	9
Arm	....	....	2	....	....	3	....	11	....	1	4	1	....	22
Hand	....	....	....	1	....	4	1	61	3	12	6	3	....	91
Back	....	....	....	3	2	4	2	44	....	1	2	7	1	69
Rib	....	....	....	....	....	....	....	....	....	1	2	....	....	3
Leg	....	....	3	2	3	....	1	51	....	15	7	1	....	83
Foot	....	....	3	....	....	2	....	21	....	7	3	....	1	37
Other Minor	....	....	....	....	....	1	....	16	....	2	2	....	....	21
Total Minor	....	....	9	8	6	18	5	235	3	43	29	12	2	374
Grand Total	....	....	10	9	7	24	5	277	3	54	38	13	5	449

There were no serious accidents reported in the year under review in the following Goldfields :—Kimberley, Ashburton, Peak Hill, Gascoyne, East Murchison, Yalgoo, North-East Coolgardie, Broad Arrow and Greenbushes.

TABLE B.

Minerals other than Coal and Oil.

Mineral	Men Employed	Accidents		
		Fatal	Serious	Minor
Asbestos	352	....	10	192
Beryl	38	....	....	....
Copper	194	....	14	81
Gold	5,769	1	402	1,767
Ilmenite	97	....	....	....
Iron Ore	166	....	3	20
Lead	47	....	7	5
Manganese	97	....	....	5
Pyrite	117	....	8	26
Tin	43	....	....	....
Other Minerals	41	....	....	....
Rock Quarries	313	....	5	8
Totals	7,274	1	449	2,104

TABLE C.

Fatal and Serious Accidents showing Causes and Districts.

District	Explosives		Falls		Shafts		Fumes		Miscellaneous Underground		Surface		Total	
	Fatal	Serious	Fatal	Serious	Fatal	Serious	Fatal	Serious	Fatal	Serious	Fatal	Serious	Fatal	Serious
Kimberley	....	....	....	....	....	....	....	....	....	....	....	....	....	....
West Kimberley	....	....	....	....	....	....	....	....	....	....	....	3	....	3
Pilbara	....	....	....	....	....	....	....	....	....	....	....	1	....	1
West Pilbara	....	....	....	....	....	1	....	....	....	2	....	7	....	10
Ashburton	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Peak Hill	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Gascoyne	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Murchison	....	....	....	1	....	....	....	....	....	5	....	3	....	9
East Murchison	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Yalgoo	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Northampton	....	....	....	2	....	....	....	....	....	4	....	1	....	7
Mt. Margaret	....	....	....	....	....	1	....	....	....	13	....	10	....	24
North Coolgardie	....	....	....	....	....	....	....	....	....	3	....	2	....	5
Broad Arrow	....	....	....	....	....	....	....	....	....	....	....	....	....	....
North-East Coolgardie	....	....	....	....	....	....	....	....	....	....	....	....	....	....
East Coolgardie	....	1	....	29	1	5	....	....	....	188	....	54	1	277
Coolgardie	....	....	....	....	....	....	....	....	....	2	....	1	....	3
Yilgarn	....	....	....	3	....	3	....	....	....	37	....	11	....	54
Dundas	....	....	....	1	....	....	....	....	....	27	....	10	....	38
Phillips River	....	....	....	....	....	....	....	....	....	10	....	3	....	13
Greenbushes	....	....	....	....	....	....	....	....	....	....	....	....	....	....
South-West	....	....	....	1	....	....	....	....	....	....	....	4	....	5
Total for 1959	....	1	....	37	1	10	....	....	....	291	....	110	1	449
Total for 1958	....	3	3	28	3	18	....	....	2	313	2	76	10	438

WINDING MACHINERY ACCIDENTS.

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

Fatal.—(1) This accident at Hamilton Shaft appears earlier in this report.

Overwinds.—(9) An overwind occurred on the 21st March at the Copperhead mine. The cage at the 1,800 foot level was signalled to the 800 foot level but the driver drove in the wrong direction causing the cage to descend into the sump. The counterweight rope clips on going into the sheave wheel burst a section off the side of the wheel which cut the rope. The counterweight remained anchored in the head frame. No serious personal injury resulted from this accident.

On the 3rd April overwinds occured at Edwards shaft, and Chaffers shaft when the drivers failed to reverse their engines after tipping skips of ore. All safety devices functioned satisfactorily and no damage resulted.

At the Ivanhoe shaft on the 10th June the driver allowed the emptied skip to move upwards causing the detaching hook to enter the thimble. The hook was not detached from the skip.

When a trainee driver was practicing at the Copperhead shaft on the 26th June he applied the power in the wrong direction causing the skip to be overwound. No damage resulted.

A mishap occured at the Sons of Gwalia mine on the 14th August. Both skips were at the No. 25 level and when the driver started to bring the north skip to the surface, he neglected to take the south skip out of gear with the result, it hit the shaft bottom. About 85 feet of rope was coiled on the skip before the driver could stop the engine. The rope was not damaged.

At the Associated shaft and at the Sons of Gwalia skips were overwound when the drivers failed to sufficiently retard the load when approaching the tipping pint. Safety equipment operated in both cases and little damage resulted.

An overwind occurred at Edwards shaft on the 28th December when the driver forgot to reverse the engine after tipping a skip of ore. All safety devices functioned and no damage resulted.

Cages Hung Up.—(5) On the 27th April the skip in the north compartment of the Croesus shaft stuck on a broken skid about halfway between ground level and the tip. The skip, on its way down after tipping its load, was distorted.

When a load of old pipes and rails was being brought to the surface at the Victoria shaft on the 3rd July, the lashing came adrift causing the material to foul the shaft and jam the cage about 80 feet below the shaft collar.

A stone which rested on the skip bail under the skip tub caused the skip, in the south compartment of Chaffers shaft, to jam in the tipping track on the 12th August.

The cage hung up in Frazer's shaft of Great Western Consolidated N.L. on the 27th August. The cause of this mishap was the loss of a nut and lock nut from the gripper linkage assembly. A new nut and lock nut had been fitted a week earlier but apparently had not been tightened sufficiently. The platman who was in the cage, sustained a strained knee.

On the 30th November at the Victoria shaft the left hand skip hung in the tipping position when the driver reversed the engine. About forty feet of rope was lowered before the driver could stop the engine. It is assumed that a small stone caused the accident.

Derailments.—(5) The descending south skip was derailed in the Regent shaft of Central Norseman Gold Corporation on the 17th March. Nine centre legs were knocked out and two dislodged.

On four occasions descending skips in the Royal shaft, Norseman were derailed. No one was injured in any of these accidents.

Mechanical Failures.—(3) The counterweight balance rope broke in the 1200 Winze, Hamilton shaft on the 26th March. The rope broke approximately 200 feet from the counterweight. No visible defects were observed when the rope was cut near the weight about three weeks previously. The break was caused by corrosion of the internal wires of the rope. There was no damage to any other equipment.

The shackle connecting the chains to the trailer skip of the Sons of Gwalia shaft broke on the 27th May. At about 11 p.m. the trailer skip was being

pulled on to the drop rails prior to the change of shifts. The break was clean and showed no signs of cracking. It would appear that a sudden jerk broke the cold shackle which had been annealed in March. A new type shackle was fitted.

A hot bearing developed on the winder of Lake View shaft on the 11th June. Investigation showed that the oil ring had broken on the pinion shaft bearing causing the bearing metal to run.

Miscellaneous.—(7) On the 6th January in the Lake View shaft the left hand cage was approaching the 1,000 foot level and was being retarded by the brake when the greaser's clothing caught in the governor gear and the overwind control operated. The sudden stop caused two turns of rope to jump off the drum and wrap around the winder shaft. The cage was suspended by the grippers and approximately 30 feet of rope piled up on it. A new rope was fitted. A directive was issued forbidding the cleaning of machinery whilst it is in motion.

Two men riding on the skip at the Iron King mine, Norseman were taken to the tipple when the driver who had been hoisting ore forgot momentarily that the men had rung to the surface. No injuries resulted.

Confusion through the use of private signals resulted in a man receiving a broken wrist in the South Kalgurli shaft on the 26th February. The skipman had rung the skip containing two men to the No. 12 level, but the driver thought that the other skip was required. As the skip containing the men passed the surface brace, one of the men waved to attract the attention of the driver and in so doing hit the sky shaft.

A platman suffered a broken right leg on the 3rd March in the New North Boulder shaft. Equipment, not correctly secured, moved and the air leg caught the wall plates. On noticing the bump the driver stopped the cage.

On the 9th March the rope on the north drum at the Regent shaft ran out and commenced to rewind in the opposite direction. The ropes on this shaft were of unequal length and the north skip could not be lowered to the bottom or No. 38 level. Except for a spillage no ore is hoisted from below the No. 27 level and the difference in rope length normally does not interfere with operations. On this occasion spillage was being hoisted and the driver forgot to disengage the north drum.

A platman sustained lacerations to an arm and leg in the Horseshoe No. 2 shaft on the 17th March. The cage was moved as a trolley loaded with timber was being removed from the cage.

On the 23rd July whilst ore was being pulled in the Sons of Gwalia shaft, the south skip caught the handle of No. 23 bin door, pulling it out and releasing a quantity of ore into the shaft. Only minor shaft damage resulted.

PROSECUTIONS

It was found necessary to prosecute three persons during the year.

A winze miner was fined five pounds for failing to use the ventilating appliances supplied.

A miner was fined five pounds for firing outside the prescribed times.

A mine manager was found guilty and cautioned for failing to report forthwith a serious accident.

SUNDAY LABOUR PERMITS

Twelve permits were issued during the year.

Seven permits were granted to Great Western Consolidated N.L. to work in their internal shaft. The permits were granted to re-timber, lay skip rails, place signal cables and ventilation lines, complete loading pockets, and build a penthouse.

This company was also granted permission to work two Sundays in the Nevoria shaft. One Sunday was utilised to place timber sets in the shaft and the other to remove the rock penthouse. Permission was also given to Great Western to carry out percussion drilling at Burbidge on one Sunday.

Central Norseman Gold Corporation was granted permission to work three shifts on one Sunday to commence a tail track drive from No. 9 plat Regent shaft. This work could not be safely carried out during normal working hours.

Gold Mines of Kalgoorlie (Aust.) Limited was granted permission to work three Sundays in their Perseverance shaft to strip the shaft bottom and install timber and a chute.

AUTHORISED MINE SURVEYORS

The Survey Board issued seven certificates during the year.

CERTIFICATES OF EXEMPTION (SECTION 46)

Four certificates were issued as compared with thirteen in 1958.

PERMITS TO FIRE OUTSIDE PRESCRIBED TIMES (REGULATION 51)

One permit was issued.

Great Western Consolidated N.L. was permitted to fire outside the recognised firing times in a No. 1 level winze being sunk to improve ventilation and servicing.

PERMITS TO RISE (REGULATION 64)

Fifty-six permits were issued and they related to 75 rises totalling 7,455 feet. Thirty-one rises were made using the rising gig method and six, at the Sons of Gwalia with boreholes as guides.

ADMINISTRATIVE

Mines Regulation Act.—Changes were made to Regulations 252 and 253, to remove minor anomalies. Form 5 of the Schedule of Forms was amended to include pneumoconiosis. These amendments appear in the *Government Gazette* (No. 37) of May 1959.

Mining Act.—A new regulation No. 205F was added, exempting ilmenite producers from the payment of royalties during the period July 1958 to December 1959. Details appear in the *Government Gazettes* of the 20th January and 21st August, 1959.

Regulation 205B was amended to include leucoxene concentrates. This amendment appeared in the *Government Gazette* (No. 55) of the 15th July.

Mine Workers' Relief Act.—The amendment to Regulation 48, appearing in the *Government Gazette* (No. 27) of 6th April, clarifies that regulation.

VENTILATION

All underground working places of major metalliferous mines were regularly inspected and dust counts and temperatures recorded. Air surveys were made as required. In mines using hydraulic fill for stopes some improvement has been brought about by increasing the air flow through the workings. Dust control in crushing sections of treatment plants and quarries were investigated and where necessary recommendations made to assist operators in designing improvements to existing dust collection systems.

Results of dust counts taken during the year are tabulated below:—

Dust Samples from	No. of Samples	Samples giving over 1,000 p.p.c.c.	Average Count
Development	425	1	169
Stoping	819	7	169
Levels	113	3	201
Surface	83	0	148
Totals	1,440	11	170

The average dust count was slightly lower than those recorded in the previous three years. As a comparison the last ten years' dust count averages are tabulated below:—

Year	No. of Samples	Samples giving over 1,000 p.p.c.c.	Average Count
1950	504	13	202
1951	899	16	173
1952	608	25	205
1953	1,084	13	219
1954	586	16	218
1955	1,303	35	207
1956	1,615	14	180
1957	1,823	21	175
1958	1,451	19	179
1959	1,440	11	170

During the period 1939 to 1949, inclusive, the average count was 255 p.p.c.c. Details are included in the State Mining Engineer's section of the Annual Report for 1949. It is evident from the above statistics that there has been a gradual general improvement in mine ventilation and control of dust at its source.

It is with pleasure that I report that for the third year in succession there has not been a fatal accident due to fumes of explosives. Twenty seven minor fuming accidents were reported, and all were investigated. Two men were prosecuted, one for working in a winze without the required ventilation and the other for firing outside the prescribed times.

Two mines, Australian Blue Asbestos at Colonial Gorge and the Pilot mine in the Yilgarn, made major alterations to their primary ventilation circuits. At Colonial Gorge intake air was permitted to enter the No. 3 level from the cliff face opening and pass through to the northern section of the level. At the Pilot the ventilation circuit was reversed to eradicate the dust previously drawn down through the open cut. In other mines there were no basic changes in the primary circuits. At the Great Boulder, Central Norseman, and Great Western improvements to existing circuits have been made by increasing the flow of air in them.

Aluminium Therapy.—This treatment was continued throughout the year.

The treatment ceased at the South Kalgurli shaft, of Gold Mines of Kalgoorlie (Aust.) Ltd., which closed during the year. Aluminium therapy would still be available to the men who were transferred to other shafts operated by that company.

GOLD MINING.

The ore treated during the year amounted to 2,959,202 tons as compared with 3,021,072 tons in the previous year. Gold recovered amounted to 860,969 ounces as compared with 874,819 ounces for 1958.

Grade of ore mined was slightly higher, recovery being 5.82 dwts. per ton as against 5.79 dwts. per ton for 1958.

The calculated value of the gold produced was £13,453,808 which included £1,167 distributed by the Gold Producers Association from the sale of 133,133 fine ounces of gold at an average premium of 2.1d. per fine ounce.

The Mint value of gold throughout the year was £15 12s. 6d. per fine ounce.

There was an increase in the labour force in the industry, from 5,352 in 1958 to 5,769 in 1959. Average production of ore per man was 512.95 tons valued at 90.93 shillings per ton as compared with 564.48 tons valued at 90.53 shillings per ton for 1958. Gold recovery per man averaged 149.24 fine ounces as compared with 163.46 fine ounces in the previous year.

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

Table "D"—Gold Production Statistics.

Table "E"—Classification of Gold Output for 1959 by Goldfields.

Table "F"—Classification of Gold Output, 1955-1959.

Table "G"—Mines that have produced 5,000 ounces and upwards in any one of 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 oz.	£A	Shillings A		Shillings A	Dwts.
1929	628,400	372,064	1,580,426	50·30	4,108	84·96	11·34
1930	645,344	419,767	1,874,484	58·09	4,284	89·33	13·01
1931	982,163	518,045	3,042,019	61·54	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	5,556,736	54·185	5,079	209·00	5·185
1944	1,777,128	472,588	5,966,451	55·89	4,614	210·18	5·32
1945	1,736,952	469,906	5,025,039	57·86	4,818	213·87	5·41
1946	2,194,477	618,607	6,657,762	60·70	6,961	215·25	5·64
1947	2,507,306	701,752	7,552,611	60·25	7,649	215·25	5·59
1948	2,447,545	662,714	7,132,748	58·28	7,178	215·25	5·42
1949	2,468,297	649,572	7,977,200	64·64	6,800	245·62	5·26
1950	2,463,423	608,633	9,428,745	76·55	7,080	309·83	4·94
1951	2,471,679	648,245	10,042,392	81·26	6,766	309·83	5·25
1952	2,626,612	727,468	11,809,047	89·92	6,394	324·66	5·54
1953	3,169,875	823,331	13,290,100	83·85	6,359	322·837	5·20
1954	3,240,378	861,992	13,492,209	83·27	6,128	313·04	5·32
1955	2,865,048	834,326	13,055,574	91·13	5,845	312·96	5·82
1956	2,870,273	813,617	12,724,923	88·67	5,612	312·80	5·67
1957	2,951,011	849,741	13,304,752	90·17	5,385	313·15	5·76
1958	3,021,072	874,819	13,674,193	90·53	5,352	312·62	5·79
1959	2,959,202	860,969	13,453,808	90·93	5,769	312·52	5·82

TABLE E.

CLASSIFICATION OF GOLD OUTPUT FOR 1959 BY GOLDFIELDS.

Goldfield	Unclassified Sundry Claims Alluvial, etc.	Up to 100 ozs.		101–500 ozs.		501–1,000 ozs.		1,001–5,000 ozs.		5,001–10,000 ozs.		10,001–20,000 ozs.		20,001–50,000 ozs.		50,001–100,000 ozs.		Over 100,000 ozs.		Total
	fine ozs.	No. of Producers	Gold fine ozs.	No. of Producers	Gold fine ozs.	No. of Producers	Gold fine ozs.	No. of Producers	Gold fine ozs.	No. of Producers	Gold fine ozs.	No. of Producers	Gold fine ozs.	No. of Producers	Gold fine ozs.	No. of Producers	Gold fine ozs.	No. of Producers	Gold fine ozs.	fine ozs.
Kimberley	38	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	38
West Kimberley	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Pilbara	482	5	77	2	512	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,071
West Pilbara	11	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	11
Ashburton	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Peak Hill	7	4	137	1	292	....	....	....	....	....	....	....	....	....	....	....	....	....	....	436
Gascoyne	....	1	43	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	43
Murchison	875	18	301	2	230	....	....	....	....	....	....	1	12,048	....	....	1	81,907	....	....	95,361
East Murchison	56	3	23	2	653	....	....	....	....	....	....	....	....	....	....	....	....	....	....	732
Yalgoo	22	1	39	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	61
Mt. Margaret	511	9	212	....	....	....	....	....	....	....	....	....	....	1	33,469	....	....	....	....	34,192
North Coolgardie	1,548	16	488	8	1,545	1	919	1	2,079	....	....	1	15,879	....	....	....	....	....	....	22,458
Broad Arrow	848	6	127	4	688	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1,663
North-East Coolgardie	100	4	138	1	147	....	....	....	....	....	....	....	....	....	....	....	....	....	....	385
East Coolgardie	796	25	737	2	428	2	1,728	1	1,364	....	....	....	....	....	....	1	89,007	3	416,322	510,382
Coolgardie	1,347	14	418	3	900	1	873	....	....	....	....	1	13,855	....	....	....	....	....	....	17,393
Yilgarn	422	14	315	1	116	1	699	3	4,650	....	....	....	....	....	....	1	67,100	....	....	73,302
Dundas	416	1	24	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	101,203	101,643
Phillips River	21	....	....	....	....	....	....	1	1,345	....	....	....	....	....	....	....	....	....	....	1,366
State Generally	432	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	432
Totals	7,932	121	3,079	26	5,511	5	4,219	6	9,438	....	....	3	41,782	1	33,469	3	238,014	4	517,525	860,969

TABLE F.

Classification of Gold Output, 1955-1959.

Range of Output	1959			1958			1957			1956			1955		
	No. of Producers	Production	Percentage of Total	No. of Producers	Production	Percentage of Total	No. of Producers	Production	Percentage of Total	No. of Producers	Production	Percentage of Total	No. of Producers	Production	Percentage of Total
fine ozs.		fine ozs.			fine ozs.			fine ozs.			fine ozs.			fine ozs.	
Over 100,000	4	517,525	60·1	4	547,565	62·6	3	428,334·08	50·5	2	289,315	35·5	2	280,878	33·6
50,001–100,000	3	238,014	27·6	3	238,049	27·2	4	302,421·19	35·6	5	377,203	46·3	5	368,426	44·1
40,001– 50,000	....	....	....	....	....	....	....	...	....	....	....	....	....	....	....
30,001– 40,000	1	33,469	3·9	1	30,269	3·5	1	31,043·09	3·6	....	....	....	....	....	....
20,001– 30,000	....	....	....	....	....	....	....	....	....	1	27,376	3·4	3	68,600	8·2
10,001– 20,000	3	41,782	4·9	2	27,561	3·2	3	38,930·24	4·6	4	63,742	7·8	4	68,958	8·3
5,001– 10,000	....	....	....	....	....	....	2	13,499·79	1·6	3	21,112	2·6	2	12,282	1·5
4,001– 5,000	....	....	....	....	....	....	....	....	....	1	4,045	0·5	....	....	....
3,001– 4,000	....	....	....	....	....	....	2	6,318·31	0·7	1	3,906	0·5	1	3,454	0·4
2,001– 3,000	1	2,217	0·3	1	2,942	0·3	2	5,160·59	0·6	2	5,376	0·7	1	2,451	0·3
1,001– 2,000	5	7,221	0·8	6	9,937	1·1	1	1,864·91	0·2	3	4,074	0·5	5	7,233	0·9
501– 1,000	5	4,219	0·5	5	3,617	0·4	6	4,205·13	0·5	5	3,798	0·5	8	5,579	0·7
101– 500	26	5,511	0·6	30	6,117	0·7	31	6,595·81	0·8	33	7,817	0·9	39	9,119	1·1
Up to 100	121	3,079	0·4	104	2,690	0·3	117	3,284·65	0·4	112	2,893	0·4	121	3,414	0·4
Sundry Claims, etc.	....	7,932	0·9	....	6,072	0·7	....	8,082·88	0·9	....	2,960	0·4	....	3,932	0·5
Totals	169	860,969	100·0	156	874,819	100·0	172	849,740·67	100·0	172	813,617	100·0	191	834,326	100·0

TABLE G.

Mines that have Produced 5,000 ounces and upwards in any one of the past Five Years.

Mine	1959			1958			1957			1956			1955		
	Tons Treated	Fine ozs.	Dwts. per ton	Tons Treated	Fine ozs.	Dwts. per ton	Tons Treated	Fine ozs.	Dwts. per ton	Tons Treated	Fine ozs.	Dwts. per ton	Tons Treated	Fine ozs.	Dwts. per ton
Big Bell Mines Ltd.	....	....	....	....	....	....	....	137	....	....	481	....	14,691	5,675	7·73
Boulder Perseverance Ltd.	....	....	....	Now	included in	Gold Mines	of Kalgoo	rlie (Aust.)	Ltd.	122,397	18,354	3·00	126,251	25,046	3·97
Callion (New Coolgardie G.M., N.L.)	....	....	....	....	....	....	....	....	....	8,305	4,045	9·74	26,922	13,037	9·69
Central Norseman Gold Corpn. N.L.	182,996	101,203	9·73	182,822	108,176	11·83	168,846	91,913	10·89	160,961	89,039	11·06	160,224	95,700	11·95
Eclipse Gold Mines N.L.	7,514	12,048	32·07	2,840	2,942	20·72	....	....	....	....	....	....	....	....	....
Gold Mines of Kalgoorlie (Aust.) Ltd.	496,981	134,002	5·39	519,168	147,310	5·67	523,617	147,341	5·63	222,456	61,217	5·50	195,732	52,552	5·37
Great Boulder Pty. Gold Mines Ltd.	454,474	124,041	5·46	488,761	134,307	5·50	459,734	128,928	5·61	428,571	122,313	5·71	423,879	114,560	5·41
Great Western Consolidated N.L.	393,252	67,100	3·41	459,119	76,641	3·34	462,799	77,079	3·33	444,185	76,279	3·43	423,012	62,136	2·94
Hill 50 Gold Mines N.L.	155,471	81,907	10·54	133,081	77,209	11·60	107,128	83,193	15·53	106,479	83,720	15·72	104,010	81,801	15·72
Kalgoorlie Enterprise Mines Ltd.	....	....	....	Now	included in	Gold Mines	of Kalgoo	rlie (Aust.)	Ltd.	66,744	12,839	3·85	74,429	19,627	5·27
Lake View and Star Ltd.	669,927	162,576	4·85	665,998	161,899	4·86	664,895	159,811	4·81	657,105	158,487	4·82	656,099	157,527	4·80
New Coolgardie Gold Mines N.L.	....	....	....	Now	included in	Gold Mines	of Kalgoo	rlie (Aust.)	Ltd.	32,560	16,109	9·90	33,296	19,180	11·52
North Kalgurli (1912) Ltd.	361,344	89,007	4·93	345,983	84,199	4·87	337,888	75,327	4·46	351,374	66,948	3·81	348,829	76,237	4·37
South Kalgurli Consolidated Ltd.	....	....	....	Now	included in	Gold Mines	of Kalgoo	rlie (Aust.)	Ltd.	70,631	15,375	4·35	84,928	20,328	4·79
State Batteries	39,048	14,700	7·53	41,806	13,498	6·46	42,837	15,813	7·38	35,740	13,218	7·40	42,207	15,203	7·20
The Sons of Gwalia Ltd.	135,932	33,469	4·92	137,377	30,269	4·41	137,934	31,043	4·50	113,598	27,376	4·82	102,742	23,226	4·52
Timoni (Moonlight Wiluna Gold Mines Ltd.)	32,229	15,879	9·85	31,838	15,746	9·89	31,445	15,781	10·04	30,754	17,174	11·17	30,056	17,114	11·39
Total	2,929,168	835,932	5·71	3,008,793	852,196	5·66	2,937,123	826,366	5·63	2,851,860	782,974	5·49	2,847,307	798,949	5·61
Other Sources (excluding large Retreatment Plants)	30,034	12,051	8·02	12,279	10,623	17·30	13,888	9,935	14·31	18,413	14,303	15·54	17,741	17,560	19·80
Total (excluding large Retreatment Plants)	2,959,202	847,983	5·73	3,021,072	862,819	5·71	2,951,011	836,301	5·67	2,870,273	797,277	5·56	2,865,048	816,509	5·70
Golden Horseshoe Sands Retreatment	....	....	....	....	....	....	....	....	....	....	5,003	....	....	6,607	....
Lake View and Star Retreatment	....	9,844	....	....	8,989	....	....	9,934	....	....	8,515	....	....	8,791	....
State Batteries Tailing Treatment	....	3,142	....	....	3,011	....	....	3,506	....	....	2,822	....	....	2,419	....
Grand Total	2,959,202	860,969	5·82	3,021,072	874,819	5·79	2,951,011	849,741	5·76	2,870,273	813,617	5·67	2,865,048	834,326	5·82

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—							
Murchison	Hill 50 Gold Mines N.L.	239	896	924	811	10,216	13,086
	Hill 50 Eclipse	....	637	....	542	652	1,831
Peak Hill	Horseshoe Lights G.M.	110	60	80	60	....	310
Mount Margaret	Sons of Gwalia	....	2,138	833	1,278	10,818	15,067
North Coolgardie	Timoni	....	747	126	174	....	1,047
	Altona	30	200	....	196	....	426
Broad Arrow	New Mexico	....	48	....	92	....	140
East Coolgardie	Lake View and Star Ltd.	....	19,110	3,384	6,070	19,582	48,146
	Great Boulder Pty. Gold Mine Ltd.	437	11,583	2,404	3,127	7,342	24,893
	North Kalgurli (1912) Ltd.	....	10,600	1,500	3,782	16,128	32,010
	Gold Mines of Kalgoorlie (Aust.) Ltd.	....	22,368	5,737	4,935	34,713	67,753
	Haoma	....	195	10	214	....	419
	Daisy	....	326	35	....	....	361
Coolgardie	Gold Mines of Kalgoorlie (Aust.) Ltd.	....	1,699	564	498	2,267	5,028
Yilgarn	Great Western Consolidated N.L.	913	4,769	2,050	698	18,922	27,352
	Radio	50	240	15	50	....	355
Dundas	Central Norseman Gold Corporation N.L.	415	9,294	309	3,323	43,917	57,258
East Murchison	Rajah, Emu Gold Mine	208	24	45	....	....	277
	Total in Gold Mines	2,402	84,934	18,016	25,850	164,557	295,759
Asbestos—							
West Pilbara	Australian Blue Asbestos	....	4,104	370	1,167	....	5,641
Pyrite—							
Dundas	Norseman Gold Mines N.L.	....	....	....	195	....	195
Copper—							
Phillips River	Ravensthorpe Copper Mines N.L.	98	1,293	5	318	492	2,206
Peak Hill	Thaduna Copper Mines	50	90	....	28	....	168
West Pilbara	Whundo	135	60	55	....	....	250
	Total in Copper Mines	283	1,443	60	346	492	2,624
Lead—							
Northampton	Gurkha	....	583	5	353	....	941
	Wheal Fortune Extended	70	35	25	....	....	130
	Kathleen Hope	77	184	5	118	....	384
	Total in Lead Mines	147	802	35	471	....	1,455
Iron Ore—							
West Kimberley	Australian Iron and Steel	....	....	....	....	1,031	1,031
	Total in All Mines	2,832	91,283	18,481	28,029	166,080	306,705

EAST COOLGARDIE GOLDFIELD.

The total ore treated in this goldfield amounted to 1,970,250 tons with a recovery of 510,382 fine ounces of gold at an average of 5.18 dwts. per ton. This production was equal to 59.2 per cent. of the gold production for the State. In the previous year 2,004,316 tons of ore averaging 5.29 dwts. were treated for a recovery of 529,768 fine ounces of gold.

There was very little activity in the *Bulong District* the total production being 89 fine ounces from the treatment of 475 tons of ore.

In the *East Coolgardie District* 510,293 fine ounces were recovered from the treatment of 1,969,775 tons of ore. Following are notes on the activities of the principal producers in the district.

Lake View and Star Ltd. with a production of 669,927 tons of ore for a return of 162,576 fine ounces of gold at an average of 4.85 dwts. per ton was the State's leading producer. Retreatment of tailings yielded an additional 9,844 fine ounces.

The previous year's production was 161,899 fine cunces from the treatment of 665,998 tons plus 8,989 fine ounces from tailings retreatment.

Ore reserves are listed at 3,575,000 short tons of an average grade of 4.85 dwts.

At the Chaffers shaft the installation of a new electric winder has been completed and the auxiliary winder for the service compartment converted to electric power. The old wooden headframe was replaced by a 113 foot steel frame, designed and erected by the company's engineers. New seven ton capacity bottom dumping skips were also installed.

The Ivanhoe shaft was cleaned out to the 3,400 foot horizon in preparation for the installation of a cartridge loading skip pocket below the 3,300 level.

The Imperial shaft, south of the Lake View Extended, was re-opened during the year. The water level was lowered to the 400 foot level and after check sampling of workings, preparation work for mining was completed on the 200 and 400 foot levels. Ore breaking started late in the year.

Gold Mines of Kalgoorlie (Aust.) Ltd. produced 134,002 fine ounces from the treatment of 496,981 tons at an average recovery of 5.39 dwts. per ton. The Kalgoorlie group of mines produced 119,862 ounces from 476,697 tons with an average recovery of 5.03 dwts. per ton. The remainder of production came from Bayley's South and tributor's ore from the Barbara at Coolgardie.

Ore reserves are stated as 1,267,825 tons at 5.7 dwts.

The South Kalgurli shaft was closed down during the year. This section is now worked from adjoining shafts chiefly from the Perseverence and Enterprise. Development at the Perseverance shaft was largely confined to the new Nos. 8, 10 and 12 levels formed to mine ore previously left as a result of difficulties experienced in stoping the 200 feet lift between levels.

Of the Paringa shaft, the main development was northwards with the aim of bringing the Federal-Block 45 area into production. A main haulage way was driven on the No. 8 level along the Federal lode line.

Work in the open cut ceased during the year, and preparations commenced to break, by long hole blasting, the remaining ore below the No. 3 level under the open cut.

There was an increase in tempo on the New North Boulder shaft where development of the new Ley lode indicated ore from the No. 6 to the No. 9 level.

A start was made on a main haulage drive on the Perseverance No. 19 level. This drive will traverse Lake View and Star's Australia lease and will connect with an internal shaft to be sunk from the Oroya No. 15 level.

Great Boulder Pty. Gold Mines Ltd. treated 454,474 tons of ore for a recovery of 124,041 fine ounces of gold, average recovery being 5.46 dwts per ton. During the previous year 488,761 tons yielded 134,307 fine ounces at an average grade of 5.50 dwts per ton.

Mine ore reserves are 1,794,107 tons at 6.21 dwts. per ton. Development of the internal shaft, located near the Main shaft, from the 2,950 level to a depth of 18 feet below the new 3,550 foot level will assist in maintaining the reserve figure in the coming year. A Cryderman shaft mucking machine was used in the shaft sinking.

During the year, the Twin Tandem Vertical Steam winder at Edwards shaft was converted to electric power using the Ward Leonard Ilgner system. The winder is powered by a 1,000 H.P. electric motor.

Initial work was commenced preparatory to the conversion of the Hamilton shaft winder to electric power. When this conversion is completed, the small Lane shaft winder will be the sole remaining steam winder on the Golden Mile.

No. 2 winze between the 1,800 and 3,100 foot levels has been closed as a service shaft, and the 150 H.P. winder has been removed to the new internal shaft.

Development work undertaken by the company included 437 feet of shaft sinking, 11,583 feet of driving, 1,100 feet of winzing, and 2,027 feet of rising.

North Kalgurli (1912) Ltd. treated 361,344 tons of ore for a recovery of 89,007 fine ounces at an average of 4.93 dwts per ton. This production compares favourably with the previous year's output of 84,199 ounces from 345,983 tons.

1959 saw an expansion of the hydraulic fill operations underground. There was a slight increase in average depth of workings off the Main and Croesus shafts.

Development headings off the Main shaft should enable the company to retain a good reserve of ore previously located by diamond drilling. Completed during the year were 10,600 feet of driving, 1,500 feet of crosscutting 2,234 feet of winzing, and 1,548 feet of rising.

At the Croesus plant a 150 foot roaster stack was installed to reduce the nuisance of sulphur fumes to nearby residents. This higher stack was completed in September.

Kalgoorlie Southern Gold Mines N.L. Drilling operations south of the Golden Mile was recommenced during the year. Total footage reported was 1,596 feet. In September, this company took delivery of a Mindrill F-150 drill which is designed to drill to 10,000 feet.

At *Mount Monger* the *Haoma* leases, being worked by the Mount Monger Mining Syndicate, produced 1,364 fine ounces from 1,481 tons. Mining was confined to the lower levels with most of the ore coming from the 515 foot level. Development during the year has retained reserves at about 1,000 tons of 12 dwt. ore.

The *Daisy* mine at the same centre produced 770 fine ounces from 1,015 tons. Driving opened up two payable ore bodies on the south end of the No. 6 level. A north drive failed to locate values and was discontinued. At present production rate there is three years supply of ore avalable.

At the *Rosemary* 590 tons yielded 959 fine ounces. About 3,000 tons of rock was broken by five men to obtain the above crushing.

There were several other small producers at Mount Monger which is the best centre of production in the East Coolgardie Goldfield outside of the Golden Mile.

DUNDAS GOLDFIELD

The production of 101,643 fine ounces of gold, from the treatment of 183,564 tons of ore, represented 11.8 per cent of the State's total production. In the previous year 183,071 tons were mined for a recovery of 108,331 ounces.

Central Norseman Gold Corporation treated 182,996 tons for a recovery of 101,203 ounces. Gold recovery was at a rate of 9.73 dwts per ton treated. Values were lower than in the previous year when 182,822 tons yielded 108,176 ounces at the rate of 11.83 dwts. per ton.

Estimated ore reserves are 592,200 tons at 9.15 dwts. per ton.

During the year operations were continued from Regent, Crown and North Royal shafts. The principal source, of ore being hauled through the Regent shaft, is from the Crown reef workings. Very little ore now comes from the Mararoa reef which is practically worked out. The Regent's Nos. 22, 27 and 29 levels are being developed to prospect the Crown reef at these levels.

Development of the Crown reef below No. 16 level is in progress with a number of winzes. These winzes are flat, varying in dip between 10° and 30° with some sections virtually level. Connection will be made with the No. 22 level.

The sinking of the North Royal shaft was continued and reached approximately 1,240 feet below the No. 13 level when work ceased on it in December. The inclined depth of this shaft is now 3,039 feet. Ore breaking in this mine was concentrated between the Nos. 5 and 8 levels and development work between the Nos. 4 and 11 levels.

Crushings from the new find at *Beete* yielded 361 ounces from 362 tons. All of this ore from prospectors was put through the Norseman State Battery.

MURCHISON GOLDFIELD.

168,453 tons of ore were treated in this goldfield for a return of 95,361 fine ounces of gold. This production was equal to 11.1 per cent. of the State's total. In the previous year 81,984 ounces were obtained from the treatment of 142,178 tons.

The *Cue District* production was 102 ounces from the treatment of 225 tons of ore plus 374 ounces from cyanidation of sands at the State Battery. Prospecting was at a very low ebb and no improvement is anticipated in the coming year.

In the *Meekatharra District* 810 ounces were recovered from the treatment of 4,887 tons of ore. The most successful mines were the *Margueritta* with 126 ounces from 720 tons and the *Bluebird* with 103 ounces from 434 tons.

The *Day Dawn District* was very quiet, production being 11 ounces from 39 tons. Deep drilling at the Great Fingall was completed during the year and the rig returned to store. Some further diamond drilling of the Fingall leases is being undertaken by Metals Exploration N.L.

Mount Magnet District produced 94,064 fine ounces from the treatment of 163,302 tons of ore. The principal producer was *Hill 50 Gold Mines N.L.* with 81,907 fine ounces from 155,471 tons. Average recovery was 10.54 dwts. per ton which was below the previous year's recovery of 11.60 dwts.

Ore reserves were given at 711,000 short tons averaging 10.1 dwts.

The shaft was advanced 239 feet to a depth of 1,893 feet and a new level will be developed from the 1,800 foot horizon. Although it was planned to change over from cage to skip haulage this was not done and shaft capacity has been increased by using 30 cwt. capacity trucks. The cages have been fitted with rubber tyred guide wheels.

No major alterations were made to the primary air circuit in this mine. A winze from the 13 to the 15 level was completed, giving improved conditions in the north end of the mine. The sixty-inch two stage Sirrocco axial flow exhaust fan was measured at 75,000 cumins.

Eclipse Gold Mines N.L.—Production for 1959 amounted to 7,514 tons of ore treated for a recovery of 12,048 fine ounces of gold. This represents an average recovery of 32.07 dwts. per ton.

The main ore body, which is more or less a single pipe of high values, requires a considerable amount of vertical development to enable it to be mined.

Late in the year a start was made to develop the nearby Totalisator ore body. Work was also commenced to re-open and examine the Lady Bunbury workings. This ore body is reported to be similar to the Eclipse and it is only a few hundred feet north-west of that mine.

YILGARN GOLDFIELD.

Production for the year was 73,302 fine ounces of gold from 414,751 tons averaging 3.53 dwts. per ton as compared with 81,740 fine ounces from 464,065 tons of ore averaging 3.52 dwts. in the previous year. This goldfield was responsible for 8.5 per cent. of the State's production.

Great Western Consolidated N.L. milled 393,252 tons for a recovery of 67,100 fine ounces of gold averaging 3.41 dwts. per ton. Production for the previous year was 76,641 fine ounces from 459,119 tons.

Ore reserves stand at 667,000 tons of 3.8 dwt. grade. Commonwealth Government assistance has played a large part in the economics of the mine.

The *Copperhead* mine at Bullfinch has been the centre of attention for 1959. Development, off the internal shaft at the Nos. 20 and 22 levels, has been disappointing. The only positive ore proved was the East Branch of the Southern Series. The results of a diamond drilling campaign will establish if further development is warranted. The west compartment of the internal shaft has been sunk to the No. 24 level in anticipation of favourable intersections.

At the *Corinthian* mine the inclined shaft was deepened to the 300 feet horizon and development of the No. 3 level has proved a northern extension of the ore body.

The inclined shaft of the *Pilot* mine was advanced to the No. 4 level. Stoping in the open cut at this mine is carried out by long hole boring from a sub-level.

Ore from the *Fraser's* mine materially assisted in boosting average mine grade.

Early in the year the No. 2 shaft of the *Nevoria* was deepened to the No. 4 level (650 feet) and development of this level is in progress.

Output from the various mines operated by Great Western is listed below—

Mine	Ore Treated	Gold	Average
	tons	fine oz.	dwt. per ton
Copperhead	255,022	39,506	3·1
Fraser's	19,100	6,442	6·7
Nevoria	62,267	13,266	4·3
Corinthian	20,983	2,579	2·5
Pilot	35,628	5,247	2·9
Other Sources	252	60	4·8
Totals	393,252	67,100	3·4

The *Radio* mine in the Golden Valley centre reported the production of 1,269 fine ounces from 2,180 tons crushed. The owners, Barr Bros. are building a new mill and in 1960 hope to treat 400 tons monthly.

By arrangement with Great Western, 14,713 tons of overburden from the *Cornwall* were crushed for a return of 2,217 fine ounces of gold. These results have aroused interest in other Marvel Loch holdings.

King Solomon Gold Mines at Edwards Find crushed 810 tons of ore from above the No. 3 level. This plus treatment of sands gave a yield of 699 fine ounces.

The only other production of note was 1,165 ounces obtained from the treatment of aproximately 3,500 tons of sands from Evanston.

MOUNT MARGARET GOLDFIELD

The total ore treated in this goldfield amounted to 141,408 tons yielding 34,192 fine ounces of gold at an average recovery rate of 4.8 dwts. per ton. This output represented 3.3 per cent of the State's total. In the previous year 141,810 tons, averaging 4.4 dwts. recovery, were treated for a yield of 31,010 fine ounces.

In the *Mount Morgans District* 146 ounces were produced from 476 tons. Seventy ounces of this production came from 129 tons of material cleaned up from around the old plant of Morgans Gold Mines Limited.

The *Sons of Gwalia Ltd.* was the only producer of note in the *Mount Malcolm District*. Employing an average of 266 men this mine's production was 33,469 fine ounces from the treatment of 135,932 tons of ore. The average recovery was 4.92 dwts. per ton. The output for the previous year amounted to 30,269 ounces from 137,377 tons.

The ore reserves are much the same as those reported last year.

A total of 2,138 feet of driving was completed on the 10 and 12 West lode levels and on the Hanging Wall lode on the 23, 25 and 27 levels. Further development is now in progress to open up the West lode on the No. 14 level 10,818 feet of diamond drilling was completed during the year under review.

The new crushing section was put into operation early in 1959. The plant, utilising the existing Gates crusher, now includes a Symons crusher in closed circuit with a screening unit. This crushing section now replaces the 30 head stamp battery previously used as a secondary crusher.

The *Mount Margaret District* produced 163 ounces from 1,669 tons. Most of this production came from the crushing of old dumps and some alluvial gold.

NORTH COOLGARDIE GOLDFIELD.

Production from this goldfield amounted to 22,458 fine ounces from 41,335 tons of ore averaging 10.9 dwts. per ton recovery. As a comparison the production for the previous year was 21,027 ounces from 41,868 tons averaging 10.0 dwts. Output from this goldfield was 2.6 per cent. of the total.

The main producer in the *Menzies District* was *Moonlight Wiluna Gold Mines Ltd.* operating the Timoni mine at Mount Ida. From this mine 15,879 fine ounces were obtained from 32,229 tons. This mine, which employs about 60 men, is nearing the end of its life and production is not expected beyond 1960.

The more successful of the smaller producers were the *First Hit* with 123 ounces from 795 tons and the *Goodenough* with 129 ounces from 510 tons. Treatment of sands at the State Battery yielded 889 fine ounces of gold.

Production from the *Ularring District* was 2,152 fine ounces from the treatment of 2,032 tons of ore. Output for the previous year was 1,866 fine ounces from 3,017 tons.

At Morleys the *First Hit* produced 122 ounces from 203 tons. The *Golden Wonder* at Mulline reported 919 fine ounces from 96 tons. A shaft sunk some 100 feet north of the previous workings has intersected good values from 50 to 70 feet. At the same centre the *Ajax West* produced 376

ounces from 572 tons. In the Davyhurst district the *Oakley* mine, down some 900 feet on the underlay, produced 280 ounces from 300 tons.

The principal producer in the *Niagara District* was the *Altona* with 261 ounces from 1,204 tons of ore crushed. There is every indication that production for 1960 will be well above this year's figure as good values have been cut in shaft sinking and driving. The total production from this and other mines in the district was 518 fine ounces of gold from 1,842 tons.

In the *Yerilla District*, 2,335 fine ounces of gold were obtained from 2,722 tons of ore. Practically all of this production came from tributors working the *Yilgangie Queen* where 2,079 ounces were obtained from 1,899 tons.

COOLGARDIE GOLDFIELD.

During 1959, 27,004 tons of ore were treated for a return of 17,393 fine ounces of gold at an average recovery rate of 12.9 dwts. per ton. In the previous year 31,484 tons yielded 14,867 fine ounces.

Gold Mines of Kalgoorlie (Aust.) Ltd. operating the Bayley's group of leases at Coolgardie reported the production of 13,855 fine ounces of gold from 19,637 tons of ore obtained from this centre. All of this ore was hoisted through Price's shaft and carted to Kalgoorlie for treatment.

Development of the high grade Price's reef ore shoot in the western part of the mine was continued on the Nos. 6 and 7 levels. Preparations are in hand to sink an internal shaft from the No. 11 level. This shaft will provide access for the testing of the Nos. 12 and 13 level horizons of Price's and New Price's reefs.

Among the smaller mines the best returns were from the Ellen Jean with 142 ounces from 238 tons and the *Jackpot* with 472 ounces from 931 tons. Tributors mining near the Barbara obtained 286 ounces from 647 tons.

At *Ryan's Find* three prospectors, Messrs. Voumard, Walls and Edwards loamed onto a small rich pipe of ore. Up till the end of the year 478 fine ounces of gold were obtained from this deposit.

The *Northern Mineral Syndicate's* mine at the Paris group near Widgiemooltha came into production during the year. 873 ounces were obtained from 2,827 tons of ore. Development work is proceeding rapidly and a new No. 7 shaft has been advanced to 170 feet.

Very little mining was undertaken in the *Kunanalling District* which produced 64 ounces from 245 tons.

PHILLIPS RIVER GOLDFIELD

Ravensthorpe Copper Mines N.L. obtained 1,345 fine ounces of gold as a by-product of copper mining. In the *Hatters Hill* area 21 ounces were obtained by prospectors. No other production was reported from this field.

PILBARA GOLDFIELD

In this goldfield 1,071 ounces were recovered from the treatment of 2,009 tons of ore averaging 10.7 dwts per ton.

The principal producers were the *Prince Charlie* at Bamboo Creek with 365 ounces from 1,051 tons and the *Barton* at Middle Creek with 147 ounces from 422 tons. At Bamboo Creek work is in progress to find additional supplies of water for the State Battery.

BROAD ARROW GOLDFIELD

There was very little prospecting undertaken during the period under review. Total output was 1,663 fine ounces of gold from 4,397 tons.

The best return was from the *Gimlet South* at Ora Banda where 282 ounces were obtained from 1,490 tons. Costs at this mine are low as the ore is mined by the glory hole system and crushed in a Huntington mill.

Other regular producers were the *Bellevue* with 102 ounces from 312 tons, the *New Mexico* with 178 ounces from 482 tons, and the *Prince of Wales* with 125 ounces from 45 tons.

EAST MURCHISON GOLDFIELD

From this goldfield 732 fine ounces were obtained from 807 tons of ore. Mining of a pillar in the *Black Range* gold mine yielded 478 ounces from 134 tons. This work has now been abandoned. The *Sheelite* leases at Barrambie produced 175 ounces from 303 tons. There was practically no activity in the *Wiluna or Lawlers* districts. At Agnew a shaft has been sunk to 208 feet on the *Emu* gold mine. Development work is proceeding from the 196 foot horizon.

PEAK HILL GOLDFIELD

Production totalled 436 fine ounces of gold from the treatment of 3,993 tons of ore. The *Horseshoe Lights* was the main producer with 292 ounces from 2,221 tons. Virtually all the remaining production came from old dumps in the field.

NORTH EAST COOLGARDIE GOLDFIELD

This goldfield produced 385 fine ounces from 932 tons of ore. The only producer of note was the *Kanowna Red Hill* with 147 ounces from 289 tons.

KIMBERLEY GOLDFIELD

The production of 38 fine ounces of alluvial and dollied gold was reported.

GASCOYNE GOLDFIELD

Forty three fine ounces of gold was produced in this field.

YALGOO GOLDFIELD

Total production was 61 fine ounces of gold from the treatment of 269 tons of ore. The *Marigold* production was 39 ounces from 181 tons.

Other sources within the State produced 443 fine ounces of gold from 81 tons of ore.

MINERALS OTHER THAN GOLD AND COAL

The production of minerals, other than Gold and Coal for 1958 and 1959 is shown in the table below.

PRINCIPAL MINERALS OTHER THAN GOLD AND COAL.

Mineral	1958		1959	
	Tons	Value £A	Tons	Value £A
Asbestos—				
Chrysotile	1,377·81	38,652	631·66	17,249
Crocidolite	11,877·10	1,304,725	14,680·17	1,611,293
Bentonite	37·00	153	133·00	532
Bismuth	1·48	1,475	....	....
Beryl	170·03	31,801	266·71	48,052
Clays—				
Cement Clay	13,506·00	13,439	22,321·00	23,055
Fireclay	20,211·96	25,435	28,500·10	33,950
White Clay	79·00	395	1,190·00	4,945
Copper—				
Ore and Concentrates	1,801·95	54,424	4,408·75	230,078
Fertiliser grade	7,643·72	114,670	11,858·80	184,006
Dolomite	196·00	786	....	....
Felspar	680·60	3,093	1,395·80	6,352
Glass Sand	6,420·41	4,267	6,827·54	4,555
Glauconite	112·00	5,590	102·00	5,103
Gypsum	35,514·97	40,134	37,730·55	54,207
Ilmenite	82,926·27	448,218	73,627·67	353,076
Iron Ore—				
(Exported)	536,713·00	532,355	672,239·00	666,601
(For pig)	30,075·00	458,561	57,206·00	808,644
Lead Ore and Concentrates	2,492·43	139,191	1,902·89	89,004
Leucoxene	....	....	276·25	3,930
Magnesite	....	....	18·50	74
Manganese	61,809·43	960,474	69,980·24	1,020,824
Monazite	....	....	109·55	7,210
Ochre—				
Red	171·00	1,710	104·00	1,040
Yellow	18·30	183	....	....
Petalite	67·77	293	....	....
Phosphatic Guano	169·65	1,828	....	....
Pyrites	49,388·64	351,847	53,030·39	371,989
Quartz Grit	90·00	75	312·00	260
Rutile	....	....	297·45	8,424
Semi-Precious Stones—				
Chrysoprase (lb.)	5·00	5	....	....
Opaline (lb.)	25·00	4	....	....
Silver (fine oz.)	200,767·48	79,651	193,561·53	79,913
Talc	2,500·67	35,304	4,047·69	58,085
Tantalo/Columbite	6·03	8,550	8·46	9,833
Tin	138·20	77,319	249·70	154,729
Zinc	20·06	511	....	....
Zircon	....	....	4,068·34	41,129
Totals	....	4,735,118	....	5,898,142

Brief notes on mineral production are given below:

Asbestos

Production of chrysotile, from Hancock's leases at Lionel and Nunyerry declined to 632 tons valued at £17,249.

Most of the recorded production was mined during the previous year.

At Wittenoom Gorge, Australian Blue Asbestos Ltd. produced 14,680 tons of crocidolite valued at £1,611,293. During 1959 plant extensions, costing over £100,000 were completed at the Colonial mill. Underground operations at the mine included 4,104 feet of driving, 370 feet of cross cutting and 1,167 feet of winzing and rising. An average of 352 men were employed throughout the year, 162 underground and 190 on the surface.

The growth of the town of Wittenoom and the resultant demand for domestic water raised a problem which was acentuated by drought conditions. All domestic and mine water has been obtained from wells and pools near the mine. It is now planned to obtain the townsite water from bores on the north side of the town. This should ensure ample water supplies in the future.

Bentonite.

Bentonite production from Marchagee was at a low ebb with only 133 tons produced for local requirements.

Beryl

Two hundred and sixty-seven tons, containing 3,010 units of beryllium oxide valued at £48,052, were produced. In the Pilbara 2,225 units were obtained from prospectors in the Marble Bar, Cooglegong, Abydos, Moolyella, Mt. Francisco, Streley, Tabba Tabba, Wodgina, and Nullagine areas. In the Gascoyne most of the output of 537 units came from Yinnietharra. Production from the Coolgardie goldfield was 153 units.

The export of beryl ores and concentrates has been restricted since 1947. Until May, 1958 exports under license were permitted only to the United Kingdom. From May, 1958 the export of beryl from Australia was prohibited and the Australian Atomic Energy Commission purchased all the production of good grade material.

The Commission suspended its buying programme early in January, 1960 and it was announced that export of beryl would be permitted to approved destinations. Future stockpiling of beryl will be on a reduced scale and the Commission's purchases will be made on the open market.

Clays.

Clay production from the Metropolitan area, Clackline, Goomalling, and Mount Kokeby, totalled 52,011 tons valued at £61,950.

Copper.

Production of the fertilizer grades of copper ores increased to 11,859 tons as compared with 7,644 tons in the previous year. The output averaging 9.31 per cent Cu was valued at £184,006. Main producers were:—

The *Thaduna Copper Mining Coy.* produced 5,762 tons of 7.59 per cent. Cu valued at £62,206. At this mine all ore available by open cut methods has been extracted and future operations will be underground. A concentrating table has been installed to upgrade some of the ore to make it marketable.

The *Copper Hills* mine south of Marble Bar produced 4,901 tons, valued at £96,021. The sulphide minerals from this mine are carted to the Comet mine and there the ore is upgraded by flotation and then dried and fed into an Edwards roaster to produce a copper sulphate. These operations employed 10 men at the mine and 21 at the crushing and concentrating plant.

From *Kumarina* 193 tons of approximately 18 per cent. Cu were mined and crushed for a return of £8,519. The owner has improved his crushing plant and now intends to crush and blend some of the ore which had been previously discarded as uneconomic to haul to the rail head.

The *Whundo* produced 201 tons of 11.5 per cent. Cu which realised £4,333.

Ravensthorpe Copper Mines N.L. produced 4,409 tons of 25 per cent Cu concentrate for export. This output was valued at £230,078 f.o.b. In addition 1,332 fine ounces of gold and 8,596 fine ounces of silver were produced.

The principal development was the driving of the No. 3 level Elverdton to connect with the Desmond shaft. The Elverdton shaft has been sunk approximately 100 feet below the No. 4 level. The No. 5 level will be driven in the coming year. Total development was 2,206 feet and included 98 feet shaft sinking. 1,293 feet driving and 318 feet winzing. Late in the year a start was made on the re-opening of the old *Cattlin* mine which is situated about one mile north of the Ravensthorpe townsite. The headframe erected, was from the Protheroe lead mine which closed down in 1958.

Felspart.

Australian Glass Manufacturers Co. Pty. Ltd. obtained 1,393 tons from their quarry at Londonderry. This production was valued at £6,352. A 3-ton parcel was obtained from *Balingup* in the south-west part of the State.

Glass Sand.

Production from the Lake Gnangarra deposit was 6,828 tons valued at £4,555. Most of this output was by Australian Glass Manufacturers.

Glauconite.

One hundred and two tons of glauconite valued at £5,103 were recovered from the treatment of 510 tons of greensand obtained from the Gingin deposit.

Gypsum.

Plaster manufacturers obtained their supplies from deposits in the Yilgarn and Dundas goldfields. Output was 37,731 tons valued at £54,207. Included in this total is 11,164 tons valued at £33,493 f.o.b. obtained from Lake Cowan for export from the Port of Esperance. This gypsum had previously been stockpiled at Norseman after being transported from the deposit which is four miles south-west of the town.

Ilmenite, Leucoxene, Monazite, Rutile, Zircon.

Production of 73,628 tons of Ilmenite was nearly 10,000 tons less than the production for the previous year. As demand for this mineral increases so will the output, from the four operating companies, rise.

Cable (1956) Ltd. produced 8,918 tons assaying 54 per cent Ti O_2 and valued at £40,187. 286 tons assaying 61 per cent Ti O_2 were produced by *Westralian Oil Ltd.* This output realised £3,922. *Ilmenite Pty. Ltd.* operating at Wonnerup obtained 18,770 tons assaying 54 per cent Ti O_2 and valued at £112,980. More than half of the State's production came from Capel where *Western Titanium N.L.* produced 45,654 tons of 55 per cent concentrate valued at £195,987. This company was also responsible for the total production of Leucoxene (276 tons), Monazite (110 tons), Rutile (297 tons), and Zircon (4,068 tons).

Iron Ore

At Cockatoo Island, *Australian Iron and Steel Ltd.* mined and shipped 672,239 tons of ore assaying 66½ per cent Fe to the Eastern States. This was an increase of 135,526 tons on the previous year's output.

Diamond drilling and geological examination of the Koolan Island deposits have been completed and developmental work is to commence in 1960. It is planned to have a combined annual output of three million tons of iron ore from these islands.

The Charcoal Iron and Steel Industry at Wundowie obtained 57,206 tons of 62 per cent Fe ore from the Koolyanobbing deposit. This was nearly double the output as compared with 1958 production.

Lead

Lead production declined to 1,903 tons of concentrate containing 1,382 tons of the metal. Reported production from the Kooline field was 41 tons and from the Pilbara 421 tons. From the Northampton field 1,441 tons of concentrates valued at £69,629 were obtained.

All the mines now operating in the Northampton Mineral Field are in need of considerable development. The slender margin of profit has prevented the producers from undertaking normal forward development.

At the *Wheal Fortune Extended* all available ore has been extracted and no further development work is envisaged till prices rise.

Magnesite

A trial shipment of 18½ tons was obtained from Ravensthorpe by Garrick Agnew Pty. Ltd.

Manganese

Considerable activity took place during 1959 at the manganese deposits of the Pilbara. A total of 39,276 tons was exported from Port Hedland where there are extensive stockpiles.

Towards the end of the year Rio Tinto Management Services (Aust.) Ltd. carried out testing operations on the Ripon Hills deposits. The project was later abandoned but not before proving that the area contains numerous small deposits of economic importance.

Production of manganese, from the Horseshoe locality of the Peak Hill Goldfield, was temporarily curtailed in October when the ore stock-piled at Geraldton exceeded requirements. Production from this source by Westralian Ores Pty. Ltd was 30,362 tons assaying 44 per cent. manganese plus 203 tons of battery grade material assaying 78 per cent. Mn. Production was reported of three low grade parcels from various sources.

Ochre

One parcel amounting to 104 tons and valued at £1,040 was produced from Wilgie Mia.

Oil

The search for oil continued throughout 1959. West Australian Petroleum Pty. Ltd's exploration programme included the drilling of holes at Frome Rocks, Meda, and Thangoo. Late in the year Exoil Pty. Ltd. commenced stratigraphic drilling in the Eucla basin.

Pyrites

Norseman Gold Mines N.L. railed 38,909 tons of concentrate, containing 18,666 tons of sulphur, to superphosphate works in the metropolitan area. This output was valued at £302,719 f.o.r. Norseman. Very little mine development work was undertaken during the year but stope preparation required 1,556 feet driving, 320 feet rising and 54 feet of crosscutting. Ninety nine thousand seven hundred and eighty one tons of ore were broken whilst 100,973 tons were put through the heavy media separation plant. Recrushing and screening of reject material provided 12,527 tons of metal for road making.

Gold Mines of Kalgoorlie (Aust.) Ltd. forwarded to works at Fremantle 14,121 tons of auriferous pyritic concentrate containing 5,541 tons of sulphur valued at £69,270.

Quartz Grit

Three hundred and twelve tons for local use were obtained at Collie.

Silver

Silver as a by-product of Gold, Lead, and Copper mining amounted to 193,561.53 fine ounces valued at £79,913.47.

Talc

The Universal Milling Coy. Pty. Ltd. obtained 4,048 tons from their mine at Three Springs.

Tantalo-Columbite

Very little activity was directed towards the production of these minerals. Total production from the Pilbara was three tons of concentrates obtained in the Marble Bar and Tabba Tabba districts. In the Greenbushes mineral field 5½ tons of concentrate were produced as a by product of tin mining operations.

Tin

Production for the year under review was 250 tons of concentrate containing 174 tons of the metal. Twenty three tons were obtained from Greenbushes. The tin producers of the Shaw River, Cooglegong and Moolyella centres experienced a very difficult year because of extreme water shortages. Good rains at the beginning of 1960 have given them an excellent water supply and there is every possibility that the 1959 production of 227 tons will be doubled.

The State's leading producer was the Northern Minerals Syndicate with 112 tons obtained from Cooglegong.

J. K. N. Lloyd,
Asst. State Mining Engineer.

Appendix No. 1.

EXPLORATORY DRILLING.

State Mining Engineer:

Report on Drilling Activities for Year ended 31st December, 1959.

A particularly busy year was experienced by the Drilling Section during 1959 with each of the Department's drills working during the year. Operations were widespread, ranging from Bridgetown in the south of the State to Wyndham in the north.

Major items of plant added to the establishment during the year included—

(a) one "Holman" 300 c.f.m. air compressor powered by a Dorman 6-cyl. diesel engine at a cost of £3,700;

(b) one "Holman" 120 c.f.m. air compressor powered by a Fordson diesel engine. This machine was purchased for the Assistance to Prospecting scheme at a cost of £1,365;

(c) an air hoist, rock drill sharpener and other auxiliary equipment of a total value of £595 4s. 11d., was purchased in conjunction with item (b) and hired to prospectors at Meekatharra;

(d) an I.B.C. deep well pump jack powered by a Lister 7 h.p. air cooled diesel, together with necessary rods and equipment to lift from 600 feet at a cost of £844 2s. 6d.;

(e) one only Pomona angle drive pump capable of lifting 10,000 gallons per hour from 500 feet powered by International 4-cyl. diesel engine together with pump column and rods at a cost of £3,410;

(f) one Mindrill Model F20 Diamond Drill complete with built in tripod for the sum of £3,020;

(g) one Leyland Comet "100" Truck W.A.G. 4225 at a cost of £4,000.

Mines Department Rig No. 1, the B.B.S.4 drilled 1,668 feet at Day Dawn during the year. Hole No. 2A was advanced from 3,185 feet to its completed depth at 3,372, a footage of 193. Wedges were set in this hole at a depth of 2,277 and a deflection made to a depth of 3,752 feet, a footage of 1,475. On completion of this deflection the rig was dismantled and returned to our store at Welshpool. The B.B.S.4 is nine years old and has drilled 40,000 feet. Due to wear its condition has deteriorated and could not be used for deep drilling without major replacements at a high cost.

Rig No. 2, the Failing M1 Rotary Drill, was engaged drilling on the Amalgamated Collieries Leases at Collie during the first half of the year. A total of 6,931 feet in 14 holes was drilled here. On completion of this job the Failing was taken to Fremantle where a series of holes was drilled for the Railway Department testing for foundation conditions at the site of the proposed new Railway Bridge across the Swan. Eight holes totalling 1,140 feet 6 inches were drilled, one from an artificial bank constructed by the Department

and seven from on board a barge afloat on the river. When this programme was complete the rig was returned to our workshop at Welshpool where it is now being stripped down preparatory to a major overhaul.

Rig No. 3 (an A.3000) was drilling at Tallering Peak on the Iron Ore Resources Survey for the period. A total of 2,028 feet was drilled here in three holes. This work was done on a contract basis by Mr. A. Horsham.

Rig No. 4 (A. 2000) was occupied for the year in drilling at Coolgardie. Hole "Lady Loch" No. 2 was advanced from 130 to 580 feet. Hole "Forrest King" No. 1 was drilled to 1,155 feet and hole "Forrest King" No. 2 was commenced and reached a depth of 289 feet by the end of the year. A total of 1,894 feet was done by this rig for the period.

Rig No. 5 (A.2000) was operated on a wages basis on Lease 1337R at Yilgangie where three holes totalling 1,241 feet were drilled. From here the machine was returned to Perth for service. It was then taken to Meekatharra under contract arrangements by Mr. O. Koski and 870 feet were drilled at this centre by the end of the year.

Rig No. 6 (A.2000). This machine was engaged drilling on the site of a proposed new railway bridge across the Blackwood river at Bridgetown. One hole was advanced from 90 to 95 feet on the bank. The second was drilled beneath the river bed from a pontoon moored in the river to a depth of 107 feet and the third to 127 feet on the west bank. A total of 239 feet was completed at Bridgetown.

From this centre, the plant was transferred to Fremantle on the site of the projected new railway bridge. Four holes totalling 481 feet were drilled here. In an effort to improve core recoveries from this drilling a split inner tube type of core barrel was introduced with this machine.

Loading of this plant for operations at Mt. Goldsworthy were in hand at the end of the year.

Rig No. 7. The Mindrill F20 machine with a capacity for 800 feet of AXT drilling was shipped to Wyndham. Here five holes totalling 423 feet 3 inches were drilled at Bandicoot Bar on the site of the proposed diversion weir across the Ord River. The Bar is composed of massive quartzite and the drilling proved exceptionally hard, an average of five foot six inches advance per bit was made and as the bits cost an average of £5 10s. for setting charges alone, this drilling was expensive.

From Wyndham, this machine was transported to Broome where investigations are being made as to the site of proposed harbour extensions. Four holes totalling 329 feet were drilled here.

On completion of the Broome work the plant was taken to Port Hedland for possible use on drilling at Mount Goldsworthy.

Rig No. 8 (The Mindrill E500 air powered drill). This machine powered through the Holman 300 c.f.m. compressor was used at Bandicoot Bar where it drilled five holes totalling 297 feet. This rig was used at this locality on account of its lightness and relative portability on the sites in the Ord River bed which were very difficult of access.

As was the case last year much of our drilling was of a specialised nature and the work performed under extraordinary conditions as from barges, pontoons and difficult sites as in the Ord River bed and the total footage drilled is not a criterion of the final result.

Attached please find table showing the footages drilled for the year.

TABLE SHOWING FOOTAGE DRILLED FOR YEAR ENDED 31st DECEMBER, 1959

Rig No.	Machine	Place	Purpose	Footage	Basis
				ft. in.	
1	B.B.S.4	Day Dawn	Goldfields Exploration	1,668 0	Wages.
2	Failing	Collie	Coal Exploration	6,931 0	Wages.
2	Failing	Fremantle	Foundation Testing	1,140 6	Wages recouped by Railway.
3	A.3000	Tallering Peak	Iron Resources	2,028 0	Contract.
4	A.2000	Coolgardie	Goldfields Exploration	1,894 0	Wages.
5	A.2000	Yilgangie	Goldfields Exploration	1,241 0	Wages.
5	A.2000	Meekatharra	Goldfields Exploration	870 0	Contract.
6	A.2000	Bridgetown	Foundation Testing	239 0	Wages.
6	A.2000	Fremantle	Foundation Testing	481 0	Wages.
7	F.20	Wyndham	Foundation Testing	423 0	Wages.
....	F.20	Broome	Foundation Testing	329 0	Wages.
8	E.500	Wyndham	Foundation Testing	297 0	Wages.
			Grand Total	17,541 6	
			Total Foundation Testing	2,909 6	
			Exploration	14,632 0	

Hydrological Section.—During the year 60 holes totalling 6,091 feet were drilled by our Ruston Bucyrus 22 RW well drills in the Kalannie district.

At the completion of this work the two drills were transferred back to the Hill River area near Badgingarra. At the end of the period Hole No. 2 was at a depth of 1,047 feet with the drilling string stuck at this depth.

Hole No. 3 was at a depth of 1,132 feet and cased. Preparations were in hand to test this hole by pumping and equipment for this purpose was being installed.

Tabulated hereunder are details of our percussion drilling:—

	feet
Kalannie district	6,091
Hole 2—Badgingarra district	1,047
Hole 3—Badgingarra district	1,132
	8,270

J. F. HADDOW,
District Inspector of Mines.

Appendix No. 2.

REPORT ON ACTIVITIES OF BOARD OF EXAMINERS FOR UNDERGROUND SUPERVISORS' AND MINE MANAGERS' CERTIFICATES FOR 1959.

School of Mines,
Kalgoorlie, 11th March, 1960.

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

Dear Sir,

Hereunder I submit the Annual Report on the activities of the Board of Examiners for Mine Managers' and Underground Supervisors' Certificates during the year 1959.

Mining Law Examination.—An examination in Mining Law for the Mine Manager's Certificate was held on the 6th April, 1959. Details of the examination are as follows:—

Number of entries received	9
Number of candidates passed	2
Number of candidates failed	6
Did not sit	1

The names of the successful candidates are as follows:—

K. F. Parry.
D. L. Wolff.

Copies of the examination papers are attached hereto.

Underground Supervisors' Examination.—An examination for the Underground Supervisor's Certificate of Competency was held on the 7th September, 1959.

Applications to sit for the examination were received from the following centres:—

Bullfinch	3
Gwalia	3
Kalgoorlie	26
Mt. Magnet	3
Norseman	3
Ravensthorpe	3
Wittenoom	4
Total	45

Three of the applications, one being from Gwalia and two from Kalgoorlie, were not accepted.

Details of the examination are as follows:—

Number of candidates examined	42
Number of candidates passed	21
Number of candidates failed	16
Number of candidates deferred	5

Names of Successful Candidates.

Annear, C. H.	Marendoli, C.
Boylen, R. S.	Ossy-Orley, T.
Carrara, G.	Parry, K. F. G.
Checksfield, A. W.	Rutherford, A. L.
Crawford, J. M.	Simmons, M. R.
Dickison, S. P.	Smith, R. F.
Elliott, R. J.	Stubbs, R. J. S.
Gleeson, F.	Teede, L. N.
Goode, M. J.	Walton, W. C.
Hogan, K. R.	Wilkerson, K. H.
Kidd, W. Y. C.	

Copies of the examination papers in Mining and Mining Law are attached.

Twenty-four (24) Certificates of Competency as Underground Supervisors were issued (3 deferred from 1958 examination and 21 from 1959 examination).

With respect to the First Aid requirement for the Underground Supervisor's Certificate it was decided that in future applications for Underground Supervisors' Certificates would not be accepted unless the applicant had passed an examination in First Aid.

Mine Managers' Certificates.—Seven (7) applications for Mine Managers' Certificates were dealt with, six (6) were approved, and one (1) was refused.

The successful applicants were:—

K. J. Carter.
R. J. Elliott.
J. B. Oliver.
K. F. G. Parry.
M. R. Simmons.
J. J. Zuvich.

In the early part of the year Mr. J. Boyland went on Long Service Leave and during this period Mr. M. Ryan, Acting Senior Inspector of Mines, deputised for him as a member of the Board of Examiners.

Yours faithfully,
L. J. CARROLL,
Secretary, Board of Examiners for Mine Managers' and Underground Supervisors' Certificates of Competency.

MINES REGULATION ACT, 1946.

Examination for Mine Manager's Certificate of Competancy.

Mining Law.

April, 1959.

Attempt six (6) questions from Section A.
Attempt four (4) questions from Section B.

Time allowed—Three hours.

Candidates should note:

(a) The Mining Act and Regulations may be used at the examination but not the Mines Regulation Act.

(b) In answering questions in Section B reference to the appropriate sections of the Act or to the Regulations alone will not be sufficient. Candidates must summarise the requirements of the Act and/or Regulations and should also make reference to the relevant section (s) or regulation (s).

(c) Candidates are required to pass in both sections of the paper.

SECTION A.

Mines Regulation Act and Regulations.

Attempt six (6) questions from this section. Do not attempt more than six (6) questions from this section.

Marks allowed are ten (10) per question.

What is required by the Mines Regulation Act and/or Regulations regarding the following:

1. Action of a mine manager:
   (i) On assuming control of a mine.
   (ii) With regard to the Mines Regulation Act and Regulations.
   (iii) When a "serious" accident occurs on the mine.
2. (a) When a mine is to be abandoned.
   (b) Use of the English language in and about a mine.
3. Qualifications of persons in charge of underground workings.
4. (a) Handling of explosives.
   (b) Misfires.
   (c) Boring in butts.
5. (a) Safety helmets.
   (b) Safety belts.
   (c) Ladders in shafts and winzes.
6. Raising or lowering of men or material in a cage, skip, kibble or similar appliance.
7. (a) Stoppings and doors.
   (b) Ventilation plans.
   (c) Appointment of ventilation officers.
8. (a) Crib places.
   (b) Safety provisions on locomotives.
   (c) Who shall use a locomotive underground?
   (d) Who may make mine plans for submission to the Mines Department?

SECTION B.

Mining Act and Regulations.

Attempt four (4) questions from this section. Do not attempt more than four (4) questions from this section.

Marks allowed are ten (10) per question.

9. (a) What is the minimum term for a tribute agreement? And what notice is necessary for the determination of a tribute agreement?
   (b) Under what conditions may a miner obtain a new miner's right which shall be effective from the date of expiration of the old one without payment of other than the normal fee?
   (c) What Crown lands shall be exempt from occupation by the holder of a miner's right?

10. (a) What is the term of a gold-mining lease?
    (b) What is the yearly rent for a gold-mining lease?
    (c) A gold-mining lease is surrendered. What action is necessary by the lessee to protect his interests in the tailings on the lease at the time the lease is surrendered?

11. (a) How would you mark out and make application for a gold-mining lease?
    (b) If certain leases are amalgamated what labour is required to satisfy normal labour covenants?

12 (a) What is a mine?
    (b) What is necessary before gold or minerals can be mined on private property as defined in the Mining Act?

13. (a) An application has been made for a gold-mining lease. Have miners the right to search for alluvial gold on this land?
    (b) If alluvial gold is found what may be the effect or effects on the original application?

14. (a) What royalties are payable on minerals won from mining tenements?
    (b) An inflow of water has occurred from an abandoned mine. What are the courses open for the prevention of flooding the adjoining properties? Who meets the cost and how is it apportioned?

Western Australia.

MINES REGULATION ACT, 1946.

Examination for Certificate of Competency as Underground Supervisor.

MINING.

September, 1959.

Time allowed—Three hours.

Answer Six questions.

Note.—Read the Examination Paper Carefully.

Answers must be written in Ink.

Candidates should illustrate with sketches where possible.

1. A crosscut 7 feet by 5 feet is to be driven a distance of 500 feet. On the same level there is an opening to an empty stope where mullock can be disposed.
   The stope measurements are 100 feet long, 8 feet wide, and 60 feet deep.
   (a) How many tons of rock will be broken to complete the crosscut?
   (b) How many tons of mullock could be tipped into the stope?
   Use—
   (i) 13 c. ft. of solid rock equal 1 ton.
   (ii) 20 c. ft. of broken rock equal 1 ton.

2. (a) What are the essential features of a shaft penthouse?
   (b) Draw a penthouse for a vertical shaft which will allow 2 ton skips to continue operating above it over a depth of 1,000 feet.
   or
   (b) Draw a penthouse at a depth of 2,000 feet in an underlay shaft. Two ton skips are to operate above the penthouse.

3. You are the Underground Supervisor in charge of a vertical shaft, and at the time in question you are at the surface brace. The shaft has two hoisting compartments and is close timbered. The platman has reported that a cage load of old pipes when being hoisted to the surface has become jammed in the shaft between No. 2 and No. 3 levels.
   Explain what action you would take, how you would safely free the cage, and what would be necessary before that compartment was again used.
   or
   The shaft is "underlay." The skipman has reported that the door of the ore bin below No. 19 level has collapsed and allowed approximately 150 tons of ore to enter the shaft. The running ore has knocked out six "legs."
   Explain how the ore would be cleaned out, the shaft and bin repaired and what precautions would be taken before the shaft was again used below this bin.

4. A winze has been sunk in ore a distance of 120 feet below a level along which flows a good current of fresh air.
   The winze has not been entered for some 12 months and contains a small accumulation of level drainage water. It is essential that the ore be opened by driving both ways from the winze bottom and it is expected that the drives will extend 250 feet each way from the winze.
   Explain how you would proceed with the work, draw a diagram showing the placement of all essential appliances, and list the equipment necessary to commence the work.

5. The floor pillar above a "cut and fill" stope is to be removed. The level above is timbered with square sets and must be maintained.
   How would you carry out this work? Draw sketches in explanation.

6. Two levels 180 feet apart are to be connected by a rise. The rise will be driven on an elevation of 40 degrees from the horizontal.
   Explain what equipment is required and how you would proceed to put up the rise. Draw sketches.

7. Diamond drilling has proved that the downward extension of an orebody below the 2,000 foot level is 280 feet long and 18 feet wide. The orebody dips at 78 degrees, is of average to good standing, and has medium to good walls; it averages 5½ dwt. per ton.
   A crosscut has cut through the orebody near one end.
   Explain briefly, but with detailed sketches, how you would open up and stope this section of the orebody.
   or
   An orebody 180 feet long, 6 feet wide, and dipping at 35 degrees has been opened by drives at the 500 foot and 650 foot levels. The ore is said to average 8 dwt. per ton. The hanging wall is of medium standing ability but the footwall contains a weak seam.
   Explain—giving sketches—how you would extract this orebody.

8. What ventilation and dust suppression precautions would you, as Mine Supervisor, take to ensure maximum safety and healthy conditions for men working in a mine?

9. An old vertical 3 compartment shaft 500 feet deep is filled with water to within 80 feet of the surface. It is known from records that water 'makes' at 120 feet at the rate of 350 gallons per hour. It is also known that most of the water now in the mine entered the workings from heavy runs of storm water.
   It is required to unwater the mine so that the bottom level may be sampled, and you will supervise the sampling.
   How would you carry out this work and what precautions would you take?

Western Australia.

MINES REGULATION ACT, 1946.

Examination for Certificate of Competency as Underground Supervisor.

MINING LAW.

September, 1959.

Paper "A".

Time allowed—one and a half hours.

Answer ten questions.

Note.—Read the Examination Paper carefully.

Answers must be written in ink.

What is required by the Mines Regulations Act or the Regulations made under that Act regarding any ten (10) of the following:—

1. Handling of explosives.
2. (a) Signalling in winzes.
   (b) Ladders in winzes.
   (c) What must be provided before firing in winzes.
3. Method of firing charges when electric blasting not in use.
4. (a) Safety fuse.
   (b) Clearing passes and chutes.
5. Safety belts.
6. Safety provisions on cages or ore skips used for hauling men.
7. Ladders in shafts.
8. Precautions to be taken when repairing shafts.
9. Misfires.
10. (a) Raising or lowering tools.
    (b) Boring in butts.
    (c) Persons allowed to use explosives.
11. (a) Waste timber underground.
    (b) Who shall have charge of a locomotive underground.
12. (a) Employees required to know winding signals.
    (b) Sinking signals.
13. (a) Disused workings.
    (b) Return airways.
    (c) Ventilation of development ends.
14. Men working alone.

Western Australia.

MINES REGULATION ACT, 1946.

Examination for Certificate of Competency as Underground Supervisor.

MINING LAW.

September, 1959.

Paper "B".

Time allowed—half (½) an hour.

Answer all questions.

Note.—Read the Examination Paper carefully.

Answers must be written in ink.

For this you are provided with a copy of the Mines Regulation Act and you are required to give the Section of the Act or the Regulation referred to in the question.

Example.

Question—What Section of the Act or what Regulation refers to "Guides in Shafts"

Answer—Regulation 102.

What Section of the Act or what Regulation refers to each of the following:—

1. Use of the English language in and about a mine.
2. Safety fuse.
3. Underground dams.
4. Used ropes.
5. Stagnant water.
6. Ventilation of battery charging stations.
7. First Aid outfit.
8. Testing winding engines after repairs.
9. Recharging holes.
10. Recirculation of air.

Index to State Mining Engineer's Annual Report for 1959

LIST OF TABLES

DIVISION III

Report of the Superintendent of State Batteries—1959

Under Secretary for Mines:—

For the information of the Hon. Minister for Mines, I have the honour to submit my report on the operations of the State Batteries for the year ending 31st December, 1959.

Crushing Gold Ores:—

One 15 head, six 10 head, and eleven 5 head mills crushed 39,048 tons of ore made up of 599 separate parcels, an average of 65.18 tons per parcel. The bullion produced amounted to 17,346 ozs. which is estimated to contain 14,700 ozs. of fine gold, equal to 7 dwts. 12 grs. of gold per ton of ore.

The cost of crushing, including administration was 66/10 per ton, an increase of 7/10 per ton compared with the previous year when 41,806 tons were crushed at a cost of 59/ per ton.

The average value of the ore after amalgamation, but before cyanidation was 3 dwts. 1 gr. Thus the average head value of the ore was 10 dwts. 13 grs., which is 1 dwt. 0.3 grs. more than the previous year's average.

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

	Tons	Per cent.
Over 2 dwts. 8 grs. per ton	13,560	34·7
1 dwt. 18 grs. to 2 dwts. 8 grs. per ton	3,903·25	10·0
Under 1 dwt. 18 grs. per ton	20,560·25	52·7
Refractory	1,024·25	2·6
	39,047·75	100·0

Cyaniding:—

Seven plants treated 21,409 tons of tailings from amalgamation for a production of 3,142 fine oz. of gold worth £49,264. The average content was 4 dwts. 11 grs. before cyanidation, while the residue after treatment averaged 1 dwt. 7 grs. The theoretical extraction was therefore 71 per cent. The actual extraction was 66 per cent.

The cost of cyaniding was 38s. 7d. per ton, a decrease of 2s. 3d. per ton on the previous year, when 22,327 tons were treated at a cost of 40s. 10d. per ton.

Estimated Overall Recovery:

Figures for estimated recovery are:—

	Content Fine oz.	Per ton crushed dwts. grs.	Per cent.
Head Value	20,672	10 13	100
Amalgamation Recovery	14,700	7 12	71·1
Cyanidation Recovery....	3,142	1 14·6	15·3
Total Recovery	17,842	9 2·6	86·4

Treatment of Ores other than Gold:

Lead Ores:

During the year the Northampton State Battery crushed 4,214.25 tons of lead ore with an estimated average content of 15.3 per cent lead. There were 19 separate parcels, giving an average of 221.8 tons of ore per parcel.

A total of 761.48 tons of concentrates were produced. The concentrates averaged 75.7 per cent lead giving an estimated content of 577.1 tons of lead in concentrates.

3,452.8 tons of tailings were discarded. These had an average content of 2 per cent lead, giving a total of 69.1 tons of lead discarded in tailings.

The recovery of lead in the concentrates was 89.3 of the lead in the ore delivered to the plant.

The cost of operating the Northampton State Battery, including administration, was £10,140 5s. 8d. being 48s 1d. per ton of ore crushed. Revenue received was £4,290, 20s 4d. per ton. The corresponding figures for 1958, when 2,903.5 tons of ore was crushed, were operating cost £8,526 10s. 1d., 58s. 9d. per ton, and revenue £3,047 19s., 21s. per ton.

Sales of lead concentrates from the Northampton State Battery for the year were valued at £36,806.

Value of Production:

The estimated value of production from the State Batteries since their inception, excluding the value of gold tax paid to the Commonwealth, is:—

	GOLD 1959 £	Grand Total £
Par production—		
Crushing	62,444	8,576,414
Cyanidation	13,515	2,120,219
Gold Premium—		
Crushing	167,252	4,873,873
Cyanidation	35,749	1,404,191
Open Market Premium—		
Crushing	129	30,211
Cyanidation	28	10,241
Total Gold Production	£279,117	£17,015,149

OTHER ORES REALISED

	£	£
Tin—		
Ores	*Nil*	94,005
Residues	*Nil*	572
Tungsten Concentrates	*Nil*	18,850
Agricultural Copper Ore	*Nil*	2,648
Lead Concentrates	36,806	242,615
Total Other Ores	36,806	358,690
Grand Total	£315,923	£17,373,839

FINANCIAL

	Tons	Expenditure £	Receipts £	Loss £
Crushing—				
Gold Mills	39,047·75	130,430	19,155	111,275
Northampton	4,214·25	10,140	4,290	5,850
Cyaniding	21,409	41,297	17,873	23,424
		£181,867	£41,318	£140,549

The loss of £140,549 is an increase of £7,202 on the previous year. It does not include depreciation and interest on capital.

Capital Expenditure, all from General Loan Fund, was incurred as below:—

	£	s.	d.
Bamboo Creek—			
Water Supply	1,345	18	0
Peak Hill—			
Warman Pump	989	6	1
Coolgardie—			
Dynamo and Warman Pump	622	3	3
Lake Darlot—			
Cyanide Plant	4,549	11	1
General Erection and Maintenance—			
Hoist for truck	372	16	7
Leonora—			
Purchase and improvement of Battery	941	8	0
Various—			
Purchase of Assay Equipment from Allsop and Don	223	18	0
	£9,045	1	0

Cartage Subsidies:

	Tons	Cost
Ore carted to State Plants	12,559	£6,758

Comparative figures for the last three years are:—

	State Plants				Private Plants		
Year	Tons Crushed	Tons Subsidised	Per cent. Subsidised	Cost	Tons Subsidised	Cost	Total Cost
				£		£	£
1957	42,837	16,032	37·4	8,098	*Nil*	*Nil*	8,098
1958	41,806	19,517	46·7	9,674	*Nil*	*Nil*	9,674
1959	39,048	12,559	32·16	6,758	853	525	7,283

Administrative:

Expenditure amounted to £19,050 3s. 7d., equivalent to 6/3 per ton of ore crushed and cyanided, compared with an expenditure of £19,997 8s. 5d., 6s. per ton, for 1958.

	1958			1959		
	£	s.	d.	£	s.	d.
Salaries	10,247	6	10	10,144	19	0
Pay Roll Tax	2,682	4	10	2,877	14	4
Workers' Compensation	4,809	5	8	4,026	1	2
Travelling and Inspection	1,950	18	6	1,572	5	8
Sundries	307	12	7	429	3	5
	£19,997	8	5	£19,050	3	7

Staff:

I have to report the deaths of Managers R. G. Coumbe and A. Clayden during 1959. Both of these men, although managers for only a few years had loyally served the State Batteries Branch for many years.

Manager Steel was transferred from Marble Bar to Marvel Loch.

Manager Morrow was transferred from Marvel Loch to the Leonora-Laverton circuit.

Manager Sanfead was transferred from Leonora-Laverton to Marble Bar.

I wish to thank all officers at Head Office and in the field for their capable and willing service during the year.

General:

The 39,047.75 tons of gold ore crushed was 2,758.25 tons less than the previous year, but the average head value was 1 dwt. per ton higher, giving a total estimated gold recovery by amalgamation and cyanidation of 17,842 fine oz., 1,333 oz. more than in 1958. Gold ore crushing expenditure increased by £7,151, and with the reduced tonnage crushed, crushing costs increased by 7s. 10d. per ton.

The tonnage cyanide was 918 tons less than in 1958 and expenditure was £4,323 less, giving a reduction of 2s. 3d. per ton cyanided. The low cyanide recoveries at Kalgoorlie, Menzies, Marble Bar and Cue were caused by some fairly refractory ores being treated. At Menzies and Marble Bar the sources of the refractory ores were known, and the producers were paid on actual recoveries. At Kalgoorlie and Cue, it was not known which parcels of ore caused the low cyanide recoveries, so as all tailings had been purchased on a 75 per cent recovery basis, revenue was considerably reduced. In the future the ore received will be watched more closely, and doubtful tailings will be tested to find what recoveries can be made by cyanide leaching.

The Northampton Battery crushed 4,214.25 tons of lead ores, 1,310.75 more than in the previous year. The increased tonnage, with reduced maintenance expense, caused a reduction of 10s. 8d. per ton of ore crushed.

K. M. PATERSON,
Superintendent of State Batteries.

SCHEDULE No. 1

Return showing tons crushed, Gold Yield by Amalgamation, Average per ton in shillings, and Total Value without Premium for the Year ended 31st December, 1959

Battery	Tons Crushed	Gold Yield Bullion oz.	Value per Ton in Shillings	Total Value without Premium
				£ s. d.
Boogardie	297·75	143·20	34·73	515 10 5
Coolgardie	4,491·5	2,401·45	38·50	8,645 4 5
Cue	325·25	193·75	42·89	697 10 0
Kalgoorlie	7,285	3,435·40	33·96	12,367 8 10
Lake Darlot	2,429	213·75	6·33	769 10 0
Laverton	1,356	283·60	15·04	1,020 19 2
Leonora	2,164·5	693·45	23·07	2,496 8 5
Marble Bar	1,280	489·30	27·52	1,761 9 7
Marvel Loch	1,274·75	450·80	25·46	1,622 17 7
Meekatharra	3,749	769·50	14·77	2,770 4 0
Menzies	3,794·5	2,884·15	54·83	10,382 18 9
Norseman	546	412·15	54·24	1,483 14 10
Nullagine	422	171·70	29·29	618 2 5
Ora Banda	1,808·5	893·75	35·57	3,217 10 0
Paynes Find	268·75	57·00	15·27	205 4 0
Peak Hill	3,993	487·40	8·79	1,754 12 9
Sandstone	642	517·25	58·30	1,862 2 0
Yarri	2,920·25	2,847·90	70·21	10,252 8 10
Total	39,047·75	17,345·50	31·98	62,443 16 0

SCHEDULE No. 2

Number of Parcels Treated, Tons Crushed and Head Value for the Year ended 31st December, 1959

No. of Parcels Treated	Battery	Tons Crushed	Yield by Amalgamation Bullion	Yield by Amalgamation Fine Gold	Tailings Gross at 100 per cent.	Total Contents of Ore Fine Gold	Average per Ton Fine Gold	Gross Value per Ton Fine Gold @ £4 4s. 11½d per Ounce
			oz. dwts.	oz. dwts.	oz. dwts.	oz. dwts.	dwts. grs.	£ s. d.
12	Boogardie	297·75	143 4	121 7	50 14	172 1	11 13	2 9 0
97	Coolgardie	4,491·5	2,401 9	2,035 4	758 12	2,793 16	12 11	2 12 11
14	Cue	325·25	193 15	164 4	57 11	221 15	13 15	2 17 10
37	Kalgoorlie	7,285	3,435 8	2,911 10	1,463 5	4,374 15	11 22	2 10 7
94	Lake Darlot	2,429	213 15	181 3	191 2	372 5	2 14	11 0
17	Laverton	1,356	283 12	240 7	73 5	313 12	4 13	19 3
48	Leonora	2,164·5	693 9	587 14	164 18	752 12	6 23	1 9 7
19	Marble Bar	1,280	489 6	414 14	350 1	764 15	11 23	2 10 10
27	Marvel Loch	1,274·75	450 16	382 1	129 5	511 6	8 1	1 14 2
45	Meekatharra	3,749	769 10	652 3	563 12	1,215 15	6 12	1 7 7
71	Menzies	3,794·5	2,884 3	2,444 6	1,127 3	3,571 9	18 19	3 19 10
9	Norseman	546	412 3	349 6	62	411 6	15 2	3 4 1
5	Nullagine	422	171 14	145 10	50 4	195 14	9 6	1 19 4
32	Ora Banda	1,808·5	893 15	757 9	357 9	1,114 18	12 7	2 12 3
3	Paynes Find	268·75	57	48 6	13 17	62 3	4 15	19 8
20	Peak Hill	3,993	487 8	413 1	141 8	554 9	2 18	11 8
12	Sandstone	642	517 5	438 7	152 4	590 11	18 10	3 18 3
37	Yarri	2,920·25	2,847 18	2,413 12	265 15	2,679 7	18 7	3 17 9
599	Total	39,047·75	17,345 10	14,700 4	5,972 5	20,672 9	10 13	2 4 9

Average Tons per Parcel	65·18
Average Yield by Amalgamation per ton (Fine Gold)	7 dwts. 12 grs.
Average Value by Amalgamation per ton (Fine Gold)	£1 11s. 10d.
Average Head Value of Tailings per ton (Fine Gold)	3 dwts. 1gr.
Average Value of Tailings per ton (Fine Gold)	12s. 11d.

SCHEDULE No. 3

Segregation of Tailings Produced according to Value Year ended 31st December, 1959

Battery	Payable		2 dwts. 8 grains to 1 dwt. 18 grains		1 dwt. 18 grains and under		Refractory		Total	
	tons	oz. dwts.	tons	oz. dwts.	tons	oz. dwts.	tons	oz. dwts.	tons	oz. dwts.
Boogardie	215	42 8	69·25	7 9	13·50	 17	....	....	297·75	50 14
Coolgardie	2,157	582 14	233·50	22 6	2,013·25	133 3	87·75	20 9	4,491·50	758 12
Cue	195	44 1	8	 18	119·75	8 16	2·50	3 16	325·25	57 11
Kalgoorlie	2,515·75	1,170 13	712·25	71 7	4,057	221 5	....	....	7,285	1,463 5
Lake Darlot	618	106 11	438	47 4	1,373	37 7	....	....	2,429	191 2
Laverton	194·50	50 18	27·50	3	1,134	19 7	....	....	1,356	73 5
Leonora	323	69 1	252	33 14	1,589·50	62 3	....	....	2,164·50	164 18
Marble Bar	1,209	342 3	71	7 18	....	....	....	....	1,280	350 1
Marvel Loch	328·25	50 1	304·50	29 14	508	26 1	134	23 9	1,274·75	129 5
Meekatharra	1,668	432 19	3	 6	1,809	130 7	269	....	3,749	563 12
Menzies	2,294·25	1,027 13	220·25	24 6	1,280	75 4	....	....	3,794·50	1,127 3
Norseman	184	38 3	43	4 13	319	19 4	....	....	546	62 ....
Nullagine	121	25 14	....	....	301	24 10	....	....	422	50 4
Ora Banda	711·75	284 9	164·50	12 18	932·25	60 2	....	....	1,808·50	357 9
Paynes Find	268·75	13 17	....	....	....	....	....	....	268·75	13 17
Peak Hill	43	7 6	....	....	3,700	134 2	250	....	3,993	141 8
Sandstone	438·75	140 19	23·50	2 3	179·75	9 2	....	....	642	152 4
Yarri	75	13 17	1,333	126 6	1,231·25	95 19	281	29 13	2,920·25	265 15
Total	13,560	4,443 7	3,903·25	394 2	20,560·25	1,057 9	1,024·25	77 7	39,047·75	5,972 5

SCHEDULE No. 4

Details of Extraction Tailings Treatment, 1959

Battery	Tons Treated	Head Value		Contents	Tail Value		Contents	Recovery	Call	Recovery	Shortage	Surplus
		dwts.	grs.	dwts.	dwts.	grs.	dwts.	%	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Coolgardie	3,744	3	8	12,515	....	20	3,115	75	1,996 10 1	1,783 7 10	213 2 3	....
Cue	3,628	3	13	12,896	1	2	3,872	70	1,916 14 3	1,589 15 2	326 19 1	....
Kalgoorlie	4,992	3	19	18,902	1	2	5,460	71	2,855 0 5	2,531 2 5	323 18 0	....
Laverton	Slags	....	....	....	....	....	....	....	....	5 16 1	....	5 16 1
Marble Bar	2,188	7	5	15,825	2	10	5,272	67	2,241 9 1	1,997 5 0	244 4 1	....
Meekatharra	234	2	14	605	....	12	117	80	103 10 10	....	103 10 10	....
Menzies	4,815	5	14	26,825	1	15	7,898	71	4,020 1 8	4,160 12 4	....	140 10 8
Ora Banda	1,808	4	15	8,403	....	22	1,684	80	1,427 1 2	1,446 14 11	....	19 13 9
Total	21,409	4	11	95,971	1	7	27,418	71	14,560 7 6	13,514 13 9	1,211 14 3	166 0 6

Net Shortage .... £1,045 13s. 9d.
Head Value .... 4 dwts. 11 grains
Tail Value .... 1 dwt. 7 grains
Theoretical Recovery .... 71 per cent.
Actual Recovery .... 66 per cent.

SCHEDULE No. 5

Direct Purchase of Tailings, Year ended 31st December, 1959

Battery	Tons of Tailings Purchased	Amount Paid at £4 4s. 11½d. per oz.	Amount Paid Account of Premium
		£ s. d.	£ s. d.
Boogardie	24·50	13 13 1	15 5 11
Coolgardie	1,881·75	1,259 16 0	3,153 2 11
Cue	203·00	73 13 11	611 1 4
Kalgoorlie	2,094·50	2,532 0 4	6,387 16 11
Lake Darlot	843·00	174 11 6	400 15 3
Laverton	175·00	80 15 5	185 8 6
Leonora	162·50	74 5 11	170 11 2
Marble Bar	806·25	321 3 5	1,171 18 8
Marvel Loch	195·75	39 10 8	90 15 1
Meekatharra	1,455·75	539 15 1	1,363 16 9
Menzies	1,706·25	1,444 1 5	4,147 14 5
Norseman	15·25	2 17 9	6 12 7
Nullagine	109·00	33 5 7	76 8 0
Ora Banda	550·50	533 2 5	1,575 3 9
Peak Hill	52·75	15 1 3	34 11 5
Sandstone	394·75	300 9 8	689 16 3
Yarri	63·00	8 4 0	18 16 5
Total	10,733·50	7,446 7 7	20,099 15 4

SCHEDULE No. 6

Cyanide Yield, 1959

Battery	Tons	Fine oz.	Value	Premium	Total
			£	£	£
Coolgardie	3,744	419·65	1,783·391	4,774·470	6,557·861
Cue	3,628	373·85	1,589·758	4,253·218	5,842·976
Kalgoorlie	4,992	592·13	2,531·121	6,736·823	9,267·944
Laverton	....	1·35	5·804	15·333	21·137
Marble Bar	2,188	468·11	1,997·250	5,325·591	7,322·841
Meekatharra	234	....	....	....	....
Menzies	4,815	947·45	4,160·615	10,779·331	14,939·946
Ora Banda	1,808	339·65	1,446·746	3,864·217	5,310·963
	21,409	3,142·19	13,514·685	35,748·983	49,263·668

SCHEDULE No. 7

Statement of Receipts and Expenditure for the Year ended 31st December, 1959

Milling

Battery	Tons Crushed	Management and Supervision	Wages	Stores	Total Working Expenditure	Cost per Ton	Repairs and Renewals	Sundries	Gross Expenditure	Cost per Ton	Receipts	Receipts per Ton	Profit	Loss
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.
Bamboo Creek	....	407 4 3	423 10 8	126 4 9	956 19 8	....	84 8 1	43 6 5	1,084 14 2	....	....	....	....	1,084 14 2
Boogardie	297·75	215 5 0	307 4 10	208 0 9	730 10 7	49 1	411 7 9	324 0 9	1,465 19 1	98 6	139 19 1	9 5	....	1,326 10 0
Coolgardie	4,491·5	1,783 8 5	2,880 1 4	2,530 19 5	7,194 9 2	32 0	3,006 13 1	1,529 4 2	11,730 6 5	52 3	2,037 1 5	9 1	....	9,693 5 0
Cue	325·25	1,025 11 10	642 2 3	360 2 11	2,027 17 0	124 8	1,230 14 10	819 13 3	4,078 5 1	250 9	358 12 5	22 1	....	3,719 12 8
Kalgoorlie	7,285	4,200 19 4	4,080 9 0	4,615 6 6	12,896 14 10	35 5	1,698 16 2	3,034 13 4	17,630 4 4	48 5	3,220 10 10	8 10	....	14,409 13 6
Lake Darlot....	2,429	1,290 7 8	2,907 12 2	809 5 4	5,007 5 2	41 3	398 0 9	806 16 0	6,212 1 11	51 2	1,062 8 6	8 9	....	5,149 13 5
Laverton	1,356	1,294 0 4	967 16 3	505 10 11	2,767 7 6	40 10	259 7 9	773 17 2	3,800 12 5	56 1	594 18 9	8 9	....	3,205 13 8
Leonora	2,164·5	1,343 2 6	3,420 0 3	2,132 19 6	6,896 2 3	63 9	1,557 0 9	1,464 2 9	9,917 5 9	91 8	1,159 2 8	10 9	....	8,758 3 1
Marble Bar	1,280	2,056 12 9	2,149 16 7	1,438 7 2	5,644 16 6	88 2	1,782 5 5	1,371 12 2	8,798 14 1	137 6	984 13 4	15 5	....	7,814 0 9
Marvel Loch	1,274·75	1,168 17 5	2,368 18 3	769 4 4	4,307 0 0	67 7	630 0 7	691 8 8	5,628 9 3	88 4	670 18 2	10 6	....	4,957 11 1
Meekatharra....	3,749	3,020 12 0	5,201 17 2	2,073 5 6	10,295 14 8	54 11	1,103 10 0	1,806 14 9	13,205 19 5	70 5	1,779 9 0	9 6	....	11,426 10 5
Menzies	3,794·5	1,543 10 5	3,751 15 6	1,873 6 9	7,168 12 8	39 9	603 15 8	1,276 8 10	9,048 17 2	47 8	2,034 6 11	10 9	....	7,014 10 3
Norseman	546	111 12 4	471 14 2	207 18 4	791 4 10	29 0	254 0 9	278 4 0	1,323 9 7	48 6	236 11 7	8 8	....	1,086 18 0
Nullagine	422	665 4 5	1,525 7 11	673 8 4	2,864 0 8	135 9	657 8 1	476 5 3	3,997 14 0	189 6	223 11 0	10 7	....	3,774 3 0
Ora Banda	1,808·5	1,569 9 10	1,587 12 4	1,093 15 7	4,250 17 9	47 0	2,274 16 1	792 7 5	7,318 1 3	80 11	1,036 2 2	11 6	....	6,281 19 1
Paynes Find	268·75	188 7 7	772 16 10	110 18 8	1,072 3 1	79 9	554 7 0	219 18 7	1,846 8 8	137 5	134 17 6	10 0	....	1,711 11 2
Peak Hill	3,993	1,322 16 3	3,358 17 10	1,016 18 1	5,698 12 2	28 7	610 15 6	1,611 13 9	7,921 1 5	39 8	1,398 13 0	7 0	....	6,522 8 5
Sandstone	642	532 13 1	1,554 0 7	674 4 4	2,760 18 0	86 0	1,593 15 2	714 14 8	5,069 7 10	157 11	263 19 11	8 3	....	4,805 7 11
Yarri	2,920·25	1,435 8 4	5,051 15 3	1,724 5 0	8,211 8 7	56 3	821 3 2	1,319 19 7	10,352 11 4	70 11	1,815 2 9	12 5	....	8,537 8 7
Head Office	....	....	....	....	....	....	....	....	....	....	4 0 10	....	4 0 10	....
	39,047·75	25,175 3 9	43,423 9 2	22,944 2 2	91,542 15 1	46 11	19,532 6 7	19,355 1 6	130,430 3 2	66 10	19,154 19 10	9 10	....	111,279 4 2
Northampton (Lead)	4,214·25	2,917 5 4	2,940 12 7	1,502 10 5	7,360 8 4	34 11	1,130 5 1	1,649 12 3	10,140 5 8	48 1	4,290 0 0	20 4	....	5,850 5 8
Totals	43,262	28,092 9 1	46,364 1 9	24,446 12 7	98,903 3 5	45 9	20,662 11 8	21,004 13 9	140,570 8 10	65 0	23,444 19 10	10 10	4 0 10	117,129 9 10
Net Loss	....	....	....	....	....	....	....	....	....	....	....	....	....	117,125 9 0

SCHEDULE No. 8

Statement of Receipts and Expenditure for the Year ended 31st December, 1959

Cyaniding

Battery	Tons Treated	Management and Supervision	Wages	Stores	Total Working Expenditure	Cost per Ton	Repairs and Renewals	Sundries	Gross Expenditure	Cost per Ton	Receipts	Receipts per Ton	Profit	Loss
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.
Bamboo Creek	....	....	....	112 18 2	112 18 2	....	74 8 9	....	187 6 11	....	....	....	....	187 6 11
Coolgardie	3,744	792 16 0	3,151 19 9	936 16 4	4,881 12 1	26 1	991 6 8	1,448 12 11	7,321 11 8	39 1	4,077 7 0	21 9	....	3,244 4 8
Cue	3,628	429 8 9	2,792 14 4	1,232 9 7	4,454 12 8	24 7	308 14 6	1,815 19 1	6,579 6 3	36 3	1,566 10 0	8 8	....	5,012 16 3
Kalgoorlie	4,992	1,339 6 6	3,388 0 9	2,667 2 4	7,394 9 7	29 8	444 10 3	1,931 15 7	9,770 15 5	39 2	2,448 12 1	9 10	....	7,322 3 4
Laverton	....	....	30 0 0	11 18 7	41 18 7	....	169 14 10	....	211 13 5	....	20 10 2	....	....	191 3 3
Marble Bar	2,188	260 6 11	2,019 14 9	684 7 4	2,964 9 0	27 1	889 13 5	1,379 6 9	5,233 9 2	47 10	2,765 9 8	25 3	....	2,467 19 6
Marvel Loch	....	....	....	15 19 6	15 19 6	....	....	....	15 19 6	....	....	....	....	15 19 6
Meekatharra....	234	....	441 5 10	61 8 10	502 14 8	43 0	....	73 10 1	576 4 9	49 3	....	....	....	576 4 9
Menzies	4,815	710 14 2	4,686 1 6	1,340 3 8	6,736 19 4	28 0	117 14 0	1,574 18 9	8,429 12 1	35 0	5,959 2 8	24 9	....	2,470 9 5
Nullagine	....	....	....	3 3	3 3	....	....	....	3 3	....	....	....	....	3 3
Ora Banda	1,808	305 9 1	1,662 1 10	405 0 1	2,372 11 0	26 3	132 10 2	465 17 8	2,970 18 10	32 10	3,195 3 7	35 4	224 4 9	....
Totals	21,409	3,838 1 5	18,171 18 9	7,468 7 8	29,478 7 10	27 6	3,128 12 7	8,690 0 10	41,297 1 3	38 7	20,032 15 2	18 9	224 4 9	21,488 10 10
Interest Paid to Treasury	....	....	....	....	....	....	....	....	....	....	2,160 0 0	....	....	2,160 0 0
							....	....	....	....	17,872 15 2	....	....	....
Gross Loss	....	....	....	....	....	....	....	....	....	....	....	....	....	23,648 10 10
Less Profit	....	....	....	....	....	....	....	....	....	....	....	....	....	224 4 9
Net Loss	....	....	....	....	....	....	....	....	....	....	....	....	....	23,424 6 1

STATE BATTERIES

Trading and Profit and Loss Account for the Year ended 31st December, 1959

1958 £		1959 £	£
	Trading Costs—		
91,784	Wages	96,467	
35,887	Stores	31,915	
20,538	Repairs, Renewals and Battery Spares	23,791	
29,216	General Expenses and Administration	29,695	
177,425			181,868
	Earnings—		
44,078	Milling and Cyaniding Charges		41,318
133,347	Operating Loss for the Year		140,550
	Other Charges—		
23,356	Interest on Capital	23,799	
13,259	Depreciation	12,743	
2,453	Superannuation—Employers' Share	2,371	
39,068			38,913
£172,415	Total Loss for the Year		£179,463

STATE BATTERIES

Balance Sheet as at 31st December, 1959

31st December, 1958 £	Funds Employed	31st December, 1959 £	£
	Capital—		
567,022	Provided from General Loan Fund	576,858	
137,245	Provided from Consolidated Revenue Fund	137,245	
704,267			714,103
	Reserves—		
28,622	Commonwealth Grant—Assistance to Goldmining Industry	28,622	
13,786	Commonwealth Grant—Assistance to Metalliferous Mining	13,786	
42,408			42,408
	Liability to Treasurer—		
925,624	Interest on Capital		949,422
5,000	Advance for Purchase of Tailings		....
	Other Funds—		
1,055,925	Provided from Consolidated Revenue Fund (Excess of Payments over Collections)		1,200,487
2,733,224			2,906,420
	Deduct—		
	Profit and Loss :		
2,367,835	Loss at Commencement of Year	2,540,250	
172,415	Loss for Year	179,463	
2,540,250	Total Loss from Inception		2,719,713
£192,974			£186,707
	Employment of Funds		
	Fixed Assets—		
698,676	Plant, Buildings and Equipment	708,512	
591,128	*Less* Depreciation	603,871	
107,548			104,641
	Current Assets—		
3,269	Debtors	3,349	
55,710	Stores	58,598	
1,694	Battery Spares	1,957	
	Purchase of Tailings :		
6,808	Treasury Trust Account	3,193	
50,546	Tailings not Treated	49,056	
7,398	Estimated Gold Premium	6,971	
125,425			123,124
232,973	Total Assets		227,765
	Deduct—		
	Current Liabilities :		
6,096	Creditors	5,315	
22,152	Liability to Treasurer (Superannuation—Employers' Share)	24,523	
	Purchase of Tailings :		
4,353	Creditors	4,249	
7,398	Estimated Premium Due	6,971	
39,999			41,058
£192,974			£186,707

(4)—37498

DIVISION IV — CONTENTS

REPORTS

LIST OF PLATES

LIST OF FIGURES

DIVISION IV

Annual Progress Report of the Geological Survey Branch of the Mines Department for the year 1959

The Under Secretary for Mines,

I submit herewith, for the information of the Honourable the Minister for Mines, my report on the activities of the Geological Survey for the year 1959:

STAFF.

Staff members as at 31st December, 1959 were as follows:—

			Total
Professional—			
Ellis, H. A., B.Sc., A.O.S.M. (N.Z.)	Government Geologist		10
Berliat, K., D.Sc. (Switzerland)	Senior Geologist	....	
Sofoulis, J., B.Sc. (W.A.)	Geologist, Grade 1	....	
de la Hunty, L. E., B.Sc. (W.A.)	Geologist, Grade 1	....	
Low, G. H., B.Sc. (W.A.)	Geologist, Grade 1	....	
Noldart, A. J., B.Sc. (Syd.)	Geologist, Grade 1	....	
Wyatt, J. D., B.A. (W.A.)	Geologist, Grade 2	....	
Connolly, R. R.	Geologist, Grade 2	....	
Bartram, G. D., B.Sc. (W.A.)	Geologist, Grade 2	....	
Bock, W. M., B.Sc. (Q.)	Geologist, Grade 2	....	
Clerical—			
Baker, R. E.	Clerk	....	3
Miller, J. B. (Mrs.)	Typist	....	
Cooper, A. W.	Temporary Junior Clerk	....	
Laboratory—			
Fimmell, L. H.	Laboratory Technician		1

Promotions, Resignations, Appointments.

There were no resignations or promotions of professional officers during the year. Mr. W. M. Bock, a graduate from the University of Queensland was appointed on 14/8/59 to one of the three vacant Geologist Grade 2 positions.

Mr. R. F. Rasmussen, Clerk, was transferred to the Department of Agriculture on 3/7/59. He had served the Branch enthusiastically and efficiently during his short period of service. Mr. R. E. Baker took over Mr. Rasmussen's duties as Clerk on 29/6/59.

Mr. H. G. Potts, Junior Clerk, was transferred to the Records Branch, Mines Department on 12/6/59 and was replaced by Temporary Junior Clerk J. W. Rogers on 10/6/59. Mr. Rogers left the Branch on 6/11/59 and was replaced by Temporary Junior Clerk A. W. Cooper on 23/11/59.

PROFESSIONAL STAFF.

The authorised establishment for professional officers as at 31st December is as follows:—

Government Geologist	1
Senior Geologist	1
Geologists, Grade 1	4
Geologists, Grade 2	6
Total	12

Despite repeated attempts to fill all three Geologist Grade 2 vacancies by Australia wide advertisement throughout the year, two positions remained unfilled at the end of the year.

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

Period	No. of Geologists available including the Government Geologist	Area of State	Square Miles per Geologist	Population of State
		sq. miles		
Jan.-Aug.	9	975,920	108,400	722,321
Sept.-Dec.	10	....	97,592	....

Activities of Professional Officers:

H. A. Ellis, Government Geologist.

In addition to head-office administrative and consulting duties, field work for various purposes was undertaken as follows:—

May.—Ravensthorpe, Esperance and Spargoville districts.

June-July.—Nullagine, Oakover River and Ellarine Hills districts.

September.—Byro Station, Meekatharra and Day Dawn districts.

A large volume of consulting work arose during the last half of the year from the Government's published intention of seeking a permit to export iron ore from the Commonwealth Government. Mining and commercial interests based on Japan, the Eastern States and locally, were in constant attendance on me for information about the iron ore resources of the State, the geography, geology and transport systems and road capacities of the areas in which the iron ore occurs.

Relevant information had been compiled for Mineral Resources Bulletin No. 7, "Iron Ores in Western Australia," but the usual struggle to get the matter into print did not succeed during the year and a lot of repetitive consulting work ensued.

K. Berliat, Senior Geologist.

January-May.—Hydrological field work laying out of drill sites for groundwater, and drilling supervision, Kalannie district.

June.—Office duties.

July.—Laying out of exploratory drill sites for water and drilling supervision, Hill River district.

August.—Hydrological investigations on West Kimberley sheep and cattle stations.

September-December.—Hydrological Surveys, Geraldton, Dongara and Mingenew districts. Drilling supervision, Hill River district.

L. E. de la Hunty, Geologist, Grade 1.

January.—Annual leave for 1958.
February.—Report writing and water supply investigation at Miling.
March.—Report writing and testing of "Megger" geophysical instrument at Burakin.
April-October.—Regional Survey of Balfour Downs 4-mile Sheet and collection of bulk samples of manganese ore for beneficiation tests.
November.—Report writing and inspection of manganese deposits in the Pilbara Goldfield.
December.—Report writing and annual leave for 1959.

J. Sofoulis, Geologist, Grade 1.

January.—Photogrammetric work with Lands Department.
February-April.—Working in Canberra on air photo interpretation of Belele, Meekatharra, Wiluna and Kingston 4-mile Sheets in conjunction with officers of C.S.I.R.O. Division of Land Research.
May-July.—Regional Survey of Widgiemooltha 4-mile Sheet.
August-October.—Regional Survey of Balfour Downs 4-mile Sheet.
November-December.—Report writing and annual leave.

G. H. Low, Geologist, Grade 1.

January-February.—Annual leave for 1958 and supervision Coolgardie and Tallering Range drilling programmes and preparations for Widgiemooltha survey.
March-April.—As above with reports on auriferous areas at Beete and Burnakura.
May-July.—Regional mapping Widgiemooltha survey, Coolgardie drilling supervision and examination of the "New Mexico" G.M., Ora Banda.
August-September.—Closed Widgiemooltha survey on August 14. One month special leave and office work on Widgiemooltha survey.
October-December.—Survey and drill site location on Mt. Goldsworthy iron deposits. Drafting and report writing for Widgiemooltha survey. Further examination of New Mexico G.M. Report on drilling for coal by Amalgamated Collieries Ltd., in the South-East Cardiff area. Annual leave for 1959.

A. J. Noldart, Geologist, Grade 1.

January.—Compilation Pilbara Survey Bulletin.
February-April.—Supervision of diamond drilling at Day Dawn and Yarrie.
May-June.—Field work for Pilbara survey.
July-August.—Supervision of diamond drilling at Day Down and Tallering Range. Preparation of data for Leonora/Gwalia survey.
September - October.—Supervision Leonora/Gwalia survey and diamond drilling at Day Dawn.
November-December.—Compilation of report on Day Dawn drilling. Correlation of field sheets and compilation of report on Leonora/Gwalia survey.

J. D. Wyatt, Geologist, Grade 2.

January-April.—Miscellaneous inspections.
May-October.—Supervision of foundation test drilling, Ord River Diversion Dam site.
October-December.—Report writing and miscellaneous inspections.

R. R. Connolly, Geologist, Grade 2.

January-March.—Long Service Leave.
May-August.—Mapping of Saunders Creek radioactive prospect in collaboration with the Commonwealth Bureau of Mineral Resources.
September.—Drilling supervision Coolgardie and Tallering Range programmes. Report writing.
October-December.—Proof reading publications. Borehole siting Weld Range iron deposits. Inspection Bungalbin iron deposits. Report writing.

G. D. Bartram, Geologist, Grade 2.

January-May.—Assisting in the supervision of water boring, Kalannie District.
June-July.—Preparation of hydrological maps from information obtained in the 1958 field season.
August.—Hydrological surveying of the Greenough River district.
September-October.—Hydrological surveying of the Nanson-Eradu district and the Dongara district.
November.—Hydrological surveying of the Mingenew district.
December.—Annual leave for 1959.

W. Bock, Geologist, Grade 2.

August.—Commenced duties August 14; miscellaneous inspections.
September-October.—Leonora/Gwalia regional survey.
November-December.—Miscellaneous inspections and report writing.

ACCOMMODATION

A decision was made by the Government towards the end of the year, that the space occupied by us in the north-eastern corner of the Museum Buildings in which the head office of this Survey has been located since 1903, was to be vacated by us and made available to the Art Gallery.

Alternative office and laboratory accommodation for the occupants of the above space is to be provided at No. 26 Francis Street, a privately owned dwelling some 700 feet west of our present site, and 380 feet west from our main staff office building and storage sheds situated at the corner of Francis and Museum Streets.

The Geological Survey is surely worthy of a home of its own where its present scattered components can be housed to the advantage of both the public, the staff members and in the interests of general efficiency.

FIELD WORK

Major Field Work Completed during the Year and in Progress as at 31st December, 1959.

(1) Completion of diamond drilling at Day Dawn (Great Fingall Exploration).

(2) Completion of diamond drilling at Yilgangie.

(3) Completion of diamond drilling at Tallering Range. (Iron-ore).

(4) Completion of detailed geological survey of an area surrounding Leonora.

(5) Completion of Iron Ore Survey of the State.

(6) Commencement of a regional geological survey of an area between Coolgardie and Norseman covered by the 4 miles = 1 inch Sheets, Boorabbin, Widgiemooltha, Lake Johnston and Norseman.

(7) A regional geological survey of the Balfour Downs 4 miles = 1 inch Sheet in continuation of the search for manganese.

(8) Geological mapping, the collection of underground data, and supervision of percussion drilling for water in various parts of the State.

(9) Continuation of the Manganese-Chromite survey of the State.

(10) Supervision of deep diamond drilling at Paddy's Flat, Meekatharra and at Coolgardie.

(11) Supervision of damsite test drilling at Bandicoot Bar, Ord River.

(12) Completion of field work in conjunction with the Bureau of Mineral Resources, on the Halls Creek uranium prospect.

Field Work Planned for 1960.

(1) Supervision of diamond drilling at Coolgardie, Meekatharra, Mt. Goldsworthy and Wilgie Mia and any other operations arising out of the Mines Department's drilling policy.

(2) Continuation of geological work and supervision of water-boring in connection with the Water Drilling Section of the Mines Department and the Hydrological Section of the Geological Survey.

(3) Continuation of the regional geological survey of an area between Coolgardie and Norseman.

(4) Continuation of the regional geological survey of the Balfour Downs 4 miles = I inch Sheet.

(5) Continuation of supervision of Ord River damsite test drilling.

TRANSPORT.

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

Vehicle W.A.G.	Make and Type	Load (cwt.)	Mileage as at 31/12/59	Mileage for 1959	Date Purchased (new)	Remarks
2393	International Utility	14	112,000	3,099	1950	Sold 25/6/59
909	Willys Jeep	5	50,543	7,407	1953	....
3135	Fargo Utility	15	64,062	8,715	1954	....
3678	Dodge Utility	15	42,653	9,220	1955	....
3535	Landrover L.W.B. Utility	10	54,385	11,373	1955	....
3876	do. do.	10	40,897	11,225	1956	....
4559	do. do.	10	38,069	16,197	1957	....
4475	do. do.	10	36,756	14,601	1957	....
4691	International Utility	20	26,413	8,249	1957	....
5009	do. do.	20	19,309	16,699	1958	....
4793	do. do.	20	18,186	13,932	1958	....
5352	do. do.	20	5,250	5,250	1959	Purch'd 14/7/59

Total miles: 125,967.

In addition to the above listed vehicles, a two-wheel trailer (W.A.G. 462) was used to supplement the load capacity of the Willys Jeep and two caravans (W.A.G. 1122 and W.A.G. 1140) were used by the officers of the Hydrological Section.

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

The year saw many and varied demands under the above headings on the services of this Branch, with enquiries for information on iron ore resources in a prominent position. Much time and work could be saved if our reports could be made available in a published form reasonably soon after they are prepared.

ACTIVITIES OF THE COMMONWEALTH BUREAU OF MINERAL RESOURCES.

The programme of airborne magnetometer and scintillometer surveys in the Eastern Goldfields and the Carnarvon sedimentary basin was continued and three stratigraphic bores were drilled at strategic points in the sedimentary basins (see separate report). The Bureau has made costly and valuable contributions to our geological knowledge in recent years.

PUBLICATIONS.

Issued during 1959.

Bulletin 105, Pt. 2.—The Collie Mineral Field, by G. H. Low, B.Sc.

Bulletin 109.—Miscellaneous Reports for 1954.

Bulletin 112.—Miscellaneous Reports for 1955.

Annual Progress Report of the Geological Survey of Western Australia for the year 1957.—Administrative Section only.

In the Press.

Mineral Resources Bulletin No. 7.—Iron Ores in Western Australia.

Bulletin 113.—Miscellaneous Reports for 1956.

Bulletin 114.—Miscellaneous Reports for 1957.

Annual Progress Report for 1958.

In Course of Preparation.

A Bulletin on the Geology of the Nullagine and Marble Bar 4 miles = 1 inch Sheets.

A Mineral Resources Bulletin on the Manganese and Chromite Resources of W.A.

A Mineral Resources Bulletin on the Copper Deposits of W.A.

H. A. ELLIS,
Government Geologist.

18th January, 1960.

REPORT ON WATER DRILLING OPERATIONS IN THE KALANNIE DISTRICT.

By K. Berliat, D.Sc.,

Senior Geologist.

Water drilling operations in the Kalannie District (approximately 180 miles by road north-north-east of Perth) commenced on 22nd September, 1958, when the first Ruston Bucyrus R.W.22 drill arrived from Perth. A second plant arrived on 13th November, 1958, after completion of Hill River No. 1 bore at Badgingarra. Drilling operations in the district were completed on 27th May, 1959. The drilling plants were owned by the Government and operated by day labour.

Ministerial directions were to carry out a drilling programme for individual farmers on a "no water, no pay" basis. Under the terms of the Agreement a "successful bore hole" meant "a bore hole giving a flow of not less than one thousand gallons of water during a period of twenty-four hours, such water not containing more than seven hundred grains of sodium chloride per gallon." The rates charged for a successful bore were £1 10s. per foot to a depth of 300 feet, plus casing at cost price.

The number of bore holes that could be put down on "any one single farming property" was limited to three. A later direction was that three bores could be sunk on any one location, hence if a farming property consisted of say four locations, then twelve holes could be drilled on that property. However, this decision was reversed again in favour of the original three bores on each farm, whether that be one location or a number of locations.

Drilling priorities had to be based on the dates of completion of the various drilling Agreements. This meant that the two plants could not be used to the best operational advantage, as they had to operate out of order geographically, and up to 50 miles apart.

Kalannie has always been a most difficult district for underground water. Information from local farmers indicates that in the past, on an overall average, some 50 unsuccessful bores have been drilled for each existing useful supply. The very fact that so many Agreements were signed shows that farmers have been unable to locate suitable underground water.

The topography of the district is generally that of a sand plain, exhibiting little or no modification of relief. Drainage is internal, without defined superficial channels. The plain is underlain by ancient Pre-Cambrian rocks, mostly granite. With the exception of a few granite "rocks" there are no outcrops.

Our observations have shown that the bulk of the underground water is too highly saline even for stock purposes, and that useful accumulations are few and scattered. In the absence of topographical and geological features these occurrences would be most difficult to locate even if they were generally found in accordance with the empirical principles governing the accumulation of ground water in other dry areas. Information gained from drilling shows that in the Kalannie area these principles do not generally apply, and that there is little or no topographical control of salinity.

The answer to the problem lies in the peculiar nature of the underground drainage, which is controlled by a highly irregular granitic surface at depth. There is no way of ascertaining the configuration of this surface by geological methods.

Drilling details:	Feet.
Total footage drilled	6,566
Number of bores sunk	77
Number of bores yielding 1,000 gallons or more per 24 hours of water containing 700 grains of sodium chloride or less per gallon	11

Tabulated details of the drilling programme are appended.

K. BERLIAT,
Senior Geologist.

5th June, 1959.

Bore No.	Ninghan Location No.	Lands Dept. Litho.	Owner	Total Depth (feet)	Water Cut (feet)	Supply (galls. per day)	Salinity (grains per gall. NaCl)	Commenced	Completed	Remarks
1	2314	65/80	W. R. McPharlin	125	94	1,500	98	8/10/58	21/10/58	Total salts, 132 grs./gall. Bore cased.
2	2910	65/80	W. R. McPharlin	96	75	1,500	756	28/10/58	13/11/58	Total salts, 756 grs./gall. Bore had to be abandoned because of rising clay cutting off the aquifer.
3	1946	65/80	Sanderson & Sanderson	77	75	10,000	1,600	17/11/58	18/11/58	Bore not cased.
4	2904	88/80	R. G. Stanley	74	....	....	....	17/11/58	20/11/58	Bore dry.
5	1946	65/80	Sanderson & Sanderson	87	85	1,200	850	19/11/58	25/11/58	Bore not cased.
6	2906	88/80	R. G. Stanley	92	....	....	....	24/11/58	28/11/58	Bore dry.
7	1863	89/80	G. & W. W. Mauchline	95	....	....	....	26/11/58	28/11/58	Bore dry.
8	2288	89/80	G. & W. W. Mauchline	173	140	200	390	1/12/58	8/12/58	Supply insufficient.
9	2906	88/80	R. G. Stanley	96	....	....	....	2/12/58	4/12/58	Bore dry.
10	2564	65/80	W. R. & I. W. Knapp	91	....	....	....	5/12/58	10/12/58	Bore dry.
11	2288	89/80	G. & W. W. Mauchline	83	....	....	....	8/12/58	9/12/58	Bore dry.
12	2170	65/80	E. H. Stanley & Co.	78	77	8,000	840	10/12/58	12/12/58	Bore not cased.
13	2564	65/80	W. R. & I. W. Knapp	23	22	1,500	900	11/12/58	12/12/58	Bore not cased.
14	2170	65/80	E. H. Stanley & Co.	73	....	....	....	15/12/58	16/12/58	Bore dry.
15	2170	65/80	E. H. Stanley & Co.	107	106	10,000	920	16/12/58	19/12/58	Bore not cased.
16	2644	65/80	W. R. & I. W. Knapp	106	102	1,000	940	16/12/58	19/12/58	Bore not cased.
17	2561	65/80	W. R. & I. W. Knapp	75	70	2,000	1,450	7/1/59	9/1/59	Bore not cased.
18	2312	65/80	E. H. Stanley & Co.	63	60	3,000	485	12/1/59	14/1/59	576 grs./gall, total salts. Bore cased.
19	2561	65/80	W. R. & I. W. Knapp	75	70	2,500	1,400	12/1/59	13/1/59	Bore not cased.
20	2561	65/80	W. R. & I. W. Knapp	81	....	....	....	14/1/59	15/1/59	Bore dry.
21	1946	65/80	Sanderson & Sanderson	90	90	300	1,230	15/1/59	16/1/59	Bore not cased.
22	2101	65/80	W. R. & I. W. Knapp	78	....	....	....	19/1/59	21/1/59	Bore dry.
23	2678	88/80	Sanderson & Sanderson	8	....	....	....	20/1/59	20/1/59	Bore dry.
24	2678	88/80	Sanderson & Sanderson	34	....	....	....	22/1/59	22/1/59	Bore dry.
25	2101	65/80	W. R. & I. W. Knapp	93	91	650	1,080	22/1/59	27/1/59	Bore not cased.
26	3977	88/80	Sanderson & Sanderson	50	49	10,000	3,000	23/1/59	27/1/59	Bore not cased.
27	3977	88/80	Sanderson & Sanderson	86	71	400	820	27/1/59	28/1/59	Bore not cased.
28	2101	65/80	W. R. & I. W. Knapp	59	....	....	....	28/1/59	29/1/59	Bore dry.
29	3977	88/80	Sanderson & Sanderson	103	102	4,000	2,000	29/1/59	2/2/59	Bore not cased.
30	2130	65/80	W. R. & I. W. Knapp	7	....	....	....	30/1/59	2/2/59	Bore dry.
31	3893	88/80	Sanderson & Sanderson	35	34	2,000	2,000	2/2/59	3/2/59	Bore not cased.
32	2562	88/80	Sanderson & Sanderson	57	55	2,000	1,050	3/2/59	4/2/59	Bore not cased.
33	2130	65/80	W. R. & I. W. Knapp	60	....	....	....	3/2/59	4/2/59	Bore dry.
34	1185	65/80	R. J. Roach	90	....	....	....	4/2/59	6/2/59	Bore dry.
35	1129	65/80	R. J. & A. J. Hathaway	36	35	250	650	4/2/59	5/2/59	Supply insufficient.
36	1129	65/80	R. J. & A. J. Hathaway	92	90	2,000	1,150	6/2/59	9/2/59	Bore not cased.
37	1185	65/80	R. J. Roach	33	....	....	....	9/2/59	9/2/59	Bore dry.
38	1129	65/80	R. J. & A. J. Hathaway	112	112	2,000	1,160	10/2/59	11/2/59	Bore not cased.
39	1411	65/80	R. J. Roach	101	....	....	....	10/2/59	11/2/59	Bore dry.
40	2401	65/80	A. E. Orchard	98	....	....	....	11/2/59	13/2/59	Bore dry.
41	2401	65/80	A. E. Orchard	181	{ 110 { 181	700 1,300	} 415	12/2/59	25/2/59	Total salts, 499 grs./gall. Bore cased.
42	2526	65/80	T. B. Corbett	44	....	....	....	16/2/59	18/2/59	Bore dry.
43	1128	65/80	T. B. Corbett	81	80	2,000	800	19/2/59	20/2/59	Bore not cased.
44	1128	65/80	T. B. Corbett	119	118	500	680	20/2/59	23/2/59	Supply insufficient.
45	3991	88/80	I. & H. Warren	86	81	700	800	23/2/59	24/2/59	Bore not cased.
46	3333	88/80	I. & H. Warren	83	....	....	....	25/2/59	27/2/59	Bore dry.
47	3333	88/80	I. & H. Warren	120	120	1,500	800	3/3/59	5/3/59	Bore not cased.
48	2915	65/80	W. E. Orchard	162	152	2,000	250	4/3/59	18/3/59	Total salts, 284 grs./gall. Bore cased.
49	3915	88/80	V. I. Easton	74	32 69	3,000	540	6/3/59	10/3/59	Total salts, 653 grs./gall. Bore cased.
50	2616	88/80	V. I. Easton	72	....	....	....	13/3/59	16/3/59	Bore dry.
51	2616	88/80	V. I. Easton	108	81	2,000	102	16/3/59	18/3/59	Total salts, 124 grs./gall. Bore cased.
52	2915	65/80	W. E. Orchard	78	....	....	....	20/3/59	22/3/59	Bore dry.
53	3336	88/80	Leach & Sons	145	144	50	700	20/3/59	1/4/59	Bore not cased.
54	2915	65/80	W. E. Orchard	72	....	....	....	23/3/59	2/4/59	Bore dry.
55	3336	88/80	Leach & Sons	97	96	700	1,600	2/4/59	6/4/59	Bore not cased.
56	107	65/80	J. E. Thompson	26	....	....	....	6/4/59	6/4/59	Bore dry.
57	3337	88/80	Leach & Sons	81	80	1,700	980	7/4/59	8/4/59	Bore not cased.
58	107	65/80	J. E. Thompson	69	65	1,500	592	7/4/59	9/4/59	Successful bore under term of Agreement. At farmer's request not cased.
59	2586	65/80	W. & D. J. Campbell	102	96	100	280	9/4/59	14/4/59	Bore not cased.
60	1664	64/80	E. E. Collinson	23	....	....	....	10/4/59	14/4/59	Bore dry.
61	2586	65/80	W. & D. J. Campbell	129	128	200	880	14/4/59	20/4/59	Bore not cased.
62	1664	64/80	E. E. Collinson	21	....	....	....	14/4/59	16/4/59	Bore dry.
63	1664	64/80	E. E. Collinson	67	....	....	....	16/4/59	20/4/59	Bore dry.
64	2586	65/80	W. & D. J. Campbell	116	115	2,000	1,180	21/4/59	23/4/59	Bore not cased.
65	1665	65/80	M. Prior	107	21	700	100	21/4/59	29/4/59	Bore not cased.
66	3305	88/80	D.A.L. Pty. Ltd.	144	132	2,000	210	24/4/59	1/5/59	Bore cased.
67	1665	65/80	M. Prior	58	57	1,000	810	30/4/59	1/5/59	Bore not cased.
68	1665	65/80	M. Prior	143	....	....	....	4/5/59	12/5/59	Bore dry.
69	3300	88/80	Glamoff Syndicate	104	....	....	....	4/5/59	4/5/59	Bore dry.
70	3300	88/80	Glamoff Syndicate	84	83	10,000	1,000	5/5/59	6/5/59	Bore not cased.
71	3300	88/80	Glamoff Syndicate	107	106	3,000	1,120	7/5/59	8/5/59	Bore not cased.
72	2524	65/80	L. Tomsett	71	66	3,000	680	12/5/59	13/5/59	Total salts, 825 grs./gall. Bore cased.
73	2901	88/80	A. Harris	121	....	....	....	11/5/59	14/5/59	Bore dry.
74	2600	65/80	A. & L. Mitson	66	....	....	....	14/5/59	20/5/59	Only small seepage at 16 feet.
75	2901	88/80	A. Harris	121	100	2,000	420	14/5/59	21/5/59	Bore cased.
76	2600	65/80	L. & A. Mitson	116	....	....	....	21/5/59	22/5/59	Bore dry.
77	2600	65/80	L. & A. Mitson	77	....	....	....	25/5/59	27/5/59	Bore dry.

REPORT ON WATER SUPPLY, WEST KIMBERLEY STATIONS.

Area Centred Approximately.

Longitude 124° 30′ E.

Latitude 17° 34′ S.

By K. Berliat, D.Sc.

Senior Geologist, Geological Survey of W.A.

As a result of a request by pastoral companies for geological assistance the writer was instructed to proceed to the West Kimberleys to advise on stock water supply problems. The area investigated is situated between 60 and 100 road miles east of Derby, extending from the Napier Range in the north to the Great Northern Highway (Yeeda to Fitzroy Crossing) in the south, and includes four station properties, viz., Calwynyardah, Blina, Kimberley Downs and Napier Downs.

Hydro-Geological Outline.

The area north of the Napier Range is composed of Pre-Cambrian rocks, whilst the country to the south is underlain by sedimentaries of Devonian, Permian and Triassic age. These rocks strike regionally north-west and south-east, and from the Napier Range dip at low angles to the south-west. By far the greater portion of the surface is covered by residual soil or alluvium.

The regional distribution of the various rock units is shown on a Generalized Geological Map, published in the Annual Report of the Geological Survey for the year 1958. The map accompanies a report by Geologist J. Wyatt on artesian and subartesian water supplies in the area under discussion. This information has been made available to the management of the various stations. (Suitable locations for artesian drill sites could be located on Kimberley Downs, Blina and Calwynyardah, but on account of the depth involved, the owners were not interested in this type of supply and the writer's investigations had to be confined to ordinary groundwater).

The hydrological characteristics of the main rock units can be summarized as follows:—

Pre-Cambrian.—Consists of slates, phyllites, micaschists, granite and granitized sediments. These rocks offer limited possibilities only for subterranean water. It is most unlikely that the large supplies required by cattle people will be obtained in this class of country.

Devonian.—The limestones of this age group are considered as unfavourable aquifers. This is well illustrated by a number of unsuccessful bores.

Permian.—The conglomerates, sandstones and siltstones of the Grant, Poole and Liveringa formations are excellent aquifers, but the Noonkanbah formation has been found to be a poor source for water.

Triassic.—Rocks of this age include the Blina Shales and the Erskine Sandstones. The former yield only saline water from interformational porous horizons; the Erskine formation is suitable as an aquifer.

Recommended Bore Sites.

Calwynyardah.—This property is well served by supplies obtained from the Liveringa formation, and additional supplies are only sought in that portion underlain by the Noonkanbah formation, where already some twelve unsuccessful bores had been drilled. No sites could be recommended in this type of country, where the water supply problem will have to depend on surface conservation.

Blina.—Three sites were selected in the western portion of the property, all located in favourable topography in the Liveringa formation.

Kimberley Downs.—The following sites were recommended:—

White Well: This locality is in the Erskine Sandstone formation, and is considered to have excellent chances of yielding an adequate supply.

Duffer's Dam: Located in country underlain by the Liveringa formation.

67-Mile Bore: This site is close to the old 67-mile (Government) bore, now in a state of disrepair. The bore had a depth of 3,012 feet and yielded a flowing supply of 124,000 gallons per day. The driller's log shows that a large supply was struck at 215 feet. The bore is in Poole Sandstones.

An area considered generally favourable for drilling sites was also pointed out about half-way between the 67-mile bore and the junction of the Lennard and Barker rivers, in terrain underlain by the Grant formation.

Napier Downs.—This station is in urgent need of water in that portion which is situated to the north of the Napier Range. As already mentioned, the country here is formed by Pre-Cambrian rocks, generaly unfavourable aquifers. However, three sites were recommended on account of their favourable locations in alluviated ground, close to the banks of three prominent water courses (Wombarella Creek, Red Bull Creek and Bull Hole), but even here it is doubtful whether large supplies (in the order of 700 gallons per hour) will be obtained from any one single bore.

Butter Camp.—This site is located approximately five miles south-south-west from New Napier Downs homestead. It is in Barker River alluvium, which in turn is underlain by rocks of the Grant formation.

K. BERLIAT,
Senior Geologist.

31/8/59.

ACTIVITIES OF THE HYDROLOGICAL SECTION DURING 1959.

During 1959 two departmental geologists, Mr. G. D. Bartram and the writer were fully engaged investigating matters pertaining to groundwater problems, and two Ruston-Bucyrus 22-RW drills with crews were operated throughout the year.

The drilling programme in the Kalannie agricultural district (approximately 180 miles by road N.N.E. of Perth), initiated late in 1958 was completed. Seventy-seven bores for a total footage of 6,566 feet were drilled in the course of these operations, carried out for individual farmers on a "no water—no pay" basis.

Use was made of the electric resistivity method and tests run at Kalannie were generally found to give satisfactory results in areas of very shallow basement rocks.

In the Hill River district two exploratory bores (No. 2 and No. 3) were sunk to depths of 1,045 feet and 1,032 feet respectively. These bores were designed to test the lateral extent of an aquifer struck at 695 feet in Hill River No. 1 bore, drilled at Badgingarra in 1958. Both bores located useful supplies of sub-artesion water, but owing to lack of proper equipment have not been pump-tested as yet.

Hydrological Surveys, including a census of existing groundwater supplies, and the delineation of hydrological provinces were carried out in areas covered by Lands Department Lithos 126/80 (Greenough), 157/80 (Nanson-Eradu), 127/80 (Irwin River), 124/80 and 93/80 (Dongara-Cliff Head) and part of 123/80 (Mingenew).

It is intended to carry out surveys of this nature over the whole south-west division. So far, in addition to the areas investigated during 1959 the following Lands Department Lithos have been completed or partly completed:—

156/80 (Mullewa) partly completed.
94/80 (Arrowsmith River).
90/80 (Marchagee) partly completed.
91/80 (Mt. Lesueur).
92/80 (Green Head).
61/80 (Jurien Bay).
62/80 (Badgingarra).
63/80 (Watheroo) partly completed.
58/80 (Moora) partly completed.
59/80 (Dandaragan).
30/80 (Ledge Point).
31/80 (Mogumber).
65/80 (Kalannie).
88/80 (Lake Moore) partly completed.

During the year the writer also carried out field work in parts of the West Kimberleys, and advised on stock water supply problems in Calwynyardah, Blina, Kimberley Downs and Napier Downs Stations.

An inspection was made of the Chittering Valley with a view of ascertaining its pressure water potentialities. Officers of the Geological Survey (Messrs. de la Hunty, Sofoulis, Noldart and Wyatt) not attached to the Hydrological Section, have from time to time been seconded for groundwater work, or have carried out investigations of a hydrological nature in conjunction with other duties. In the course of regional geological surveys covering the Balfour Downs 4-mile Sheet and the Lake Lefroy-Larkinville 1-mile Sheet, detailed bore information was collected. Reconnaissance surveys were made and advice on groundwater prospects was given to local authorities and farmers in the following districts: Miling, Pickering Brook, Marble Bar, Buntine, Wongan Hills, Bindoon, Williams, Kellerberrin, Merredin, Dalwallinu and Upper Swan.

K. BERLIAT,
Senior Geologist.

19/1/60.

REPORT ON IRON DEPOSITS, SIX MILES NORTH OF ROY HILL STATION, NULLAGINE DISTRICT, PILBARA GOLDFIELD.

Approximate Latitude 22° 32′ S.

Approximate Longitude 120° 00′ E.

by John Sofoulis, B.Sc.,

Geological Survey of W.A.

Introduction.

Whilst engaged in regional mapping of the "Balfour Downs" 4-mile sheet during August-October, 1959 the writer located some small high-grade iron deposits in the Roy Hill area. As these had not previously been recorded, and in view of the current interest in iron, a short time was spent in ascertaining their distribution, nature and amount of iron ore available.

This report is a result of these investigations and is accompanied by a geological map prepared from air photo Balfour Run 10/5613 and pantographically enlarged to a 20 chains = 1 inch scale.

Location and Access.

The iron deposits are located in the undulating, hilly country adjacent to the 818 mile peg on the east side of the Great Northern Highway, approximately six miles north of Roy Hill station. As shown on the accompanying map, the deposits are readily accessible from the Great Northern Highway which passes within one quarter of a mile to one mile west of them.

Nearest railhead for the deposits is at Meekatharra, a distance of 340 miles by road south of Roy Hill station. Nearest shipping facilities are at Port Hedland, 255 miles via Nullagine or 220 miles via Warrie and Woodstock stations.

Water Supplies.

Watering points on the main road in close proximity to the deposits are "Ryan's Bore" located at a fence "run through" four miles south of the 817 mile peg, and at a further bore 3½ miles north along the main road from the 817 mile peg. Both waters are of good quality, but the supply from "Ryan's Bore" is said to be poor.

The Iron Deposits.

Nature and Mode of Occurrence.—The ore deposits consist of several patches of hematitic ore forming a lateritoid capping to a dissected undulating surface which varies in elevation from plain level to 300 feet above.

Normal lateritic cappings which are widespread throughout this area, are considered to have originated in the Tertiary (Miocene?) period and are regarded as forming part of the old undulating "Tertiary Land Surface." The present landscape thus represents the dissected and stripped version of the same surface, leaving such laterite developments as scattered remnant cappings of varying thicknesses, (up to 40 feet) and mantling the undulating breakaway country.

The iron ore developments which form part of this dissected surface are spread over a belt measuring 3 × 1 miles and are in the form of relatively thin hematitic cappings, mantling and replacing sedimentary formations referred to as "Nullagine" rocks of Proterozoic age. The sediments consist mainly of massive or flaggy mudstones with thin intercalations of shale, chert and occasional dolomitic bands.

Best hematitic ore developments occur above the mudstone-shale horizons and appear as blue-black, red and white metallic ores grading laterally into the lower grade orange-brown pisolitic, and earthy limonitic capping forms outside the limits of the orebodies shown. In the exposed breakaway sections the hematitic ore cappings vary from five feet in the stripped surfaces up to 25 feet or more. The change in depth from hematite to underlying white mudstones is usually abrupt, but in some localities is transitional to give a mottled (and frequently cavernous) zone up to six feet in thickness and made up of a ferruginised, earthy mudstone mixture with frequent showings of hematite as partial replacements along bedding and jointing planes. This zone passes in depth into the weathered and leached mudstones to form part of the normal lateritic profile.

Relict bedding plane and gentle fold structures noted in the hematitic ore would indicate that a replacement of the sediments has been effected in situ by the lateritisation process, and from the presence of preserved chert beds in the ore it is evident that the replacement by iron has itself been selective. The reason for the hematitic rather than the normal lateritic development is not completely understood, but as with other selected mineral developments on the same surface (manganese, calcrete, opaline silica) is in all probability related to the Tertiary drainage conditions, further complicated by the various physical and chemical factors involved and resulting in the selected mineral development along particular portions of the drainage system.

Sampling.—Chip samples were taken down the face of the breakaways and would be representative of the hematitic ore available. These samples were taken from the various ore patches at the positions shown—the thicknesses of sections sampled being as listed in the table below.

Grade of Ore.—The samples were submitted to the Government Chemical Laboratories for determination of acid soluble iron, Fe on dry basis, the results being as follows:—

Chemical Lab. No. 1959	G.S.W.A. Sample No.	Thickness Surface to feet	Acid Soluble Iron Fe per cent. on dry basis
14906	5503	15	56·1
14908	5510	10	63·9
14909	5511	15	64·6
14910	5512	12	67·6
14911	5513	8	66·1
14912	5514	13	65·3
14913	5515	12	67·2
14914	5516	8	65·4
14915	5517	6	67·7
14916	5518	8	53·1
14917	5519	8	57·0
14918	5520	10	58·6
14921	5523	5	64·4
14922	5524	10	66·6

A composite sample made up of equal parts by weight of each of the above samples showed the following partial analysis:—

Chemical Lab. No. 14923/59	Per Cent on Dry Basis
Total Iron, Fe	63.4
Acid Soluble Iron, Fe	62.6
Silica, SiO_2	2.72
Phosphorus, P	0.06
Titanium, Ti	0.08
Magnesia, MgO	0.04
Lime, CaO	Nil
Manganese, Mn	1.62
Sulphur, S	0.01

These results show that the grade of ore available from the deposits would be in the vicinity of 60 per cent. metallic iron.

Reserve Estimates.—The total area of usable hematitic capping can be taken as 240 acres so that assuming an average thickness of 8 feet and using a conversion factor of 8 cubic feet of ore per long ton, the inferred iron ore reserves amount to 10,000,000 tons.

Possible Ore Extensions.—Sub-surface extensions of the hematitic ores could persist at shallow depth below the fringing outwash soils (i.e., where the capped surface passes below plain level on the western edge of the ore belt). Small patches of usable ores could occur along the north-west extension of the ore belt. One sample taken from a breakaway located two miles north along the main road from the northern bore showed 64.1 per cent. acid soluble iron over a thickness of 15 feet (Sample No. 5509.)

PLATE I

G.S.W.A.

GEOLOGICAL MAP

of

IRON ORE DEPOSITS

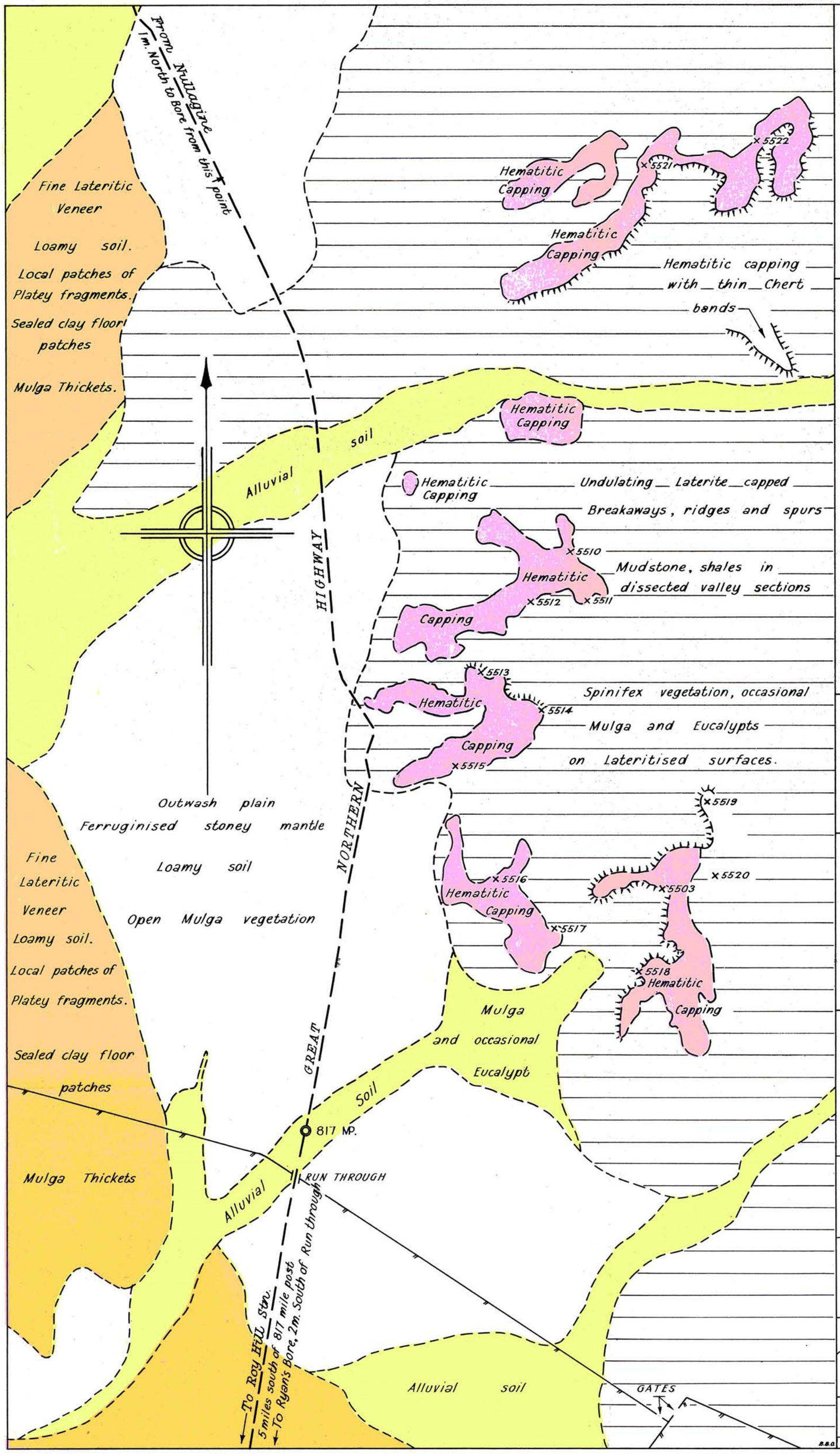
6m North of Roy Hill Station

Nullagine District

PILBARA GOLDFIELD

Scale : 20 chains to an Inch.

Geology & Sampling : By J. Sofoulis.



LEGEND

Alluvial Soil

Fine Alluvial Outwash Plain

Alluvial Outwash Plain

Hematitic Capping

Dissected Lateritic Capped Nullagine Mudstones – Shales.

REFERENCE TO SIGNS

Main Road

Fence Line

G.S.W.A. Samples ×5518

INFERRED RESERVES

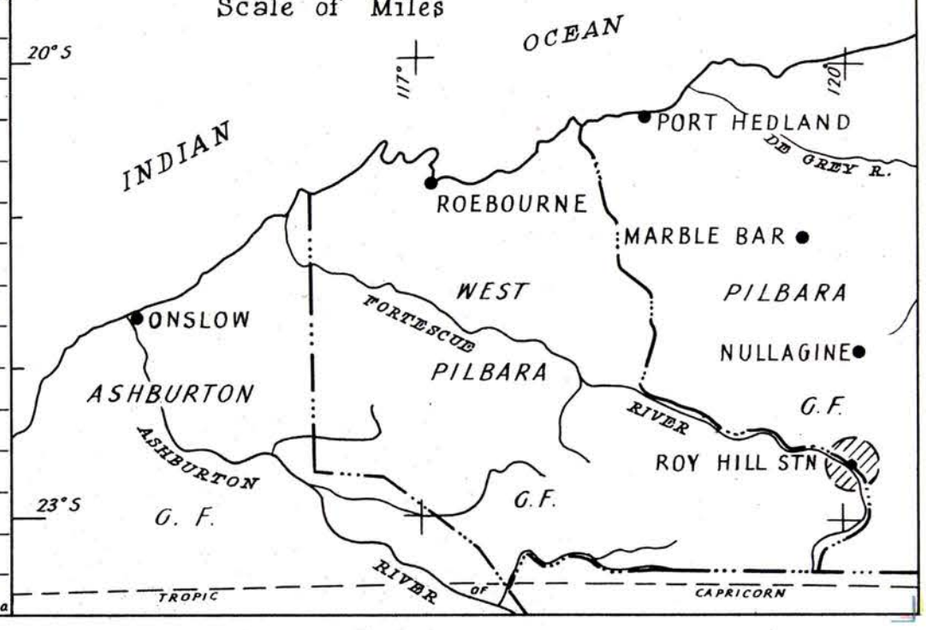
10 Million tons ; of approximately 60% Metallic Iron content.
Based on a total Area of 240 acres.
Average thickness 8 feet. Using Conversion Factor of 8 cubic feet per Long Ton.

LOCALITY MAP

ROY HILL IRON ORE DEPOSITS

75 50 25 0 75 150

Scale of Miles



Other breakways adjacent to the mapped deposits showed similar hematitic cappings, but were not grouped as ore since much of it contained a high proportion of banded chert or unreplaced sediment. Ferruginised earthy cappings in this vicinity could contain a high acid soluble iron content. Two samples of this type (Sample Nos. 5519 and 5520) showed 57.2 per cent. and 61.7 per cent. Fe over thicknesses of 8 and 10 feet respectively.

It is considered that further lateritoid iron deposits similar to those of the Roy Hill locality can be expected along the extensions of the same laterite capped country and elsewhere in the lateritised Tertiary surface remnants of the Pilbara area in general. As the formation of lateritoid hematite is considered to be related to Tertiary drainage conditions, it is recommended that the search for such deposits be confined to the fringes of the major drainage basins or their principal tributaries.

Conclusions.

Some ten million tons of iron ore containing approximately 60 per cent. metallic iron are inferred as being available from the Roy Hill iron deposits.

Nature and mode of occurrence, ease of access and presence of natural ore faces in the breakaway escarpments, make these deposits suitable for immediate exploitation.

JOHN SOFOULIS,
Geologist.

11/12/59.

PROGRESS REPORT ON THE REGIONAL SURVEY OF THE BALFOUR DOWNS 4-MILE SHEET, PILBARA GOLDFIELD, WESTERN AUSTRALIA.

By L. E. de la Hunty, B.Sc., Geological Survey of W.A.

Introduction.

A regional survey was undertaken in this area in an endeavour to establish the origin and environment of the manganese deposits in the eastern half of the area. The mapping was extended to take in all of the Balfour Downs 4-mile Sheet and a narrow strip down the eastern edge of the Roy Hill 4-mile Sheet—to include the Great Northern Highway.

As well as the 350 square miles mapped in the Roy Hill Sheet, some 4,250 square miles were mapped in the Balfour Downs Sheet—leaving 1,750 square miles to be completed in 1960.

Pastoral stations in the area include—Noreena Downs (sheep), Bonney Downs (sheep), Riverdale (cattle), Roy Hill (including Mt. Fraser—sheep and cattle,) Ethel Creek (cattle), Balfour Downs (cattle), Talawana (cattle) and the properties of J. Clarke (cattle), E. H. Kealy and W. T. Ellery.

Access.

Fairly good roads connect the station homesteads with the Great Northern Highway, and many station tracks provide access to most parts of the area. Other roads include those made to mining camps and manganese deposits while the track along the line of the Rabbit Proof Fence is well defined.

Communications.

Nullagine is the township for the area. It has a telegraph service, a telephone service to Marble Bar and Port Hedland, a twice-weekly air service, and a fortnightly road mail service from the railhead at Meekatharra. There is also intermittent road cartage from Port Hedland. Most of the stations in the area are on the Flying Doctor Wireless Service.

Photos and Maps Used.

Aerial photos of the Balfour Downs Sheet, on a scale of 50 chains to an inch, and the relevant 1-mile photo index sheets (with black plastic backing) were used in the field, but no line compilation sheets were available. Sheet 14 (De Grey) of the Lands Department 10-mile Topographical Series and Lands Department 300 chain lithos. Nos. 90, 91, 98 and 99 were used.

Field Work.

The writer, with a survey hand/motor driver and a 4-wheel drive 18 cwt. International utility, commenced the field season on April 21st. J. Sofoulis, with a survey hand/motor driver and a long wheelbase Landrover, joined the party from August 14th until the end of the season (October 21st). Nullagine was the base for communications and supplies but no camp was made. The parties "lived off the truck" and operated independently.

Mapping was done on the photos and transferred to the photo index sheets for continuity of boundaries. Features mapped included—

(1) Geology—rocks, soils and mineral deposits.

(2) Topography—hills and drainage.

(3) Water supplies—including wells, bores, pools and rock holes.

(4) Roads and tracks.

(5) Fences, yards and buildings.

(6) Cairns, trigs and beacons.

(7) Notes on vegetation.

Sampling.

During the season, a total of 162 samples and specimens of rocks and minerals were taken (Nos. 7401-7500, 5801-5841 and 5503-5524, inclusive). Assays have been made on some of these samples (by the Government Chemical Laboratories) for manganese (Mn), iron (Fe), barite ($BaSO_4$) gold (Au) and other components.

Bulk samples of manganese ore from the deposits at Balfour Downs and Ripon Hills (north of the area) were also collected and submitted to the W.A. School of Mines, Kalgoorlie, for beneficiation tests.

General Geology.

The Archean basement rocks, which outcrop in the north-west corner of the area and also as windows along a line running south-east from Rat Hill, are siliceous jaspilites and schists of the Warrawoona Series, together with the granite which intruded them to give a zone of gneiss. Intrusives include quartz dolerite dykes (of varying grain size), pegmatite dykes and quartz reefs and veins. A strong north-easterly joint and fault pattern is indicated by the quartz-dolerite dykes, together with an east-west trend. A north-northwest to north trend is also shown—mainly by quartz reefs in the granite outcrop at the northwest corner of the area.

Proterozoic rocks of the Nullagine System include sediments and lavas which outcrop over a large percentage of the area. These are described below. A few basic dykes were seen in some Nullagine lava outcrops and the writer believes these may have been vents for the lava.

Cover rocks include Permian glacial deposits, Tertiary calcrete, laterite and hardpan, also Recent sand, alluvium, river gravels and talus.

The Nullagine System.

Two distinct breaks in the stratigraphy of the Nullagine System were recognised during the mapping of this Sheet. Each of these unconformities is marked by a development of conglomerate and the lower break is also characterised by a widespread development of chert breccia.

The stratigraphic column shown below gives the maximum thicknesses observed for the various formations, and a short description of the rock types follows. However, no attempt to define the three series will be made until the field work has been completed.

Unit	Maximum Thickness Observed	Manganese (Mn) Content	Era or Period
	feet	per cent.	
Sand and Alluvium	70	....	Recent
Grit	50	....	Tertiary
Laterite and Manganese Deposits	50	....	
Oakover Beds	200	....	
Tillite and Boulder Beds	100	....	Permian
Sandstone and Quartzite	300	0·01	Proterozoic (Nullagine System)
Grit and Conglomerate	200	....	
Unconformity			
Fine-grained Basalt	100	0·15—0·37	
Pelletised Manganiferous Chocolate Shale	100	0·40—1·03	
Green Shale	100	0·03—0·39	
Banded and Spotted Sandstone	70	0·01—0·03	
Conglomerate	50	....	
Chert Breccia	50	....	
Unconformity (up to 90°)			
Chert, Shale and Mudstone	1,500	....	
Dolomite	400	0·03—0·52	
Vesicular Basalt	200	0·07—0·12	
Oolite	150	0·15	
Conglomerate	50	....	
Unconformity			
Basement	....	....	Archean

The basal conglomerate of the Nullagine System is rarely seen in this area. There is a thin outcrop along the edge of the granite about four miles north of Ant Hill on Noreena Downs, and a further outcrop on Bonney Downs (about three miles north-west of Haystack Mill) is calcareous and grades into oolite with some collenia-rich limestone.

The oolite underlies an amygdaloidal lava and the largest outcrop is two miles north of Ant Hill. The oolite is sometimes pisolitic, sometimes sandy or cherty and often contains pyrite grains.

The amygdaloidal lava has a dark green to apple green colour and the amygdales are usually of quartz with occasional calcite. In places where the lava is thick some columnar jointing may be seen and the lava appears quite basaltic. However, the frothy flow tops are composed mostly of silica and the larger amygdales contain large quartz crystals inside a jasper envelope. There are at least two flows and occasional bands of oolite and some limestone occur between flows. Some tuff has also been seen, and about 16 miles east of Rat Hill there are several outcrops of a coarsely porphyritic lava, containing large red crystals of felspar.

An impure grey to red dolomitic limestone overlies the basalt. The dolomite is thick-bedded in places but grades into thin-bedded dolomite with or without chert bands—passing into a chert-shale-mudstone formation which has the greatest observed thickness (1,500 feet) of all of the units mapped.

An unconformity followed the chert-shale-mudstone deposition and the development of chert breccia *on dolomite* was quite widespread. This was a lateritoid development which was stable over the dolomite only, and the silica was derived from the dolomite as well as the overlying rocks. (Some of the dolomite contains as much as 50 per cent. SiO_2 in small grains.) A horizon of brecciated chert was noticed in the chert-shale-mudstone formation at Sunday Hill, but this was quite distinctive from the mantle of terrestrial chert breccia.

Some faulting and folding took place about this time and an angular unconformity of 90 degrees was observed at Googhenama Creek between the chert-shale-mudstone formation and the overlying sediments.

The sediments above the chert breccia are important because they contain the pelletised chocolate shale which is the penultimate source of the manganese deposits in the area. Immediately above the chert breccia is a conglomerate which contains pebble bands and bands of chert fragments with a sandstone matrix.

A banded and spotted sandstone overlies this conglomerate. The sandstone varies in colour from white to reddish purple with a few black bands and the coloured bands are about a quarter inch wide. The spots are white in colour and spherical in shape but appear to be similar to the rest of the rock in all other respects. Another characteristic of this rock is its peculiar cross-bedding which is cut through by a cleavage parallel with the general bedding of the sandstone.

Above the sandstone is a green shale which varies in character from a sandy rock to a shale to a mudstone with small patches of chert. The green shale underlies a pelletised chocolate coloured shale (mudstone to siltstone) which contain pellets of braunite in the bedding planes. These pellets are biconvex and vary in size up to a half inch in diameter. An assay of some of these pellets which had weathered out of the shale showed 42.9 per cent. Mn. The shale rarely forms a prominent outcrop and is usually well exposed only when the overlying fine-grained basalt is preserved. Except at its fringes, this basalt is always directly underlain by the chocolate shale.

This basalt shows no extrusive characteristics in the hand specimen. It is a fine, even grained rock with no vescicles or flow structures or phenocrysts. However, since it always occurs in old topographic lows—thinning towards the edges of the basins—it is almost certainly a lava, rather than a sill. It is particularly well exposed in the area immediately east and north-east of Mt. Cooke, just west of the Davis River, where it forms a plateau more than 20 square miles in area. It has a distinctive photo pattern due to the complete absence of trees on it, and it is usually surrounded by the dark pattern of the chocolate shale at its base. Although some of the rock is quite weathered, the fresh rock rings like an anvil when struck with a hammer. This basalt was used as a marker horizon, as far as possible, but caution was necessary as a small dolerite sill intrudes the chert-shale-mudstone formation about 15 miles north-east of Mt. Cooke, and this could be a sill from the same magma.

A conglomerate which reaches a maximum thickness of 50 feet (with boulders up to 3 feet diameter) overlies this basalt, unconformably, and grades into grits with a maximum thickness of 300 feet. The grits include some 200 feet of cross-bedded sandstone which contains occasional pebbles (up to 2 inches diameter) scattered throughout.

A bed of quartzite on the grit is well developed in the north-eastern corner of the Sheet and this, with its overlying sandstone, trends south then south-east—forming a prominent escarpment up to 300 feet high. These were the youngest rocks of the Nullagine System outcropping in the area, but younger ones may outcrop further to the east.

Permian Glacial Deposits.

A belt of boulder deposits about two miles wide, extends north-north-west from a point about 15 miles east of Woblegun Hill to the northern edge of the Balfour Downs Sheet. This belt is 15 miles long (and continues to the north) and lies between Enacheddong Creek and Googhenama Creek. At the southern end of the belt, the boulders are of a more even size (about six inches diameter) and the bed is over 50 feet thick, but further north the bed seems to be thinner and the boulders are more varied in size. Many of the boulders are 2-3 inches diameter but larger erratics of a ton or more can be seen.

The boulders are of granite gneiss, basalt, chert breccia, sandstone, conglomerate, quartz and some dolomite. They are rounded and only a few show faceting and striation—indicating a fluvio-glacial origin.

Tertiary.

Where Poonagarra Creek and Noreena Creek enter the Davis River, there is an extensive outcrop of flat-lying limestone with large developments of opaline silica. These calcrete deposits are Tertiary valley fillings and they also outcrop along the Oakover River and the Fortescue River. They are the Oakover Beds described by Maitland*. Dissection of these broad Tertiary deposits has left plateaux, mesas and buttes in the northern part of the Sheet and also further downstream to the north—to Maitland's type locality.

* 1904—MAITLAND, A. Gibb: Preliminary Report on the Geological Features and Mineral Resources of the Pilbara Goldfield. *G.S.W.A. Bull. No. 15,* p. 6.

In the plain area around Roy Hill and Ethel Creek stations, the top of the calcrete is at plain level—the intervening valleys having been filled with later sediments.

The laterite formed during the Tertiary on a gently undulating surface which has since been further dissected. While the laterite is topographically higher than the Oakover Beds, it is probable that the deposition of lime and silica in the valleys was contemporaneous with the deposition of iron and manganese on the hillslopes and crests. Some laterite was seen on low level mesas in the valley of the Nullagine River, but the underlying rocks were weathered basalts of the Nullagine System and no Oakover Beds were present.

Manganese and iron deposits were formed during the Tertiary around the edges of the drainage basin but do not owe their existence to capillary action (see below).

A consolidated, but uncemented, horizontally bedded grit with a clayey-sandy matrix overlies the calcrete in places (e.g. Noreena Creek, 10-20 miles east of Noreena Downs Homestead). It is very much like a "hardpan" in places and has been assigned to the Tertiary.

Recent Deposits.

While the grit mentioned above could possibly have been deposited in Recent times, it is distinct from the river gravels, outwash plains, talus, alluvium and sand of Recent origin. Some of the outwash areas are quite large and the finer outwash was seen to be encroaching on the plains in the southern part of the area.

The sandplain occurs in several areas, including 100 square miles just east of Noreena Downs Homestead, but the dunes are usually confined to the desert area, east of the Rabbit Proof Fence. However, two dunes occur as far west as the Great Northern Highway at Ethel Creek Homestead and low ridges have been noticed in other areas where the spinifex has been burned off too often.

The sand dunes of the desert are reddish in colour and often extend for several miles. They are oriented west-north-west, are about 5-10 chains wide at the base, and about 30 feet high. Most of them are fixed by spinifex and occasional trees. The interdune areas often show outcrops of the underlying rock through the sand veneer and some seasonal scrub grows in the flats.

Water Supplies.

There are a few permanent natural watering places including pools and rock holes, but all of the streams are non-perennial. Many pools form in the river courses after rain and, though they may persist for several months, only three could be classed as permanent. These are—Kallona Pool, Carrowina Pool and Meecardagunna Pool. The rock holes are mainly confined to the eastern part of the area and are usually difficult of access. Some of them hold quite a few thousand gallons of good water—up to 100,000 gallons for Nooganoonga Rockhole.

The wells and bores in basalt country average about 40 feet to water and supplies in shale country are often a little deeper. Water from both of these sources is usually good and supplies of 1,000 to 3,000 gallons per day are usual.

In the plain area of the south and south-west, the water level is met at a depth of 40 feet, close to the main drainages. The water is good stock water—tending to become more saline downstream. Away from the drainage the wells range in depth up to 100 feet and the water is more saline.

Vegetation.

Spinifex is widespread through the area except in the calcrete sections of the plain and small local flats in the hilly country. Grasses grow in these areas.

Mulga grows in the vescicular basalt country and often above shales and granite. However, there is no tree growth on the fine-grained basalt which overlies the chocolate shale, nor does the dolomite support many trees. The vegetation of the desert was described in the notes on the sand dunes.

The eucalypts (cajuput, river gums, blackheart and bloodwood) are mostly confined to the drainage channels and small forests of cajuput occur in the Davis River. Some mountain gums occur on the higher slopes in the eastern portion of the Sheet, including the desert.

Mining Activity.

The only mining being carried on in the area during 1959 was for manganese and copper. Other minerals mined in the past include gold, columbite and beryl.

Manganese.—Manganese was being produced intermittently from M.C.194L on the east bank of the Davis River about six miles east of Mt. Cooke. Other manganese deposits from which manganese has been mined include those at Bee Hill, Ant Hill and Sunday Hill. Some ore was produced (1958) from the deposit at "Mt. Nicholas" on Mt. Fraser Station but was stockpiled at the deposit. The deposit near Balfour Downs Homestead was costeaned in 1957 but no ore was taken away.

As a result of the pegging and working of the manganese deposits (from 1956) many hundreds of miles of access roads and tracks have been made in the area by the various leaseholders. There are approximately 140 claims for manganese in the area.

Copper.—In 1959, J. Clarke was mining copper ore from his mine, three miles north of Saddleback Hill. Some copper ore has also been won from a Prospecting Area about six miles south of Mt. Divide, but the show was not working during 1959. Talbot* reported a few shallow pot holes for copper at Turummunda Rock Hole abou t11 miles south of Saddleback Hill. This area was not visited by the writer in 1959.

Gold.—Talbot* reported some old alluvial workings at Rooney's Patch (near the head of Brown Creek) and some dryblown tailings on the north end of Sunday Hill. (The writer did not see the tailings at Sunday Hill and has yet to visit Rooney's Patch).

Columbite and Beryl.—In recent years columbite has been won from alluvial and eluvial patches in the granite gneiss at the north of the area near 5-mile Creek and also from an area 8 miles north-west of Noreena Downs Homestead. The writer believes that some beryl came from here too.

Mineral Deposits.

The ores of iron and barites have not been worked in this area but all of the other known minerals of the area have been worked at some time. Mineral occurrences are—manganese, iron, copper, columbite, beryl, minor occurrences of radioactive pegmatite minerals (such as tant-euxenite), barites and gold.

Manganese.—The manganese deposits are confined to the eastern half of the Sheet where they outcrop as sheets or mounds on chert breccia, shales, sandstone, dolomite or conglomerate. The manganese oxides have been seen to replace each of these rocks and an ore deposit will form where the replacement persists long enough. The manganese oxide-silicate (braunite) is also a common ore mineral.

The managanese is derived from the pelletised chocolate shale which weathers readily and has an average content of 0.7 per cent. Mn. This is the penultimate source of the manganese which was concentrated in the shale from the weathering of earlier rocks of the Nullagine System and also from the Archean rocks.

Enrichment of the manganese deposits is going on at the present time, by solution and re-deposition, also by replacement. (The writer has collected quite a bit of evidence to illustrate the mobility of manganese under present conditions). However, most of the deposits are associated with a Tertiary land surface around the edges of the drainage basins—indicating that the emplacement of the ore-bodies was made in Tertiary times. Some

* 1920 TALBOT, H. W. B.: Geology and Mineral Resources of the North-West, Central and Eastern Divisions, Between Long. 119° and 122° E., and Lat. 22° and 28° S. G.S.W.A. Bull. No. 83, p. 110.

of the laterite outcrops contain considerable amounts of manganese (up to 35 per cent. Mn but usually much lower)—supporting the idea of Tertiary ore formation for the manganese deposits.

Essentially the manganese deposits have been formed by supergene enrichment and none of them has been formed by magmatic, hydrothermal or metamorphic action.

Iron.—A deposit of iron ore near Roy Hill Homestead showed a mode of origin similar to that for the manganese deposits—namely, replacement of the underlying shales and mudstones by iron. See "Report on Iron Deposits, Six Miles North of Roy Hil Station", (J. Sofoulis) in this publication.

Copper.—The copper ore, which was confined to a small area in the vicinity of Mt. Divide and Saddleback Hill, was composed of the carbonates malachite and azurite with some cuprite. The ore was associated with opaline silica in joints and faults in the dolomitic limestone of the Nullagine System. No quartz veins or other signs of igneous activity were apparent near the outcrops. The ore was possibly leached from overlying rocks (e.g. the fine-grained basalt) but the writer has no proof of this.

Columbite and Beryl.—These pegmatite minerals have been worked from eluvial and alluvial patches in small valleys in gneiss country. The fall in the price of columbite was mainly responsible for the cessation of work on these deposits.

Radioactive Pegmatite Minerals.—Besides the columbite and beryl, the radioactive mineral tanteuxenite has been determined in some of the pegmatite veins in the north-west part of the Sheet, but not in economic concentrations. Other radioactive minerals probably occur in the pegmatites but also in too small a quantity to be mined.

Barites.—Some barites was found as a fault-filling in vescicular basalt about 15 miles east of Rat Hill. It is associated with silica in the fault (which runs north-south) and a grab sample assayed 84.5 per cent. $BaSO_4$. Other outcrops of barites are known south of the eastern half of the area.

Gold.—Although the alluvial gold workings at Rooney's Patch have not been seen by the writer, they occur within a few miles of an outcrop of rocks of the Warrawoona Series, and associated granitic rocks, so it is probably that quartz veins in the Warrawoonas yielded the gold. Some traces of gold have been found in quartz in the Warrawoona rocks but no prospect has been found yet.

Beneficiation of Manganese Ore.

Beneficiation tests on bulk samples of manganese ore from the Balfour Downs and Ripon Hills deposits have not been completed but progress reports issued by the W.A. School of Mines have been encouraging.

27/1/60.

L. de la HUNTY,
Geologist.

REPORT ON GOLD FIND, P.A.2417, APPROXIMATELY 10 MILES EAST-SOUTH-EAST OF BEETE RAILWAY SIDING, DUNDAS GOLDFIELD.

By G. H. Low, B.Sc.

Geological Survey of W.A.

Introduction.

In accordance with instructions from the Government Geologist, this Gold Find was examined by the writer on 22nd March, 1959.

The Gold Find is located approximately 11 miles east-south-east of Beete, a railway siding on the Norseman-Esperance railway line, some 39 miles south of Norseman.

Access to the Find is 10 miles easterly by graded track from Beete Siding, thence by bush track 3 miles southerly and then 0.5 miles easterly.

This area was fairly heavily timbered by salmon gum, gimlet and morrel but it has been cut through by timber cutters and the best timber has been removed. Some blocks have been cleared for farming, but there is considerable regrowth on many of them.

Water supply is from dams and wells.

The following Prospecting Areas were held at the time of the visit: P.A.2416 (H. Eldridge), P.A.2417 (A. Battaglia), P.A.2418 (A Thompson), P.A.2419 (M. Battaglia), P.A.2420 (G. Darbyshire), P.A.2421 (G. G. Frank), P.A.2422 (C. Cornelius), P.A.2423 (G. Walls, L. Vounard, F. Bray), P.A.2426 (P. Millington), P.A.2427 (F. R. Smith), P.A.2428 (R. W. Reed), P.A.2430 (F. R. Buttsworth), P.A.2431 (U. P. Capelli), P.A.2432 (E. E. Nilson), P.A.2434 (G. Capper), P.A.2435 (P. Zanocco), P.A.2437 (S. G. Sharpe), P.A.2442 (H. Boucher).

The production record to that date, made available by the Norseman Mining Registrar, is as follows:—

P.A.2416.—Nine tons treated at the State Battery, Coolgardie, returned 16.27 fine ounces.

P.A.2417.—10.25 tons treated at the State Battery, Coolgardie, returned 18.56 fine ounces.

General Geology.

This area carries a mantle of soil which varies from a red-brown clayey type to a yellow-red sandy type. The latter type predominates.

Rock outcrops are few and far between, in fact in the vicinity of the gold find the writer saw no natural rock outcrops. (The first gold was found during wood cutting operations, in the soil held in the roots of a fallen tree.)

From the soil type, the vegetation, and by inference from the nearest rock outcrops, it would seem that the soil is underlain by granite-gneiss with patches of basic rock (greenstone). The areas occupied by greenstone cannot be delineated at present.

The Gold Find.

At the time of the visit a winze on P.A.2417 had been sunk in the ore-body, dipping 45 degrees slightly south of east, to a winze depth of approximately 130 feet. At this depth the ore-body, striking 20 degrees east of north has been driven on for about 12 feet north and 12 feet south of the winze.

About 30 yards south of this on P.A.2416, an open cut about 24 feet long at the surface has reached a depth of 30 feet. The ore-body has been exposed (not continuously) over a length of about 200 yards south of this. Prospecting Areas extend north and south of this for a distance of about 1.5 miles and for about 1 mile in an east-west direction. As is shown above, no gold has been returned from these.

The gold on P.A's. 2417 and 2416 occurs in a quartz vein which is consistently about 14 inches thick showing, where observed, only slight pinching and swelling. Thin parellel quartz stringers appear in places alongside the central vein and according to the miners, these also have carried values in places.

The wall rock as seen in the short drives at 130 feet on P.A. 2417 is a weathered thin banded gneissic rock which as far as could be judged in its weathered condition, has the composition of a basic granite. The dip and strike of the quartz vein appears to conform with the schistosity of the country rock.

The writer saw no mineralization in the rather barren looking glassy "blue-grey" quartz exposed in the drive faces at the 130 feet level, although some fine flake gold was detected in specimens of a similar material in a small dump at the surface.

The present workings are still well within the zone of oxidation. The floor of the drive was quite dry at the time of the visit.

The three men actually engaged in active mining, on P.A.'s 2416 and 2417 stated their intention of "following the gold in the ore-body" in future development.

Summary.

The area of the recent gold find some 11 miles east-south-east of Beete Railway Siding was examined on 22nd March, 1959.

To that date records at the Norseman Mining Registrar's office show that 34.83 fine ounces of gold have been recovered from 19.25 tons of ore treated at the Coolgardie State Battery. This production was from the two adjoining Prospecting Areas 2416 and 2417.

The gold occurs in a bluish-grey quartz vein, averaging about 14 inches in thickness, which strikes 20 degrees east of north and dips 45 degrees east. The vein appears to lie in the schistosity of the country rock, which is a granitic-gneiss.

The vein has been worked at two points about 40 yards apart to 130 feet and 30 feet down the dip, but it has been traced on the surface by costeaning and trenching for about 200 yards. The present depth of workings are still well within the oxidised zone.

G. H. LOW,
Geologist.

19/3/1959.

REPORT ON THE BURNAKURA GOLD MINING PROSPECT, G.M.L. 1936 N, MURCHISON GOLDFIELD.

By G. H. Low, B.Sc.,

Geological Survey of W.A.

Introduction.

The Burnakura Centre was visited by me on 13th-16th August, 1957, with a view to assessing the suitability or otherwise of the ground covered by Temporary Reserve 1563 H for diamond drilling.

No mine plans (including assay plans) were available, and very little other useful information was to be had. The most extensive, and hence the most important workings were inaccessible. However, the production record for this centre was impressive, the ore bearing formation where seen through overburden is strong, and after the surface geology was mapped and certain structural interpretations made, a recommendation was made that three holes each to cut the principal gold bearing formation at approximately 300 feet vertical depth be drilled.

The object of such drilling was *to test the possible extension at depth of the gold-bearing formation worked in G.M.L. 1849 N between the open stope on the western boundary of the Lease and the New Alliance Shaft.*

These three holes were subsequently drilled, and a detailed report with geological plan and sections covering this drilling was completed on 7th January, 1958.

The following points are clearly brought out in this report:—

(1) The various formations and bodies intersected during drilling could not be positively correlated.

(2) The area tested by drilling had been seriously affected by folding or faulting.

(3) Water troubles could be severe—300,000 gallons a day had been pumped from the New Alliance Main Shaft.

(4) The core loss from the upper portions of each borehole was high because of *the highly oxidised nature of the ground.*

Accordingly, in Paragraph 4 of the Conclusions it was stated "The best method of following up this drilling is by sinking a shaft on the good shallow intersection (76 to 82 feet) in Hole No. 1.

It was considered unnecessary, and indeed even impertinent to add for the benefit of anyone at all familar with goldmining in this State, that when a depth of 82 feet had been reached that any gold ore encountered should be followed by winzing or driving in the ore body, and NOT by shaft sinking and cross-cutting in barren or sub-ore ground.

After completing this report, I was not in any way consulted by the people concerned with the prospect and had no connection with their endeavours at Burnakura until instructed by the Government Geologist in March 1959, to visit and report on the workings. By this time operations had been suspended for some weeks.

The Workings.

The workings on G.M.L. 1936 N were examined on Wednesday, 25th March, 1959.

A few hours were spent underground and surface features in the vicinity were re-examined. During the underground examination I was accompanied by Mr. A. Cassey who was in charge of operations at the workings.

A water pump was operated for about 10 hours prior to the examination. The rest level of the water in the shaft is about 55 feet below the collar, and Mr. Cassey's estimate of the make of water is 1,500-1,600 gallons per hour.

The vertical shaft has been sunk to a depth of 121 feet and there are two levels, one at 82 feet, and the other at 100 feet. The level at 82 feet was not accessible at the time of my visit, being blocked off by mulloch, but it is understood that drives extend N.N.E. and S.S.W. for distances of 20 feet from the centre of the shaft.

From these drives, and from the shaft itself at that level, 215 tons of non-selective ore had been treated yielding a total of 10.16 dwts. per ton. Of this, 6 dwts. per ton came from treatment of sands.

According to Mr. Cassey, the north drive stopped at a fault, and the south drive although still in quartz, passed out of ore. This information incidentally, is at variance with a report in the "Kalgoorlie Miner" dated 10th November 1958, which states that values continued at both ends of the drive.

The 100 feet level was accessible and was examined thoroughly, but not sampled. The statement by Mr. Cassey that the drive values averaged 2-3 dwts. per ton is accepted. Drive lengths at this level are approximately 60 feet N.E., and 45 feet S.W.

The quartz vein is displaced at the face of the north drive by a fault of unknown displacement. This may, or may not be the fault which affects the vein at the north end of the 82 feet level. Observations made on the 100 feet level indicate that it will not be the same one unless it flattens considerably towards the upper level.

There is a fault at the south end also, and again the displacement is not known.

When asked about the type of rock in which the best values occurred, Mr. Cassey stated that it was a leached, cellular quartz containing very little iron-sulphide mineral. This type of quartz of course, commonly occurs in gold ore bodies associated with jaspilite or jasper formations where secondary enrichment has taken place.

Summary and Conclusions.

The position is therefore, that a diamond drill hole intersected a quartz vein between 76 and 82 feet in highly oxidised ground, the structural relationsip of which was not properly known, but which carried promising values.

A recommendation was made that a shaft be sunk onto this intersection to prospect this body to get information about it which there was absolutely no hope of getting with a diamond drill.

Development work was carried on past this ore body in sub-ore ground with the result that the company over-expended its capital.

Costly development work has shown that payable values do not continue at depth, and a detailed geological examination of part of the limited work done has not brought forth any additional information on which to base predictions of ore recurrence or even structural behaviour.

It appears that the best course open to the Company now is to work out the ore body found at the 82 feet level.

G. H. LOW,
Geologist.

3/4/1959.

THE SEARCH FOR OIL IN WESTERN AUSTRALIA IN 1959.

By G. H. Low, B.Sc., Geological Survey of W.A.

Drilling.

Drilling activities of Western Australian Petroleum Pty. Ltd., were confined to the Kimberleys. Between 1st January and 31st December the Company completed three test wells for a total footage of 19,135 feet, two at Frome Rocks approximately 40 miles a little north of east from Broome and one at Meda, approximately 40 miles a little north of east from Derby. The test well at Thangoo was abandoned at 3,475 feet due to bad drilling conditions, and drilling in the second hole in this vicinity had reached 3,082 feet on 31st December. Thus the complete footage drilled by the Company during 1959 amounts to 25,692 feet.

The following is a summary of the holes drilled and the results during 1959:—

Company: West Australian Petroleum Pty. Ltd.
Licence to Prospect: 56H.
Well: Frome Rocks No. 1 Test.
Location: Latitude 18° 11′ 48″ S. Longitude 123° 38′ 42″ E. Height of derrick floor above sea level: 230 feet.
Spudded in: 2nd January, 1959.
Status: Abandoned at 4,003 feet on 7th February, 1959, in Pre-Permian rocks of unknown age. There were no indications of oil or gas.

Company: West Australian Petroleum Pty. Ltd.
Licence to Prospect: 56H.
Well: Frome Rocks No. 2 Test.
Location: Latitude 18° 15′ 15″ S. Longitude 123° 38′ 42″ E. Height of derrick floor above sea level: 296 feet.
Spudded in: 19th February, 1959.
Status: Drilling abandoned on 1st June, 1959, at a depth of 7,504 feet. No indication of oil or gas.

Company: West Australian Petroleum Pty. Ltd.
Licence to Prospect: 54H.
Well: Meda No. 2 Test.
Location: Latitude 17° 24′ 36″ S. Longitude 124° 11′ 23″ E. Height of derrick floor above sea level: 100 feet.
Spudded in: 27th January, 1959.
Status: Abandoned at 7,628 feet on 20th April, 1959, in Upper Devonian reef complexes. Slight showings of gas between 7,574 feet and 7,616 feet.

Company: West Australian Petroleum Pty. Ltd.
Licence to Prospect: 66H.
Well: Thangoo No. 1 Test.
Location: Latitude 18° 22′ 06″ S. Longitude 122° 53′ 22″ E. Height of derrick floor above sea level: 566 feet (estimated).
Spudded in: 7th November, 1959.
Status: The hole was abandoned at 3,475 feet on 11th December, 1959, due to extensive caving. A new hole (Thangoo No. 1A) located 2,000 yards north-west of No. 1, was spudded on 19th December and by 31st December had reached a depth of 3,082 feet.

Company: Exoil Pty. Ltd.
Licence to Prospect: 65H.
Well: Eyre No. 1 Stratigraphic.
Location: Latitude 32° 7′ S. Longitude 126° 58′ E. Height of derrick floor above sea level: 52 feet.
Spudded in: 27th November, 1959.
Status: The drilling string was stuck in the hole at 1,275 feet on 31st December. Total depth at that date was 1,400 feet. The hole is to be drilled ahead if possible.

The Bureau of Mineral Resources has drilled three holes in Western Australia during 1959. The following is a summary of all the information available at the Geological Survey:—

Drilling Authority: Bureau of Mineral Resources.
Permit to Explore: 28H.
Well: B.M.R. No. 8 Mt. Madeline Stratigraphic.
Location: Latitude 25° 44′ 50″ S. Longitude 115° 40′ 40″ E. Height of derrick floor above sea level: 800 feet (estimated).
Spudded in: 25th May, 1959.
Status: Completed at 3,004 feet on 12th July, 1959, in Permian (Sakmarian) shales.

Drilling Authority: Bureau of Mineral Resources.
Permit to Explore: 28H.
Well: B.M.R. No. 9 Daurie Creek Stratigraphic.
Location: Latitude 25° 32′ 30″ S. Longitude 115° 52′ 50″ E. Height of derrick floor above sea level: 900 feet (estimated).
Spudded in: 16th July, 1959.
Status: Completed at 2,299 feet on 12th August, 1959, in Permian (Sakmarian shales.

Drilling Authority: Bureau of Mineral Resources.
Permit to Explore: 27H.
Well: B.M.R. No. 10 Beagle Ridge Stratigraphic.
Location: Latitude 29° 49′ 38″ S. Longitude 114° 58′ 30″ E. Height of derrick floor above sea level: 21 feet.
Spudded in: 1st August, 1959.
Status: Abandoned at 3,910 feet on 27th October, 1959, in Permian (Artinskian) Sandstones. No drill stem tests were carried out. There was an oil show at 3,710 to 3,722 feet.

LIST OF PERMITS TO EXPLORE.

The following Permits to Explore were current on 31st December, 1959:—

Company or Syndicate	Number of Permit to Explore	Date of Approval	Area Sq. Miles Approx.
West Australian	27H	23/10/52	52,000
Petroleum Pty. Ltd.	28H	23/10/52	51,000
	29H	23/10/52	31,100
	30H	23/10/52	151,600
Westralian Oil Ltd.	106H	29/3/55	11,250
Gulf Oil Syndicate	127H	29/3/55	13,000
Jackson Exploration	133H	3/9/57	15,800
Oil Drilling and Exploration (W.A.) Ltd.	134H	15/9/58	13,000
	135H	15/9/58	13,000
	136H	15/9/58	13,000
	137H	15/9/58	13,000
	138H	15/9/58	13,000
	139H	15/9/58	13,000
	140H	15/9/58	13,240
	143H	30/6/59	13,000
Hawkstone Oil Co. Ltd.	142H	9/4/59	5,500
Frome Broken Hill Pty. Ltd.	144H	20/7/59	16,400
	145H	20/7/59	13,000
	146H	20/7/59	13,000
	147H	20/7/59	13,000
	148H	20/7/59	13,000

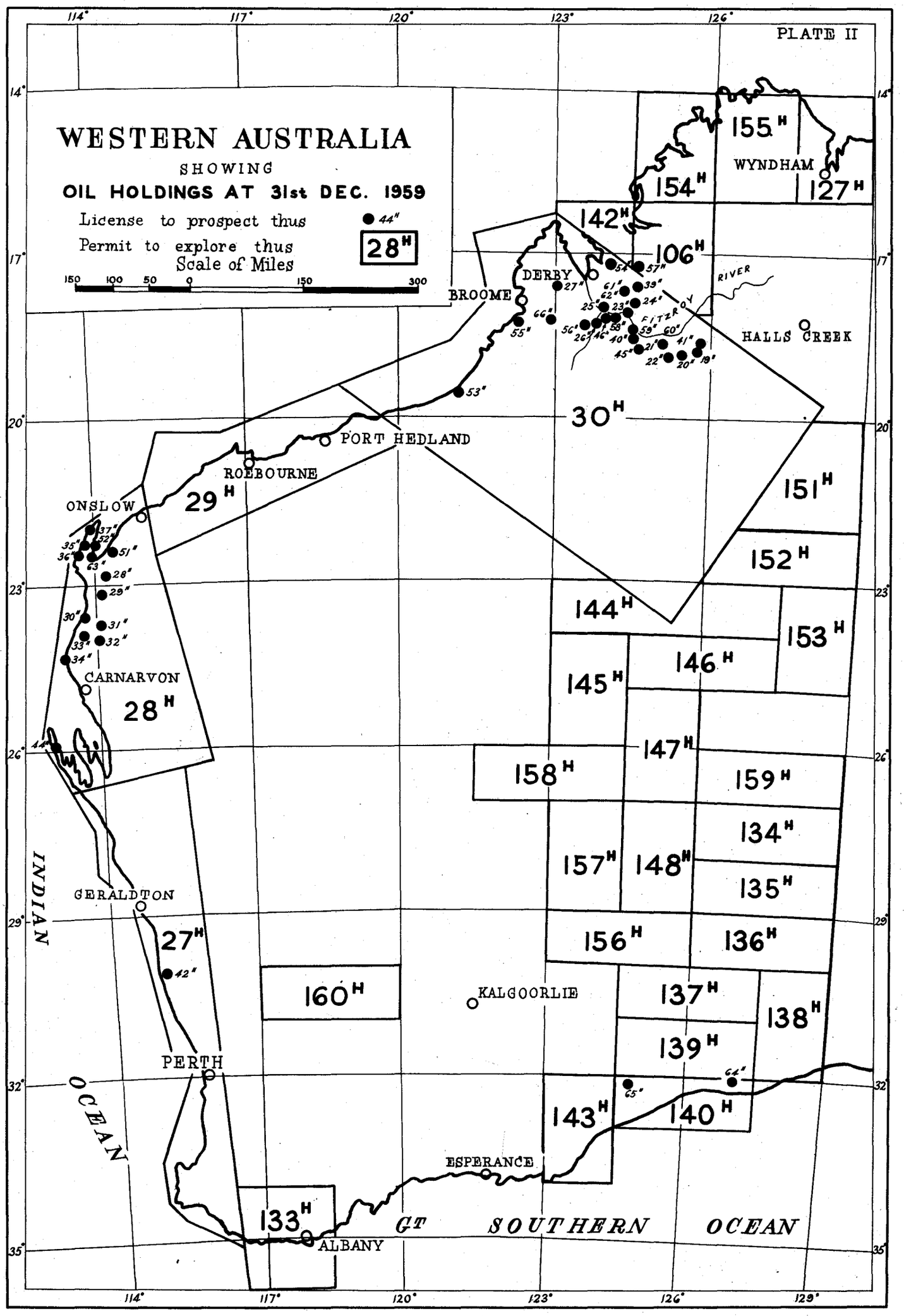
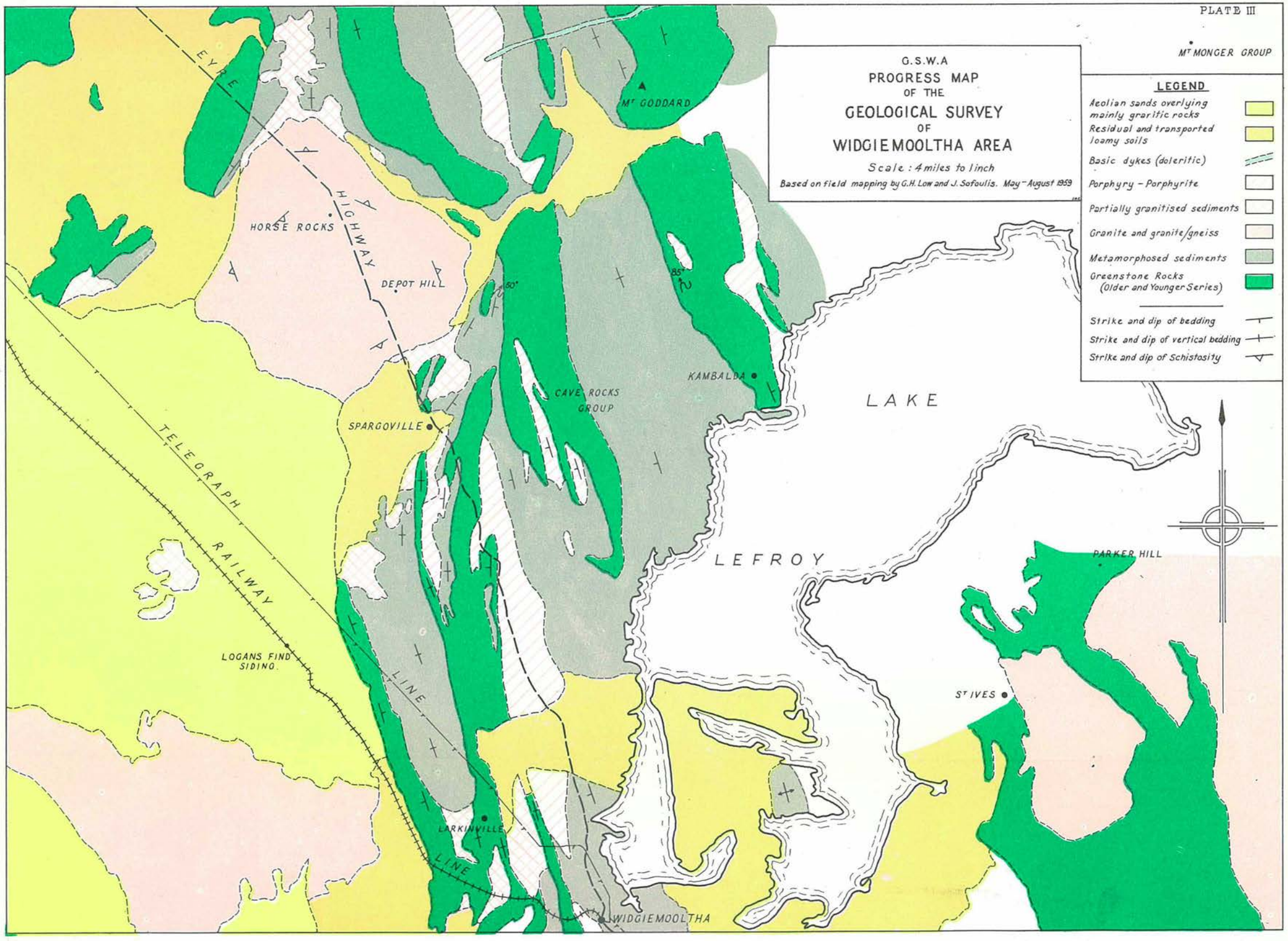


PLATE II
WESTERN AUSTRALIA
SHOWING
OIL HOLDINGS AT 31st DEC. 1959
License to prospect thus
Permit to explore thus
Scale of Miles
150 100 50 0 150 300
155 H
154 H
127 H
142 H
106 H
30 H
29 H
28 H
151 H
152 H
144 H
153 H
146 H
145 H
147 H
158 H
159 H
134 H
157 H
148 H
135 H
156 H
136 H
160 H
137 H
138 H
139 H
143 H
140 H
133 H
WYNDHAM
DERBY
BROOME
HALLS CREEK
PORT HEDLAND
ROEBOURNE
ONSLOW
CARNARVON
GERALDTON
KALGOORLIE
PERTH
ESPERANCE
ALBANY
INDIAN OCEAN
GT SOUTHERN OCEAN
FITZROY RIVER
114°
117°
120°
123°
126°
129°
14°
17°
20°
23°
26°
29°
32°
35°

PLATE III


G.S.W.A
PROGRESS MAP
OF THE
GEOLOGICAL SURVEY
OF
WIDGIEMOOLTHA AREA
Scale : 4 miles to 1 inch
Based on field mapping by G.H. Low and J. Sofoulis. May – August 1959
LEGEND
Aeolian sands overlying mainly granitic rocks
Residual and transported loamy soils
Basic dykes (doleritic)
Porphyry – Porphyrite
Partially granitised sediments
Granite and granite/gneiss
Metamorphosed sediments
Greenstone Rocks (Older and Younger Series)
Strike and dip of bedding
Strike and dip of vertical bedding
Strike and dip of Schistosity
Mt MONGER GROUP
EYRE HIGHWAY
HORSE ROCKS
DEPOT HILL
Mt GODDARD
CAVE ROCKS GROUP
KAMBALDA
LAKE
LEFROY
SPARGOVILLE
TELEGRAPH
RAILWAY
LOGANS FIND SIDING
LINE
LARKINVILLE
LINE
WIDGIEMOOLTHA
PARKER HILL
St IVES

The following Permits to Explore, which are shown on Plate 2, were applied for but not granted as at 31st December, 1959:—

Company or Syndicate	Number of Permit to Explore	Date Applied for	Area Sq. Miles Approx.
D. L. Davis	154H	9/12/59	13,800
	155H	9/12/59	13,800
Textralian Oil Pty. Ltd.	156H	9/12/59	12,450
	157H	9/12/59	12,600
	158H	9/12/59	12,800
	159H	9/12/59	12,800
W. C. M. Campbell	160H	10/12/59	12,300

LIST OF LICENCES TO PROSPECT.

The following Licences to Prospect were current on 31st December, 1959:—

Company or Syndicate	Number of Licence to Prospect	Area Sq. Miles Approx.
West Australian Petroleum Pty. Ltd.	19H	195
	20H	175
	21H	193
	22H	187
	23H	195
	24H	187
	25H	186
	26H	191
	27H	193
	28H	196
	29H	190
	30H	199
	31H	190
	32H	193
	33H	198
	34H	193
	35H	187
	36H	187
	37H	189
	39H	186
	40H	160
	41H	133
	42H	192
	44H	195
	45H	180
	46H	189
	51H	191
	52H	190
	53H	195
	54H	195
	55H	197
	56H	200
	63H	120
	66H	200
Associated Freney Oil Fields, N.L.	58H	120
	59H	112
	60H	112
	61H	112
	62H	112
Exoil Pty. Ltd.	64H	188
	65H	200
Westralian Oil Ltd.	57H	200

Other Activities.

West Australian Petroleum Pty. Ltd., conducted geophysical and geological investigations over large areas, and the Bureau of Mineral Resources conducted geophysical exploration over the northern part of the Carnarvon basin. Exoil Pty. Ltd., conducted geological and geophysical work in the Eucla Basin to support the drilling of the stratigraphic test well Eyre No. 1.

Other Permit holders are conducting preliminary investigations of their areas.

G. H. LOW,
Geologist.

21st January, 1960.

(5)—37498

PROGRESS REPORT ON THE SURVEY OF THE WIDGIEMOOLTHA AREA, COOLGARDIE GOLDFIELD.

by G. H. Low, B.Sc.,

Geological Survey of W.A.

CONTENTS

MAPS

Introduction.

In April, 1959 a start was made on the geological mapping of the area covered by the four adjacent 4-mile Army Sheets Boorabbin, Widgiemooltha, Lake Johnston and Norseman. This amounts to approximately 24,000 square miles and encompasses parts of the Coolgardie, East Coolgardie, Northeast Coolgardie, Dundas and Phillips River Goldfields. (See the locality map; scale 20 miles to an inch.) It excludes the area covered by the Coolgardie Survey, 1946-1948 inclusive. (G.S.W.A. Bull. No. 107). The country mapped will hereinafter be referred to as the "Area."

Work was initiated south-eastwards of the limits of the Coolgardie Survey and by 13th August when the field mapping was terminated for the season, approximate geological boundaries had been defined over an area of 1,000 square miles. Parts of this area had previously been examined by C. S. Honman (1913-1914, G.S.W.A. Bull. No. 66), and by E. de C. Clarke (1920, G.S.W.A. Bull. No. 90).

Field work was commenced by the writer on 27th April, and he was joined by Mr. J. Sofoulis on 11th May; the latter was then continuously engaged on regional mapping until the end of the season. In addition to being in charge of the survey, the writer was also supervising the Government diamond drilling programme at the Lady Loch and Forest King Gold Mines, Coolgardie, and was also responsible for geological examinations and a phase of mining development at the "New Mexico" Gold Mine, Ora Banda. Some assistance was also given to several prospectors in the Coolgardie-Widgiemooltha area. Mining groups in the Area, most of which incidentally are receiving occasional attention from prospectors only, were not the subject of any special investigation.

Maps.

The general geology has been recorded on Lands Department 40 chains to an inch Line Compilations made up from air photographs. Air photographs were also available in stereo pairs on the same scale, together with one mile to an inch photo mosaics. Aeromagnetic contour maps for the Widgiemooltha 4-mile Sheet became available in August.

In a survey of this sort it is necessary to reach a decision regarding the manner of recording geological boundaries. In the class of country covered by this survey, continuity of outcrop rarely exceeds a few chains in length. If only outcrops were recorded the final map would show about 90 per cent. soil cover. While such a map might be of value to an agronomist, it would be of limited value as a practical tool to gold prospectors.

In many cases a comparative study of the vegetation, soil type and topography can give a clue to the underlying rock type, and where this inference has been reasonably positive, it has been recorded on the 40-chain maps. These maps therefore may be mainly regarded as sub-surface maps. Where soil is shown it is because there was considerable doubt as to the nature of the underlying rocks, a circumstance which is usually found in valley flat or lake areas where the thickness of soil cover is considerable.

The geological boundaries must therefore be regarded as assumed or approximate.

General Geology.

General Information and Rock Classification:

The object of this survey to date was to define as accurately as possible the geological boundaries and to map pointers to structural geology with a view, in the first instance, of establishing continuity between the three important gold mining centres of Coolgardie, Kalgoorlie and Norseman, and ultimately of indicating selected favourable areas for more detailed investigation on a larger scale. It was for this reason that mapping was done on the scale of 40 chains to an inch, and detailed investigation of the mining groups was not attempted.

It is known that in the Coolgardie area the favoured host rocks for gold mineralisation are the ultra basic rocks of the Older Greenstone Series, whereas at Kalgoorlie the finer grained quartz-dolerite-greenstones of the Younger Greenstone Series have been most important.

The focus of attention therefore was the greenstone belts, and an attempt was made to distinguish ultra basic rocks, and fine and coarse grained greenstones. No distinction was made on the maps as to whether these can be later differentiated into Older and Younger Greenstones.

The following classification is based on the rocks so far seen and forms the basis of the types shown on the field sheets. Not all of these types are shown on the 4-mile map reproduced with this interim report. The classification is tentative, amendments may be made as the survey proceeds. It is seen that there is some correlation with the classifications in G.S.W.A. Bulletins 66, 90 and 107.

Table Showing a Tentative Classification and the Relative Ages of the Rocks in the Area.

Classification	Series	System	Geological Age	Remarks
Residual and transported soils	....	....	Tertiary to Recent	Various types. Eluvial, alluvial and aeolian sands.
Lake Deposits	....	....	? Tertiary to Recent	
Ferruginous laterites and " cements " (calcareous or kaolinitic)	....	....	Tertiary to Recent	
Basic dykes	....	....	? Late Proterozoic	Norites and dolerites.
Quartz veins, aplite dykes and pegmatites Intrusive biotite granite and biotite gneiss with associated quartz veins and pegmatites. " Porphyritization " and gold mineralization. Porphyry and porphyrite	....	....	Pre-Cambrian	
Meta gabbros and dolerites	? Younger Greenstones	Yilgarn-Kalgoorlie	Pre-Cambrian	Generally coarse grained.
Meta sedimentary series	? Whitestones	Yilgarn-Kalgoorlie	Pre-Cambrian	Metamorphosed erosion sediments with bands of amphibolite schist.
Meta basic and ultra basic rocks	Older Greenstones	Yilgarn-Kalgoorlie	Pre-Cambrian	Metamorphosed lavas, pyroclastic rocks and basic intrusives with bands of metamorphosed erosion sediments.

Description of the Rock Types.—No petrological work has been done on any specimens collected during the survey and the following descriptions are based on the appearance of the rocks in the field:—

(1) The Older Greenstone Series.—These are differentiated into a suite of basic lavas and a suite of ultra basic rocks—

(a) The Basic Lavas and Allied Rocks.—These are made up of conformable alternating metamorphosed beds of fine to medium grained basic lavas, amygdaloidal lavas, porphyritic lavas, pillow lavas, volcanic agglomerates and possibly tuffs. Also present are beds (usually thin) of metamorphosed erosion sediments, which in places have a porphyritic texture due to metasomatism.

These basic lavas are dark green rocks, hard and resistant to erosion. They quite often occupy topographic highs. They are rudely schistose and well jointed. They usually carry a reddish-brown coating of hydrated iron-oxides, and due to the jointing and schistosity, form a blocky rubble in outcrop. These form four main belts in the area mapped.

(b) The Ultra-Basic Rocks.—These consist of fine to coarse grained actinolite, actinolite-tremolite, anthophyllite, talc, chlorite and serpentine rocks and schists. They are garnetiferous in places, and sometimes show an abundance of magnetite. On weathering these rocks show, at the surface, decomposition products of magnesite, jaspery ironstone and cellular opaline quartz rubble, which are of great importance as an indicator of the underlying rock type in areas of no outcrop.

The ultra-basic rocks, being in general softer than the basic lavas, occupy lower country and are very difficult to trace.

As far as can be seen, these rocks are conformable with the basic lavas, and their development may be seen in each of the four main greenstone belts.

(2) The Meta-Sedimentary Series.—These are metamorphosed erosion sediments of varied types including mica, quartz-felspar-mica, graphitic, chiastolite, andalusite, garnet and hornblende schist and various phyllites, slates, grits, sandstones and conglomerates. In places the Series contains thin bands of interbedded greenstones.

Jaspilite occurrences are few and topographically insignificant.

These rocks have been prone to felspathisation during metasomatism and extensive "porphyritization" has occurred. They have been regionally folded and metamorphosed along with the Older Greenstones which they conformably overly.

They weather easily and in general ocupy the low level flats and crop out poorly.

(3) The Younger Greenstone Series.—These correspond to the meta-gabbros and meta-dolerites described by McMath from the Coolgardie area and, presumably, to the Younger Greenstones (quartz-dolerite-greenstones etc.,) of the Kalgoorlie area.

They generally appear as dark green rocks of coarse grained equigranular texture. They consist either of hornblende and subordinate felspar, with minor amounts of quartz, or else by an increase in the amount of felspar, they present a mottled or "porphyritic" appearance. These rocks are present in each of the four greenstone belts mentioned above, but the main development is in the Mt. Goddard to Red Hill area.

They resist weathering, but where the soil has accumulated locally it is of a distinctive light grey colour. This is particularly noticeable in a typical development about six miles east of Horse Rocks. At this locality and at Mt. Goddard these Younger Greenstones occur in the Older Greenstones and are marginally fine grained. The writer could not find any irrefutable evidence to show that these are anywhere transgressively intrusive.

(4) Granites and Allied Rocks.—These include intrusive porphyritic sills and dykes, porphyritized and granitised sedimentary and igneous rocks, pegmatites, aplites, quartz veins and massive granite.

The major granite mass in the Area occurs on the western side of the Coolgardie-Widgiemooltha road between Horse Rocks and Ten Mile Rocks westwards of Larkinville railway siding. There is also a considerable development east of St. Ives and south of Parker Hill in the south-east corner of the Area.

A considerable area of the Horse Rocks Ten Mile Rocks mass is obscured by soil, laterite and undulating sands, but it is reasonable to assume that there is a continuous granitic body beneath this cover.

It is a medium to coarse grained equigranular biotite granite in which observable peripheral schistosity strikes are parallel to the mapped boundaries, a feature which is particularly noticeable in the vicinity of Horse Rocks. The granite in this mass is more massive towards the centre where lineal features are less apparent.

This granite mass is a major intrusive and particularly near its northern extremity, it can be seen that the older sedimentary and greenstone rocks owe their present disposition in part to the mechanical "pushing" action of the granite as it invaded a favourable structural position in the meta-sediments. As seen on the broad scale map, these older formations have a wrapped-around appearance and their resultant strikes and dips correspond to those in the peripheral areas of the granite itself.

Northwards of the granite in the Horse Rocks vicinity, is an apical shaped area of partially granitised material extending into the sediments for a short distance north of Karramindie Soak. The boundary of these metamorphosed rocks is understandably vague. In the immediate vicinity of Karramindie Soak and within the granitised rocks, is a small outlier of massive fine grained granite.

The true intrusive porphyry is difficult to distinguish from the porphyritized rocks unless actual intrusive contacts are seen, except that the latter when followed along the strike usually show in places a gradual change to a typical metamorphosed sediment.

Most of the porphyries are granitic in composition, the essential constituent being felspar (albite), quartz and some muscovite and biotite mica. The felspar and quartz are the porphyritic elements.

The porphyries are often found in close association with gold ore bodies, but the relationship, whether genetic or structural is not yet clear.

Apophyses from the granitic magma include pegmatites, both mineral bearing and barren, aplite dykes and auriferous and barren quartz veins.

(5) Basic Dykes.—These are later basic intrusives (the "Newer Gabbro"—Norite of Honman; G.S.W.A. Bull. 66, p. 34 and the "Basaltic and Gabbroid Dykes" of Clarke; G.S.W.A. Bull. 90 p. 13). They have been mapped as transgressively intruding the Older Greenstones, the meta-sediments, and the porphyry-porphyrite series, but not to date the granite. These dykes usually weather more easily than the surrounding rocks and give the appearance, topographically, of having been "etched" out.

(6) Ferruginous Laterites and "Cements".—The ferruginous laterites occur as hard cappings on hills and rises, and are scattered throughout the Area. They are more ferruginous where they overly the green stone rocks, whereas the lighter coloured aluminous types overly the granite and meta-sediments. In some places, for example on the western side of the Area, the laterites occur as a fossil "B" horizon beneath the sand plain.

"Cement" of various types occurs in many places, varying in accordance with the nature of the underlying rocks.

These "cements" are formed by the leaching out of the more soluble elements from the rocks decomposed in situ. In the case of granitic rock this leaves kaolinitic "cement", while it is predominantly calcareous in the case of basic rocks.

(7) Lake Deposits.—Only the superficial elements of these deposits are known. These consist essentially of silt with a variable surface cover of salt and gypsum particles. These "lakes" are largely dry for a good part of the year.

(8) Residual and Transported Soils.—These consist of aeolian sand plain deposits, and limited sand and "kopi" (gypsum flour) hills around the margins of the salt lakes.

Geological Structure.

As can be seen from the accompanying geological map, the pre-granite rock succession has been regionally folded so that the various belts of rocks strike regionally slightly west of north. Variations in this strike occur around the Horse Rocks granite mass and elsewhere in local structural aberrations.

True bedding dips are hard to find but, when readable, they are variable and close to vertical except in certain localities, for example in the meta-sediments on the shore of Lake Lefroy southwest of Red Hill where the dip is consistently westerly, and in the meta-sediments surrounding the granite mass at Horse Rocks.

Generally, the reading of true dips is complicated by the superimposition of schistosity and fracture cleavage. This and the widespread soil cover, and the paucity of well developed and traceable jaspilite beds makes an interpretation of the detailed geological structure very difficult.

The Horse Rocks—Ten Mile Rock granite mass has evidently intruded after the regional folding of the older rocks. If one accepts the stipulation that the meta-sediments are younger than the Older Greenstones, then the only feasible explanation of the apparent anticlinal structure in the meta-sediments around the north end of the granite is that a thick belt of nearly vertically disposed (due to the regional folding) meta-sediments has been stoped by a hot magma at depth, and then medially intruded by a rapidly consolidating granitic mass. The relatively limited area of granitisation surrounding the mass supports this view. The opposing dips in the meta-sediments may thus be due to the wedging action of the nearly cold granite.

It was not possible however, under the above-mentioned field conditions and the limited time available, to search for the clues which would enable this and other tentatively held ideas on structural interpretation to be turned into reasonable hypotheses.

Summary.

In a short field season of four months the approximate geological boundaries over about 1,000 square miles of country were mapped. Extremely difficult conditions of field mapping due to soil cover and the paucity of marker beds make structural interpretations difficult, and there was not sufficient time to search for the field evidence necessary to consolidate tentative impressions.

The survey will be continued in 1960.

G. H. LOW,
Geologist.

24/1/60.

REPORT ON DIAMOND DRILLING OF "GREAT FINGALL" QUARTZ REEF IN DEPTH D.D.H. No. G.F.5.

By A. J. Noldart, B.Sc.,

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General.

The history of this and previous drilling ventures are contained in reports dated 15/7/56 and 22/10/57, as compiled by J. W. Duggan, geologist then in charge of drilling operations. The above reports cover diamond drill holes Nos. G.F.3 and G.F.4, and include a resume of drilling carried out on this ore body previous to the current operations.

Drilling Operations D.D.H. No. G.F.5.

The drill hole was collared at co-ordinates 2680′ W., 494′ N., co-ordinate origin being at Armstrong's Shaft, Great Fingall Goldmine. Operations were commenced on 3/9/57, under the control of drill foreman O. Koski, with the intention of drilling a hole parallel to D.D.H. No. G.F.3. The hole was designed to intersect the ore body at a depth of 3,200 feet (vertical), some 700 feet south-easterly from the intersection made by D.D.H. No. G.F.3. The same drilling techniques as had been successful in that hole were to be used again.

The initial attempt to drill D.D.H. No. G.F.5 was not successful due to excessive flattening of the hole below 150 feet and the hole was subsequently stopped at a depth of 367 feet 10 inches. The hole was then left at a depth of 201 feet, using standard casing and reaming methods, and drilling proceeded in the new channel to a depth of 305 feet 3 inches. At this depth further flattening became apparent, and the decision was taken to leave the deflection hole as was done in the initial hole. The second deflection was successfully carried out, the deflection being made at a depth of 261 feet and drilling proceeded ahead from that point.

Surveys were carried out at 50 feet intervals using the NX-BX Tro-Pari instrument that had been in use since the commencement of the venture. The surveys indicated the hole to be on a satisfactory course and bearing until faulty readings were obtained between the 1,400 feet and 1,800 feet surveys. Two new Tro-Pari NX-BX survey instruments were then available and check surveys, using the original instrument and one of the new instruments in tandem, were taken at 200 feet intervals from 400 feet to 1,800 feet down the hole. The original instrument was then found to be faulty and the true position of the drill hole considerably off the azimuth bearing as previously plotted. At this stage new procedures were adopted for survey methods, and instrument testing prior to surveys being carried out. Operational errors were then virtually eliminated and drilling recommenced. Subsequent surveys to a depth of 2,100 feet disclosed a marked unfavourable southerly trend to the hole and corrective measures were undertaken.

Normal drilling techniques were first employed to attempt to control the southerly drift, but were found to be unsuccessful. At a depth of 2,319 feet it was decided to deflect the hole by the use of wedging equipment.

The first Hall-Rowe wedge was seated at the bottom of the hole on 10/11/58 and set to deflect on full azimuth easterly. The deflection proved to be insufficient and a second Hall-Rowe wedge again set for full azimuth deflection was seated at 2,462 feet. Again the deflection was insufficient and a third wedge was seated at a depth of 2,594 feet. Drilling proceeded ahead from this wedge to a depth of 2,736 feet. It then became obvious that the unfavourable drift observed in the upper portion of the hole was still affecting the course of the hole. Drilling was stopped at this depth and an attempt made to deflect from the parent hole at the point of maximum easterly trend below the third wedge. The first attempt was made using a Thompson retrievable wedge assembly, but the wedge blade failed to hold and was drilled out. A Hall-Rowe assembly was then used seated at a depth of 2,607 feet immediately below the third wedge point. A reasonably satisfactory azimuth bearing was obtained from this wedge and the hole continued straight on a bearing of 112° T. to the point of intersection of the ore body.

No further drilling difficulties were encountered during the progress of the hole and a successful intersection was made between 3,349 feet and 3,370 feet down the hole. Further small intersections of reef quartz were made at depths of 3,433 feet 6 inches (20 inches), 3,606 feet 6 inches (57 inches) and 3,663 feet (30 inches). The hole was continued to a depth of 4,199 feet to ensure the identification of the intersection and drilling ceased on 25/11/58.

It was then decided to drill a short deflection hole from the parent hole to obtain a further sample of the ore body.

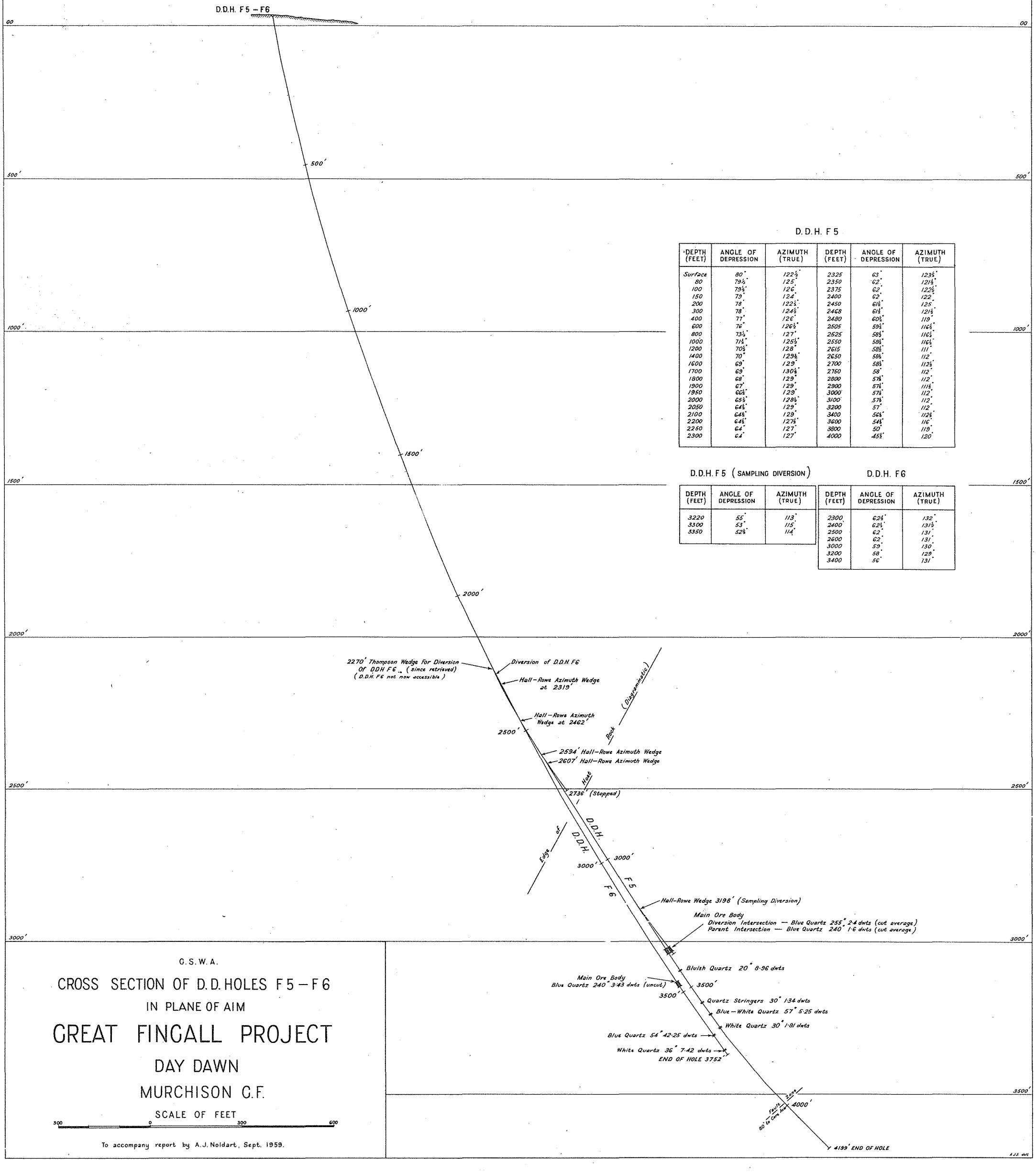
The first two attempts to deflect were made using Thompson wedges, one for full lift and one for full azimuth, but in both cases failure of the wedge blade occurred. A Hall-Rowe assembly was then seated on the drilled out Thompson equipment and a successful intersection was made some 9 feet up dip from the parent hole. The ore body was intersected between 3,350 feet 8 inches and 3,370 feet 8 inches, and the hole completed at a depth of 3,378 feet 4 inches down the hole on 27/2/59.

The progress of the drilling in D.D.H. G.F.5 and the deflection hole was repeatedly delayed by mechanical breakdowns occurring in the drilling equipment, and a considerable amount of drilling time was lost due to this cause.

A. J. NOLDART,
Geologist.

17/3/59.

PLATE IV



D.D.H. F 5

DEPTH (FEET)	ANGLE OF DEPRESSION	AZIMUTH (TRUE)	DEPTH (FEET)	ANGLE OF DEPRESSION	AZIMUTH (TRUE)
Surface	80°	122½°	2325	63°	123½°
80	79½°	125°	2350	62°	121½°
100	79½°	126°	2375	62°	122½°
150	79°	124°	2400	62°	122°
200	78°	122½°	2450	61½°	125°
300	78°	124½°	2468	61½°	121½°
400	77°	126°	2480	60½°	119°
600	76°	126½°	2505	59½°	116½°
800	73½°	127°	2525	58½°	116½°
1000	71½°	125½°	2550	58½°	116½°
1200	70½°	128°	2615	58½°	111°
1400	70°	129½°	2650	58½°	112°
1600	69°	129°	2700	58½°	112½°
1700	69°	130½°	2750	58°	112°
1800	68°	129°	2800	57½°	112°
1900	67°	129°	2900	57½°	111½°
1950	66½°	129°	3000	57½°	112°
2000	65½°	128½°	3100	57½°	112°
2050	64½°	129°	3200	57°	112°
2100	64½°	129°	3400	56½°	112½°
2200	64½°	127½°	3600	54½°	116°
2250	64°	127°	3800	50°	119°
2300	64°	127°	4000	45½°	120°

D.D.H. F 5 (SAMPLING DIVERSION)

DEPTH (FEET)	ANGLE OF DEPRESSION	AZIMUTH (TRUE)
3220	55°	113°
3300	53°	115°
3350	52½°	114°

D.D.H. F6

DEPTH (FEET)	ANGLE OF DEPRESSION	AZIMUTH (TRUE)
2300	62½°	132°
2400	62½°	131½°
2500	62°	131°
2600	62°	131°
3000	59°	130°
3200	58°	129°
3400	56°	131°

G.S.W.A.

CROSS SECTION OF D.D. HOLES F 5 – F 6

IN PLANE OF AIM

GREAT FINGALL PROJECT

DAY DAWN

MURCHISON C.F.

SCALE OF FEET

300 0 300 600

To accompany report by A.J. Noldart, Sept. 1959.

PLATE V

DDH N°F3-F4

DDH N°F5-F6

Plan Projection of Drill Holes

DDH F1

DDH F2 © Abandoned 1708

DDH F3

DDH F4

DDH F5

DDH F6

ST ALBAN'S SHAFT

Line of Outcrop

N°1 LEVEL

Main Ore Body

© DDH F1 Abandoned 1190'

209 D

225 D

119 D

213 D

159 D

211 D

158 D

212 D

1017

916

573 D

663 D

673 D

576 D

675 D

MOUNTAIN VIEW WORKINGS

Line of Longitudinal Section

Inclined Shaft

Line of N°1 LEVEL Outcrop

ARMSTRONG'S SHAFT

HEFFERNAN'S SHAFT

INTERNAL SHAFT

ORIGIN

N°7 LEVEL

N°8 LEVEL

N°9 LEVEL

N°10 LEVEL

N°11 LEVEL

N°12 LEVEL

N°13 LEVEL

N°14 LEVEL

N°15 LEVEL

N°16 LEVEL

N°17 LEVEL

N°18 LEVEL

N°19 LEVEL

N°2 LEVEL

N°3 LEVEL

N°4 LEVEL

N°5 LEVEL

DAY DAWN SHAFT

WALLACE'S SHAFT

MAIN SHAFT

GOLDEN CROWN WORKINGS

Line of Outcrop

Intermediate Sh

TEMPY RES. 1231 H

TEMPY RES 1232 H

STOPING SHOWN THUS

Collar Armstrong Shaft = Datum RL 0

N

G S W A

COMPOSITE PLAN

GREAT FINGALL WORKINGS

SHOWING PLAN PROJECTION OF

D.D.HOLES F3, F4, F5 AND F6

DAY DAWN

MURCHISON G F

SCALE OF FEET

300 100 0 300 600

To accompany report by A J Noldart Sept 1959

PLATE VI

MOUNTAIN VIEW SHAFT

ARMSTRONG SHAFT

DAY DAWN SHAFT

Datum Armstrong Shaft Collar

W 32° 24' N

E 32° 24' S

R.L. 00'

No.1 LEVEL

No.2 LEVEL

No.3 LEVEL

No.4 LEVEL

300'

No.5 LEVEL

No.6 LEVEL

No.7 LEVEL

600'

No. 8 LEVEL

No.9 LEVEL

900'

No.10 LEVEL

No.11 LEVEL

1200'

No.12 LEVEL

1500'

No.13 LEVEL

No.14 LEVEL

1800'

SHAFT

No.15 LEVEL

No.16 LEVEL

2100'

INTERNAL

No.17 LEVEL

No.18 LEVEL

2400'

No.19 LEVEL

2700'

300'

600'

900'

Note:

The drill holes shown are projected positions on the plane of the section

96' Trace values only

3000'

(Diversion)

240' at 1·6 dwts (cut av)

255' at 2·4 dwts (cut av)

26' at 2·00 dwts

20' at 8·96 dwts

38' at 43·82 dwts

58' at 23·84 dwts

MAIN ORE BODY

240' at 3·43 dwts (uncut)

30' at 1·34 dwts

342' at 3·25 dwts/ton (cut average)

57' at 5·25 dwts

30' at 1·81 dwts

3300'

54' at 45·25 dwts

FOOTWALL REEFS

36" at 1·42 dwts

1800'

1500'

1200'

900'

600'

300'

O.M.

The grid shown hereon, drawn vertical to line of section and collar of Armstrong Shaft as datum, is not to be confused with the grid shown on the composite plan.

G. S. W. A.

LONGITUDINAL SECTION SHOWING INTERSECTIONS OF D.D.H.s F3, F4, F5 & F6 WITH MAIN ORE BODY & FOOTWALL REEFS

GREAT FINGALL WORKINGS

DAY DAWN — MURCHISON G.F.

SCALE OF FEET

300 0 300 600

To accompany report by A.J. Noldart Sept. 1959

ASSAY RESULTS—D.D.H. G.F.5 INTERSECTIONS—GREAT FINGALL AND FOOTWALL ORE BODIES

Sample No.	1st Assay	2nd Assay	Average Assay	From	To	Core Length	Approx. True Width	Core Recovered	Remarks
	dwt./ton	dwt./ton	dwt./ton	ft. ins.	ft. ins.	ins.	ins.	ins.	
G.F. 131	Trace	....	Trace	660 6	662 0	18	15	18	Quartz vein.
G.F. 132	0·34	0·35	0·34	3,343 0	3,346 3	39	32	36	H/W quartz dolerite with pyrite, galena, pyrrhotite.
G.F. 133	1·74	2·12	1·93	3,346 0	3,348 11	32	27	32	do. do. do. do.
G.F. 134	0·50	0·40	0·45	3,348 11	3,349 11	12	10	12	Dark blue quartz.
G.F. 135	5·40	Trace	2·7	3,349 11	3,350 11	12	10	12	do.
G.F. 136	Trace	Trace	Trace	3,350 11	3,351 11	12	10	12	do.
G.F. 137	1·74	1·22	1·48	3,351 11	3,352 11	12	10	12	Dark blue quartz, becoming paler.
G.F. 138	188·57	192·39	190·48	3,352 11	3,353 11	12	10	12	Pale-clearish quartz.
G.F. 139	4·42	5·15	4·78	3,353 11	3,354 11	12	10	12	Pale-blue-whitish quartz with light mineralization galena, pyrite, pyrrhotite, arsenopyrite, chalcopyrite.
G.F. 140	Trace	1·15	0·57	3,354 11	3,355 11	12	10	12	
G.F. 141	2·13	1·98	2·05	3,355 11	3,356 11	12	10	12	
G.F. 142	0·37	0·28	0·32	3,356 11	3,357 11	12	10	11	
G.F. 143	Trace	Trace	Trace	3,357 11	3,358 11	12	10	12	Whitish quartz.
G.F. 144	0·67	Trace	0·33	3,358 11	3,359 11	12	10	12	do.
G.F. 145	5·51	5·09	5·30	3,359 11	3,360 11	12	10	12	Heavily mineralized pale blue quartz.
G.F. 146	0·52	0·20	0·36	3,360 11	3,361 11	12	10	12	Pale blue quartz.
G.F. 147	11·98	16·12	14·05	3,361 11	3,362 11	12	10	12	Heavily mineralized pale blue quartz.
G.F. 148	2·92	2·81	2·86	3,362 11	3,363 11	12	10	12	Pale blue quartz.
G.F. 149	Trace	0·21	0·10	3,363 11	3,364 11	12	10	12	do.
G.F. 150	0·30	0·45	0·37	3,364 11	3,365 11	12	10	12	Pale blue quartz, becoming paler.
G.F. 151	0·83	0·59	0·71	3,365 11	3,366 11	12	10	12	do. do. do.
G.F. 152	Trace	Trace	Trace	3,366 11	3,367 11	12	10	12	do. do. do.
G.F. 153	0·18	0·19	0·18	3,367 11	3,368 11	12	10	12	Glassy quartz.
G.F. 154	1·99	3·37	2·68	3,368 11	3,369 11	12	10	12	Glassy quartz with 2 in. dark blue quartz.
G.F. 155	1·18	1·45	1·31	3,371 2	3,374 2	36	30	36	F/W quartz dolerite.
G.F. 156	1·32	0·30	0·81	3,374 2	3,377 2	36	30	36	do.
G.F. 157	Trace	0·15	Trace	3,377 2	3,380 2	36	30	36	do.
G.F. 158	0·57	0·58	0·57	3,380 2	3,383 2	36	30	36	do.
G.F. 159	0·45	....	....	3,432 6	3,433 6	12	11	12	H/W quartz dolerite.
G.F. 160	8·96	....	....	3,433 6	3,435 2	20	14	20 ?	Blue quartz badly broken.
G.F. 161	1·34	....	....	3,435 2	3,436 2	12	11	12	F/W greenstone.
G.F. 162	1·34	....	....	3,560 6	3,563 0	30	27	30	Heavily mineralized quartz dolerite.
G.F. 163	2·46	....	....	3,563 0	3,565 6	30	27	30	do. do. do.
G.F. 164	2·55	....	....	3,602 9	3,606 6	45	42	45	do. do. do.
G.F. 165	3·32	....	....	3,606 6	3,608 10	28	24	27	Pale bluish quartz-min. with pyrite, galena, pyrrhotite, arsenopyrite, ? chalcopyrite ?
G.F. 166	7·17	....	....	3,608 10	3,611 3	29	25	28	
G.F. 167	0·62	....	....	3,611 3	3,614 3	36	33	36	Mineralized quartz dolerite.
G.F. 168	2·80	....	....	3,643 4	3,645 10	30	27	30	Mineralized quartz dolerite with quartz stringers.
G.F. 169	12·14	....	....	3,645 10	3,648 4	30	27	30	do. do. do. do.
G.F. 170	1·81	....	....	3,662 10	3,665 4	30	27	30	White quartz and quartz stringers.

ASSAY RESULTS—D.D.H. No. G.F.5 SAMPLING DIVERSION—GREAT FINGALL ORE BODY

Sample No.	1st Assay	2nd Assay	Average Assay	From	To	Core Length	Approx. True Width	Core Recovered	Remarks
	dwt./ton	dwt./ton	dwt./ton	ft. ins.	ft. ins.	ins.	ins.	ins.	
HANGING WALL:									
G.F. 171	0·10	0·20	0·15	3,341 0	3,344 8	44	37	38	Quartz dolerite with pyrite, galena, pyrrhotit etc. Silicified over last two feet.
G.F. 172	*Nil*	*Nil*	*Nil*	3,344 8	3,347 8	36	30	30	
G.F. 173	0·40	0·40	0·40	3,347 8	3,350 8	36	30	33	
QUARTZ ORE BODY:									
G.F. 174	4·60	4·80	4·70	3,350 8	3,351 8	12	10	12	Dark blue quartz.
G.F. 175	0·20	0·40	0·30	3,351 8	3,352 8	12	10	12	Dark blue quartz—heavily mottled blue-white—lightly mineralized pyrite, pyrrhotite, galena, etc.
G.F. 176	Trace	Trace	0·00	3,352 8	3,353 8	12	10	12	
G.F. 177	Trace	Trace	0·00	3,353 8	3,354 8	12	10	12	Strongly mottled blue-white quartz lightly mineralized with pyrite, pyrrhotite, arsenopyrite, galena, chalcopyrite.
G.F. 178	Trace	Trace	0·00	3,354 8	3,355 8	12	10	12	
G.F. 179	Trace	Trace	0·00	3,355 8	3,356 8	12	10	12	
G.F. 180	1·73	1·63	1·68	3,356 8	3,357 8	12	10	12	Strongly mottled—pale blue—fairly strong mineralization with pyrite, galena, sphalerite (?), arsenopyrite, chalcopyrite (?), bornite. Traces gold in 181–182 (?).
G.F. 181	103·46	102·16	102·81	3,357 8	3,358 8	12	10	12	
G.F. 182	2·00	1·70	1·85	3,358 8	3,359 8	12	10	12	
G.F. 183	*Nil*	*Nil*	0·00	3,359 8	3,360 8	12	10	12	
G.F. 184	Trace	Trace	0·00	3,360 8	3,361 8	12	10	12	
G.F. 185	0·60	0·50	0·55	3,361 8	3,362 8	12	10	12	Strongly mottled—blue quartz—traces mineralization only.
G.F. 186	*Nil*	*Nil*	0·00	3,362 8	3,363 8	12	10	12	
G.F. 187	2·33	2·53	2·43	3,363 8	3,364 8	12	10	12	
G.F. 188	1·40	1·10	1·25	3,364 8	3,365 8	12	10	12	Dark blue quartz—strongly mottled—trace mineralization only.
G.F. 189	6·50	6·50	6·50	3,365 8	3,366 8	12	10	12	
G.F. 190	1·70	2·00	1·85	3,366 8	3,367 8	12	10	12	Dark blue quartz—stringers of quartz dolerite remnants with coarse grained sulphides.
G.F. 191	3·20	3·10	3·15	3,367 8	3,368 8	12	10	12	
G.F. 192	0·30	0·20	0·25	3,368 8	3,369 8	12	10	12	Dark blue quartz—light mineralization only.
G.F. 193	1·20	1·10	1·15	3,369 8	3,370 8	12	10	12	
FOOT WALL:									
G.F. 194	4·67	4·47	4·57	3,370 8	3,373 2	30	25	30	Very strongly mineralized quartz dolerite—1 in. quartz vein in 194 with traces gold.
G.F. 195	0·10	0·10	0·10	3,373 2	3,375 8	30	25	30	
G.F. 196	2·20	2·00	2·10	3,375 8	3,378 4	32	26	32	

D.D.H. No. G.F. 5.

Logged by: J. W. Duggan, 0 feet—1,758 feet; A. J. Noldart, 1,758 feet to end of hole.

Summarised Core Log.

From	To	Description
ft. ins.	ft. ins.	
0 0	155 3	Fine to medium grained dolerite.
155 3	243 0	Fine grained amygdaloidal lava.
243 0	263 10	Fine to medium grained dolerite.
263 10	444 0	Fine grained amygdaloidal lava.
444 0	530 6	Fine to medium grained dolerite.
530 6	536 0	Fine grained lava-sharp upper contact at 40° to core axis.
536 0	565 6	Fine grained dolerite.
565 6	569 0	Fine grained lava.
569 0	580 0	Fine to medium grained dolerite.
580 0	811 0	Fine grained lava-quartz vein 660½ feet to 662 feet. Strong shearing 706 feet to 715 feet at 50° to core axis.
811 0	901 0	Fine to medium grained bleached dolerite.
901 0	911 0	Fine grained lava.
911 0	921 0	Medium grained dolerite.
921 0	977 0	Fine grained lava.
977 0	1,044 0	Medium grained dolerite-sharp upper contact at 40° to core axis.
1,044 0	1,202 0	Fine to medium grained lava.
1,202 0	1,218 0	Dense, massive fine grained green stone with occasional grain size variations.
1,218 0	1,541 3	Medium to coarse grained partly bleached dolerite showing good crystal outlines. Well sheared 1,251 feet to 1,252 feet at 70° to core axis.
1,541 3	1,787 0	Dense massive fine grained lava.
1,787 0	1,810 0	Interbedded massive lavas and meta-sediments.
1,810 0	1,945 0	Tuffaceous (?) greenstones with occasional meta-sedimentary and lava bands.
1,945 0	2,036 0	Medium-fine grained lavas with tuffaceous (?) bands. Quartz reef from 1,980 feet to 1,981½ feet (not mineralised).
2,036 0	2,082 0	Meta-sediments-tuffaceous (?).
2,082 0	2,099 0	Black and grey shales.
2,099 0	2,234 0	Mainly meta-sediments with some lava bands.
2,234 0	2,295 0	Mainly meta-sediments, talcose and serpentinous in small bands. Small shears 2,264 feet and 2,285 feet schistosity 60°–70° to core axis.
2,295 0	2,319 0	Highly siliceous rock.
	HALL ROWE WEDGE SEATED	
2,319 0	2,340 0	No core.
2,340 0	2,361 0	Mainly meta-sediments with some lava bands.
2,361 0	2,365 0	No core.
2,365 0	2,406 0	Mainly meta-sediments but with a fine grained doleritic appearance.
2,406 0	2,415 0	Shale horizon—small bands only in meta-sediments.
2,415 0	2,442 0	Fine grained meta-sediments.
2,442 0	2,448 0	Fine grained with doleritic texture.
2,448 0	2,451 0	Meta-sediments.
2,451 0	2,462 0	Traces of shales in meta-sediments.
	HALL ROWE WEDGE SEATED	
2,462 0	2,520 0	No core.
2,520 0	2,555 6	Medium grained quartz dolerite-sharp intrusive contacts.
2,555 6	2,560 0	Meta-sediments.
2,560 0	2,564 0	Medium grained quartz dolerite.
2,564 0	2,565 0	White " bucky " quartz vein.
2,565 0	2,576 0	Meta-sediments.
2,576 0	2,594 0	Medium grained quartz dolerite.
	HALL ROWE WEDGE SEATED	
2,594 0	2,652 0	No core.
2,652 0	2,672 0	Medium grained quartz dolerite.

Summary Log—*continued.*

From	To	Description
ft. ins.	ft. ins.	
2,672 0	2,682 0	Medium grained meta-sediments
2,682 0	2,722 0	Shale horizon—narrow bands in meta-sediments.
2,722 0	2,734 0	Medium grained meta-sediments. Tuffaceous (?).
2,734 0	2,736 0	Shale horizon.
	HOLE STOPPED WEDGE SEATED 2,607 FEET	
2,592 0	2,611 0	No core.
2,611 0	2,670 0	Medium grained quartz dolerite.
2,670 0	2,681 0	Meta-sediments.
2,681 0	2,725 0	Shale horizon—highly contorted from 2,721 feet to 2,723 feet.
2,725 0	2,740 0	Medium grained meta-sediments.
2,740 0	2,775 0	Shale horizon.
2,775 0	2,800 0	Doubtful meta-sediments—doleritic texture in part.
2,800 0	2,934 0	Medium grained quartz dolerite.
2,934 0	2,935 6	Fine grained meta-sediments.
2,935 6	2,971 0	Coarse grained quartz dolerite—HOST ROCK.
2,971 0	3,121 0	Very coarse grained quartz dolerite with small shears and quartz stringers at 3,007 feet and 3,052 feet.
3,121 0	3,123 6	Narrow meta-sedimentary band—upper contact sharp, 50° to core axis—lower contact approximately 15° to core axis.
3,123 6	3,346 0	Very coarse grained quartz dolerite becoming progressively more sheared after 3,280 feet. Core broken from 3,334 feet. Small shears 3,177 feet, 3,192 feet and 6 inches white quartz at 3,207 feet. Shears acute to core axis (approximately 15°). Epidotised 3,341 feet and 3,267 feet.
3,346 0	3,348 11	Mineralised sheared quartz dolerite carrying pyrite, pyrrhotite, chalcopyrite, quartz and calcite stringers—strongly carbonated in places.
3,348 11	3,363 11	Mottled blue and white quartz—strongly mineralised with galena, pyrite, chalcopyrite, pyrrhotite, sphalerite, arseno-pyrite and traces of free gold.
3,363 11	3,364 4	Sheared, mineralised, partly assimilated quartz dolerite.
3,364 4	3,370 6	Pale bluish, mottled quartz becoming milky at 3,370 feet and strongly mineralised in places as above.
3,370 6	3,433 6	Sheared and carbonated quartz dolerite footwall rock becoming progressively more carbonated with depth. 1 inch quartz at 3,370 feet and 2 inches quartz at 3,372½ feet.
3,433 6	3,435 2	Pale bluish quartz with sulphides as in main lode. Puggy contact on H/W, faulted contact on F/W.
3,435 2	3,440 6	Fine grained meta-sediment remnant.
3,440 6	3,478 0	Heavily carbonated quartz dolerite.
3,478 0	3,488 6	Very fine grained intrusive rock, black with minute white flecks—chilled margins—younger dolerite (?).
3,488 6	3,561 7	Sheared coarse grained quartz dolerite.
3,561 7	3,562 10	Strongly mineralised quartz stringers.
3,562 10	3,565 3	Strongly mineralised quartz dolerite with some quartz stringers.
3,565 3	3,606 6	Coarse grained quartz dolerite becoming sheared with depth—4 inches quartz at 3,583 feet, 5 inches at 3,597 feet.
3,606 6	3,611 3	Greyish-white quartz, bluish in parts, heavily mineralised with sulphides and traces of free gold.

Summary Log—*continued.*

From	To	Description
ft. ins.	ft. ins.	
3,611 3	3,643 4	Medium grained quartz dolerite becoming progressively more sheared.
3,643 4	3,648 4	Medium grained quartz dolerite with numerous quartz stringers.
3,648 4	3,662 10	Medium grained quartz dolerite with occasional small quartz stringers.
3,662 10	3,665 4	White quartz and quartz stringers.
3,665 4	3,725 0	Sheared greenstones—may be tuffaceous.
3,725 0	3,857 0	Sheared greenstones—possibly partly altered meta-sediments with intruded fine grained quartz dolerite —doleritic texture in part.
3,857 0	3,917 0	Medium grained quartz dolerite.
3,917 0	4,199 0	Possibly sheared quartz dolerite—pale in colour after 3,945 feet. Strongly sheared mud zone 80° to core axis at 3,989 feet. END OF HOLE.
SAMPLING DEFLECTION		
3,231 0	3,349 0	Coarse grained quartz dolerite—sheared after 3,338 feet.
3,349 0	3,350 8	Silicified and mineralised quartz dolerite.
3,350 8	3,370 8	Mottled blue to white mineralised quartz.
3,370 8	3,378 4	Medium grained quartz dolerite with occasional quartz stringers. END OF HOLE.

REPORT ON DIAMOND DRILLING OF "GREAT FINGALL" QUARTZ REEF IN DEPTH. D.D.H. No. F. 6.

By A. J. Noldart, B.Sc., Geological Survey of W.A.

General.

Diamond Drill Hole No. F. 5 was successfully completed on 27/2/59, and subsequent to requests by representatives of private enterprise associated with the venture, a decision was made by the Mines Department of W.A. to drill a major diversionary hole using D.D.H. No. F. 5 as the parent hole.

In conformity with nomenclature used for previous major deflections this hole became No. 6 in the series.

Reports compiled by J. W. Duggan (15/7/56 and 22/10/57) and the present author (17/3/59), contain details of D.D.H. Nos. F. 3, 4 and 5 drilled in the current venture. A report by J. C. McMath in the Annual Report of the Geological Survey for 1949 covers the operations of the first drilling attempts.

Drilling Operations D.D.H. No. F. 6.

The drill hole collar (D.D.H. No. F. 5) was at co-ordinates 2,680′ W., 494′ N., co-ordinate grid for the Great Fingall Goldmine.

The intersection made in D.D.H. No. F. 5 indicated that a marked southerly swing had developed in the strike of the ore body, and the diversionary hole was designed to test the ore body at a point approximately 200 feet southerly of the previous intersection along the presumed change of strike.

It was then decided to attempt to deflect from the parent hole at a point above the first corrective wedge in that hole, and allow the new hole to continue approximately in the same azimuth heading that the parent hole had maintained to that point.

The deflection was effectively carried out at a depth of 2,270 feet using standard Thompson wedging equipment, and drilling proceeded in the new hole. The course of the hole was satisfactory throughout and a successful intersection of the ore body was made between 3,460 feet and 3,480 feet down the hole. The hole was continued into the footwall rocks to test for smaller ore bodies encountered in previous holes, and intersections with quartz reefs were made at depths of 3,671 feet 6 inches (54 inches) and 3,732 feet 6 inches (36 inches), down the hole.

The hole was abandoned at a depth of 3,752 feet due to mechanical failure of the drilling plant at depth. The Thompson wedge was retrieved successfully on 15/9/59 and the plant dismantled.

A. J. NOLDART,
Geologist.

22nd September, 1959.

D.D.H. No. F. 6.

(Diversion from D.D.H. F. 5.)

Logged by: A. J. Noldart.

N.B.—For core log from the surface to commencement of this hole see report on D.D.H. No. F. 5 dated 17/3/59.

Summarised Core Log.

From	To	Core Description
ft. in.	ft. ins.	
2,270 0	2,277 0	NO CORE.
2,277 0	2,340 0	Predominantly meta-sedimentary—highly siliceous in places with some lava bands.
2,340 0	2,390 0	Doleritic texture in part—probably meta-igneous.
2,390 0	2,439 0	Meta-sediments—siliceous in part with some quartzitic intrusives.
2,439 0	2,444 0	Medium-grained quartz dolerite.
2,444 0	2,459 0	Meta-sediments with some small shale bands.
2,459 0	2,481 6	Tuffaceous (?) meta-sediments.
2,481 6	2,511 6	Highly contorted shales with syngenetic pyrite—6 inches quartz at 2,482½ feet.
2,511 6	2,519 6	Meta-sediments.
2,519 6	2,553 0	Medium-grained quartz dolerite.
2,553 0	2,601 0	Tuffaceous (?) meta-sediments— Siliceous in part—14 inches white quartz at 2,564½ feet, 6 inches white quartz at 2,566½ feet.
2,601 0	2,674 0	Medium to fine-grained quartz dolerite.
2,674 0	2,683 0	Siliceous meta-sediments.
2,683 0	2,726 0	Contorted black shales with syngenetic pyrite.
2,726 0	2,740 0	Tuffaceous (?) meta-sediments.
2,740 0	2,776 0	Black shales—contorted at 2,758 feet.
2,776 0	3,007 0	Fine-grained quartz dolerite gradually becoming coarser-grained and partly carbonated, coarse-grained and strongly amphibolitic after 2,804 feet—9 inches quartz at 2871 feet, 6 inches quartz at 2,909 feet, 6 inches quartz at 2,966 feet—partly silicified between 2,984 feet and 2,986 feet.
3,007 0	3,011 0	Fine-grained meta-sediments.
3,011 0	3,148 0	Very coarse-grained amphibolitic quartz dolerite—9 inches quartz at 3,119 feet, 6 inches quartz at 3,128 feet.
3,148 0	3,154 0	Siliceous intrusive parallel to core axis.
3,154 0	3,362 0	Very coarse-grained quartz dolerite, epidotised 3,200 feet, 3,210 feet, 3,252 feet, 3,362 feet—carbonated in places.
3,362 0	3,372 0	Chloritized meta-lavas.
3,372 0	3,390 0	Very coarse-grained, partly sheared and carbonated quartz dolerite, 24 inches of chloritized material with 1 inch quartz stringers at 3,290 feet.
3,390 0	3,454 0	Sheared coarse-grained quartz dolerite becoming more sheared with depth—6 inches quartz at 3,451 feet, 6 inches quartz at 3,454 feet.
3,454 0	3,460 0	Siliceous quartz dolerite with numerous quartz veinlets, mineralised with pyrite, chalcopyrite, pyrrhotite and galena.

Summarised Core Log—*continued.*

From	To	Description
ft. ins.	ft. ins.	
3,460 0	3,480 0	Blue quartz reef—white in centre, strongly mineralised where blue in colour and weak mineralisation where white—mineralisation galena, pyrite, pyrrhotite, chalcopyrite and possibly arsenopyrite.
3,480 0	3,494 0	Sheared, lightly mineralised coarse-grained quartz dolerite.
3,494 0	3,587 0	Coarse-grained, partly sheared quartz dolerite.
3,587 0	3,588 6	Very fine-grained newer dolerite intrusive.
3,588 6	3,600 0	Coarse-grained quartz dolerite.
3,600 0	3,610 0	Very fine-grained newer dolerite intrusive.

Summarised Core Log—*continued.*

From	To	Description
ft. ins.	ft. ins.	
3,610 0	3,671 6	Coarse-grained quartz dolerite, sheared after 3,657 feet and becoming mineralised.
3,671 6	3,676 0	Blue-white quartz reef with galena, pyrite, chalcopyrite and pyrrhotite.
3,676 0	3,732 6	Sheared with doleritic texture—may be meta-sediments—lightly mineralised.
3,732 6	3,735 6	White quartz reef with light pyrite, pyrrhotite and galena mineralisation.
3,735 6	3,752 0	Sheared meta-sediments with apparent doleritic texture in part. END OF HOLE.

Assay Results—D.D.H. No. F.6 Intersections—
"Great Fingall" and Footwall Ore Bodies

	Sample No.	Average Assay	From	To	Core Length	Approx. True Width	Core Recovered	Remarks
		dwts./ton	ft. ins.	ft. ins.	ins.	ins.	ins.	
H/W	G.F.197	0·67	3,451 0	3,454 0	36	30	36	Lightly mineralised hanging wall quartz dolerite contains pyrite, pyrrhotite, galena and chalcopyrite.
H/W	G.F.198	0·45	3,454 0	3,457 0	36	30	36	
H/W	G.F.199	0·34	3,457 0	3,460 0	36	30	36	
Blue Quartz Ore Body	G.F.200	11·42	3,460 0	3,461 0	12	10	12	Blue quartz with fair mineralisation as above.
Blue Quartz Ore Body	G.F.201	13·55	3,461 0	3,462 0	12	10	12	
Blue Quartz Ore Body	G.F.202	0·34	3,462 0	3,463 0	12	10	10	As above—becoming paler.
Blue Quartz Ore Body	G.F.203	Trace	3,463 0	3,464 0	12	10	5	White bucky quartz with little or no mineralisation.
Blue Quartz Ore Body	G.F.204	Trace	3,464 0	3,465 0	12	10	5	
Blue Quartz Ore Body	G.F.205	0·84	3,465 0	3,466 0	12	10	10	
Blue Quartz Ore Body	G.F.206	Trace	3,466 0	3,467 0	12	10	12	
Blue Quartz Ore Body	G.F.207	Trace	3,467 0	3,468 0	12	10	12	As above—changing to pale blue and progressively more mineralised.
Blue Quartz Ore Body	G.F.208	2·35	3,468 0	3,469 0	12	10	12	
Blue Quartz Ore Body	G.F.209	4·48	3,469 0	3,470 0	12	10	12	
Blue Quartz Ore Body	G.F.210	4·82	3,470 0	3,471 0	12	10	12	Blue quartz with mottling effect—mineralised with pyrite, pyrrhotite, chalcopyrite, galena and possibly arsenopyrite.
Blue Quartz Ore Body	G.F.211	1·01	3,471 0	3,472 0	12	10	12	
Blue Quartz Ore Body	G.F.212	5·04	3,472 0	3,473 0	12	10	12	
Blue Quartz Ore Body	G.F.213	14·90	3,473 0	3,474 0	12	10	12	As above.
Blue Quartz Ore Body	G.F.214	2·46	3,474 0	3,475 0	12	10	12	As above.
Blue Quartz Ore Body	G.F.215	1·90	3,475 0	3,476 0	12	10	12	As above.
Blue Quartz Ore Body	G.F.216	0·67	3,476 0	3,477 0	12	10	12	As above.
Blue Quartz Ore Body	G.F.217	Trace	3,477 0	3,478 0	12	10	12	As above.
Blue Quartz Ore Body	G.F.218	3·36	3,478 0	3,479 0	12	10	12	As above—with quartz dolerite remnant.
Blue Quartz Ore Body	G.F.219	1·46	3,479 0	3,480 0	12	10	12	As above.
F/W	G.F.220	2·02	3,480 0	3,483 0	36	30	36	Strongly mineralised footwall quartz dolerite with quartz stringers.
F/W	G.F.221	9·86	3,483 0	3,486 0	36	30	36	
F/W	G.F.222	1·74	3,486 0	3,489 0	36	30	36	
Footwall	G.F.223	2·50	3,668 6	3,671 6	36	30	36	Lightly mineralised quartz dolerite.
Footwall	G.F.224	45·25	3,671 6	3,676 0	54	46	54	Blue-white quartz—galena, pyrite and pyrrhotite. Lightly mineralised quartz dolerite.
Footwall	G.F.225	2·25	3,676 0	3,679 0	36	30	36	
Reefs	G.F.226	0·29	3,729 6	3,732 6	36	30	36	Lightly mineralised quartz dolerite.
Reefs	G.F.227	7·42	3,732 6	3,735 6	36	30	36	Blue-white quartz.
Reefs	G.F.228	0·29	3,735 6	3,738 6	36	30	36	Lightly mineralised quartz dolerite.

SUMMARY REPORT ON SUBSIDISED DIAMOND DRILLING HEPPINGSTONE'S FIND, YARRIE NORTH COOLGARDIE GOLDFIELD.

By A. J. Noldart, B.Sc.

Geological Survey of W.A.

Introduction.

In June, 1958 the Mines Department received a request for £1 for £1 subsidised diamond drilling from Mr. E. F. Wake, leaseholder of G.M.Ls. 1337R and 1338R. A field investigation of the prospect was carried out in July and, after study of the mine plans of the "Yilgangie Queen-Melody" goldmine operating on the lease adjoining G.M.L. 1338R, three diamond drillholes were recommended.

The object of the drilling was to test for the presumed continuation of the "Yilgangie Queen-Melody" ore shoot into G.M.L. 1338R at depth.

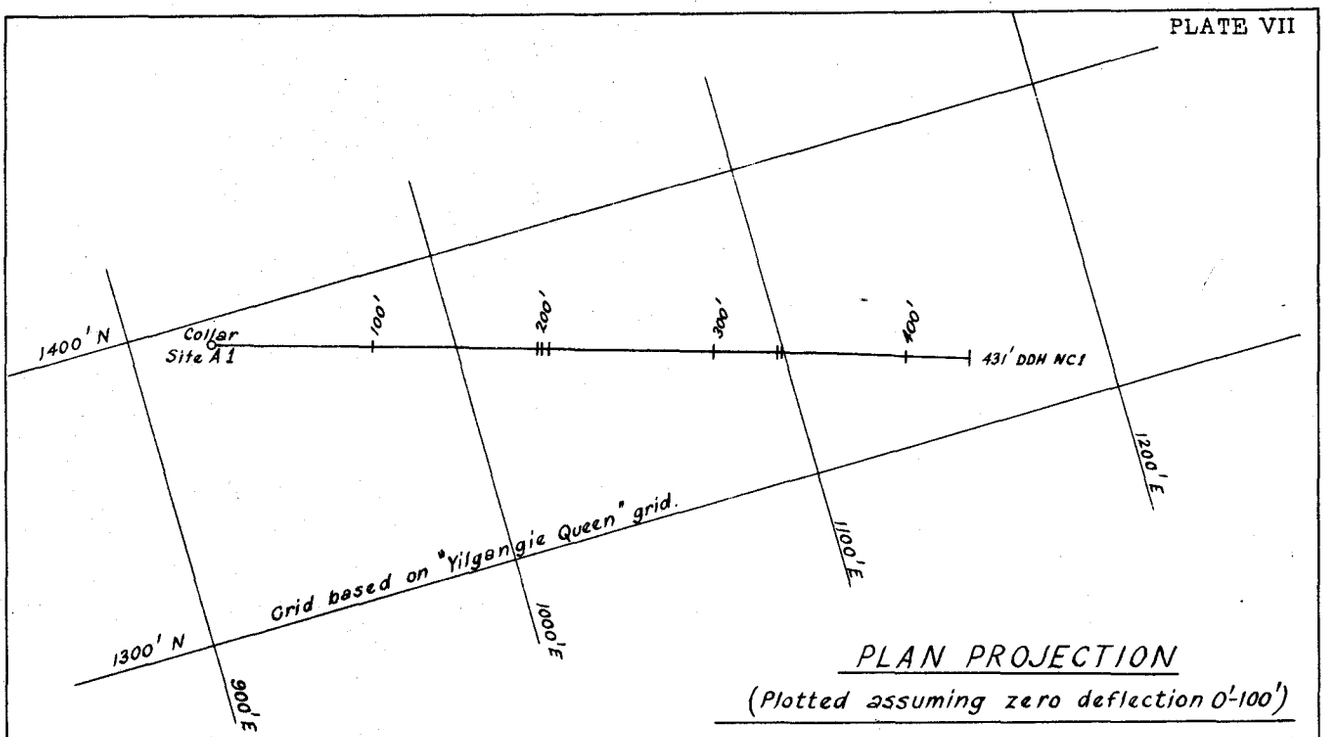
Drilling Operations.

The drill sites were pegged on 29th August and drilling commenced on 30th January, 1959. The drilling operations were carried out by H. Cant, a Mines Department diamond drill runner.

No drilling difficulties arose and D.D.H. NC1 Site A1 was completed on 25th February at a depth of 431 feet. Subsequent holes were also free of trouble and D.D.H's NC2 (depth 450 feet) and NC3 (depth 360 feet) were completed on 6th April and 6th May respectively, for a total of 1,241 feet of drilling.

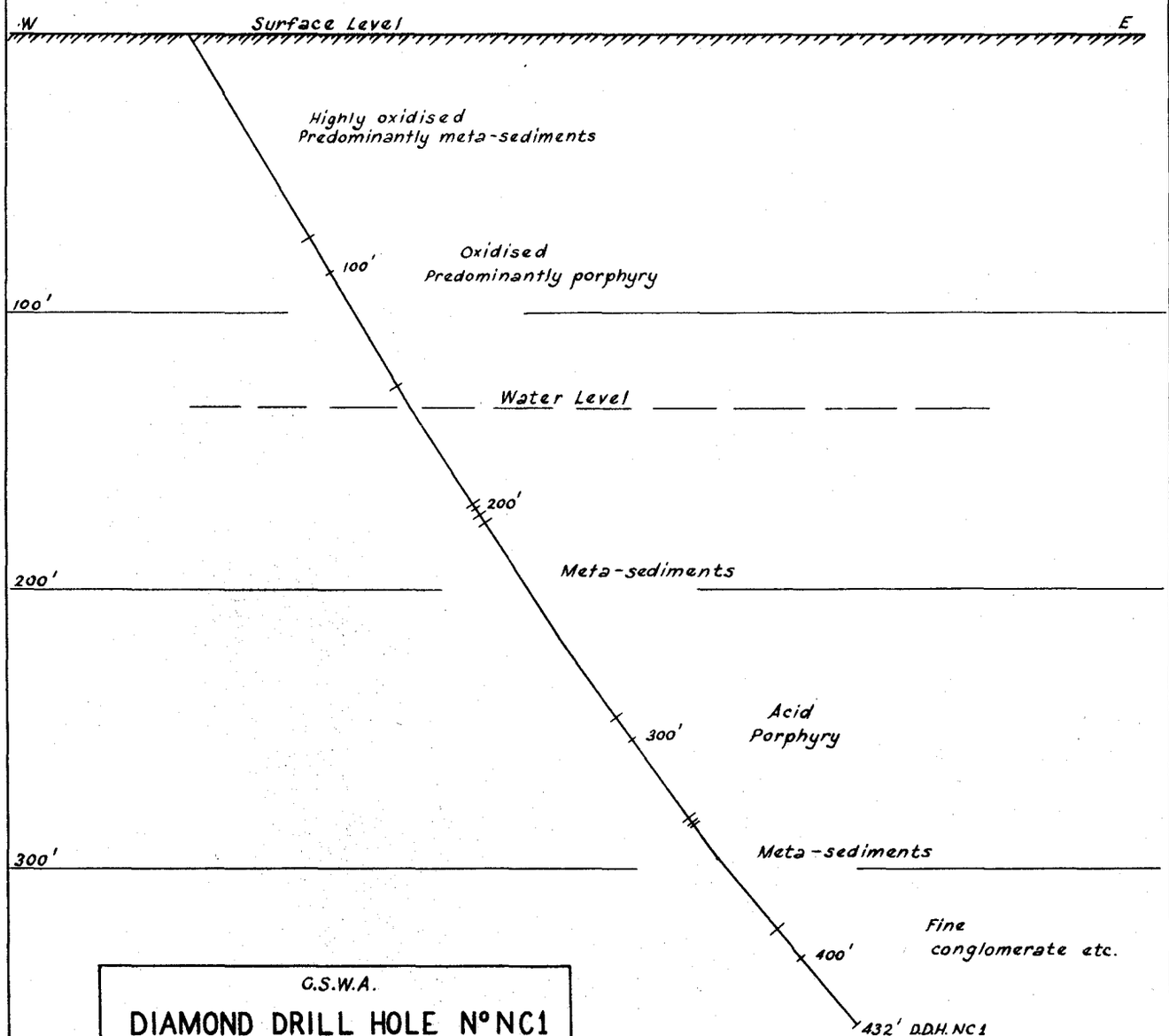
Tro-Pari surveys of each drillhole were carried out by officers of the State Mining Engineer's Branch at the completion of each hole. Plan projection and cross-section plots of each hole accompany the summarised core logs of the holes.

PLATE VII



PLAN PROJECTION

(Plotted assuming zero deflection 0'-100')



G.S.W.A.

DIAMOND DRILL HOLE N°NC1

SITE A1

GML 1337R

HEPPINGSTONE'S FIND

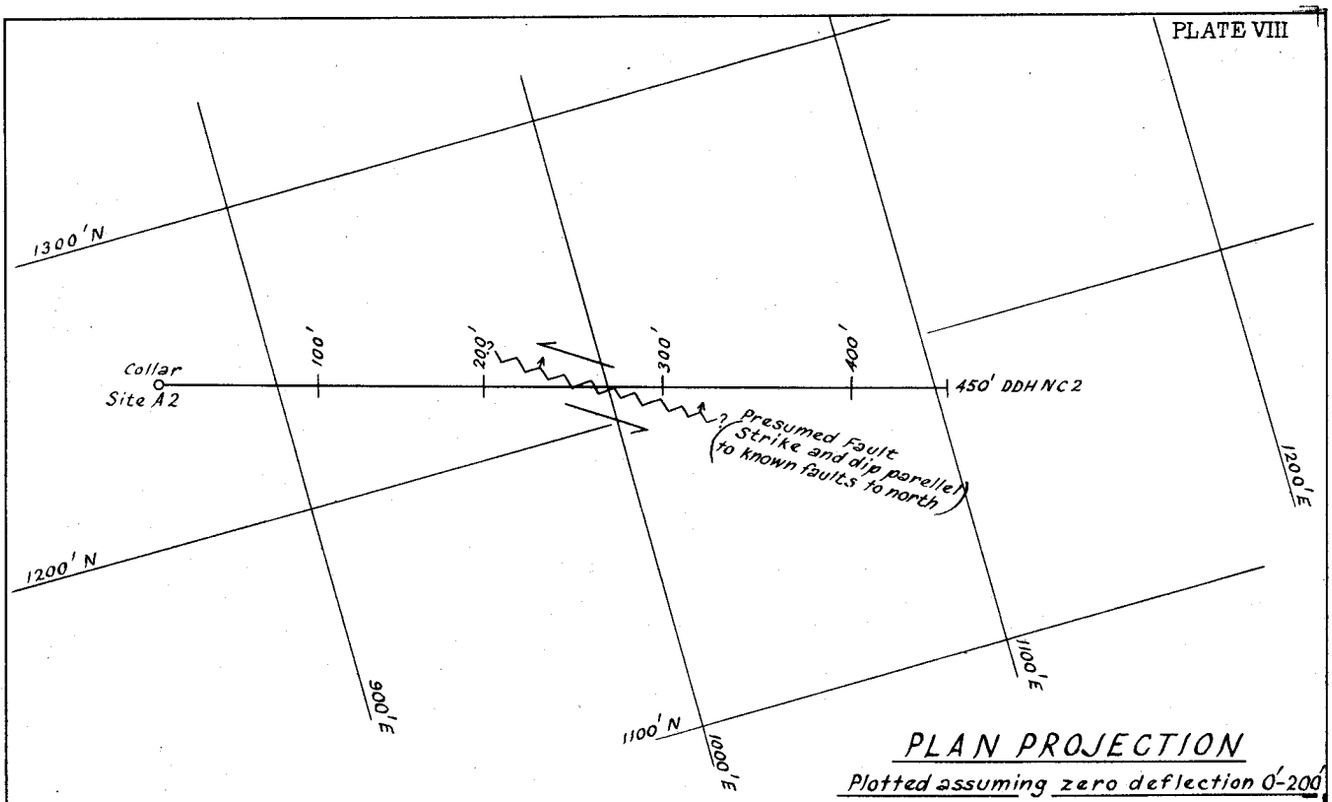
North East Coolgardie Goldfield

Scale: 60 feet to an inch

Geometrical construction by A.J. Noldart
March 1959

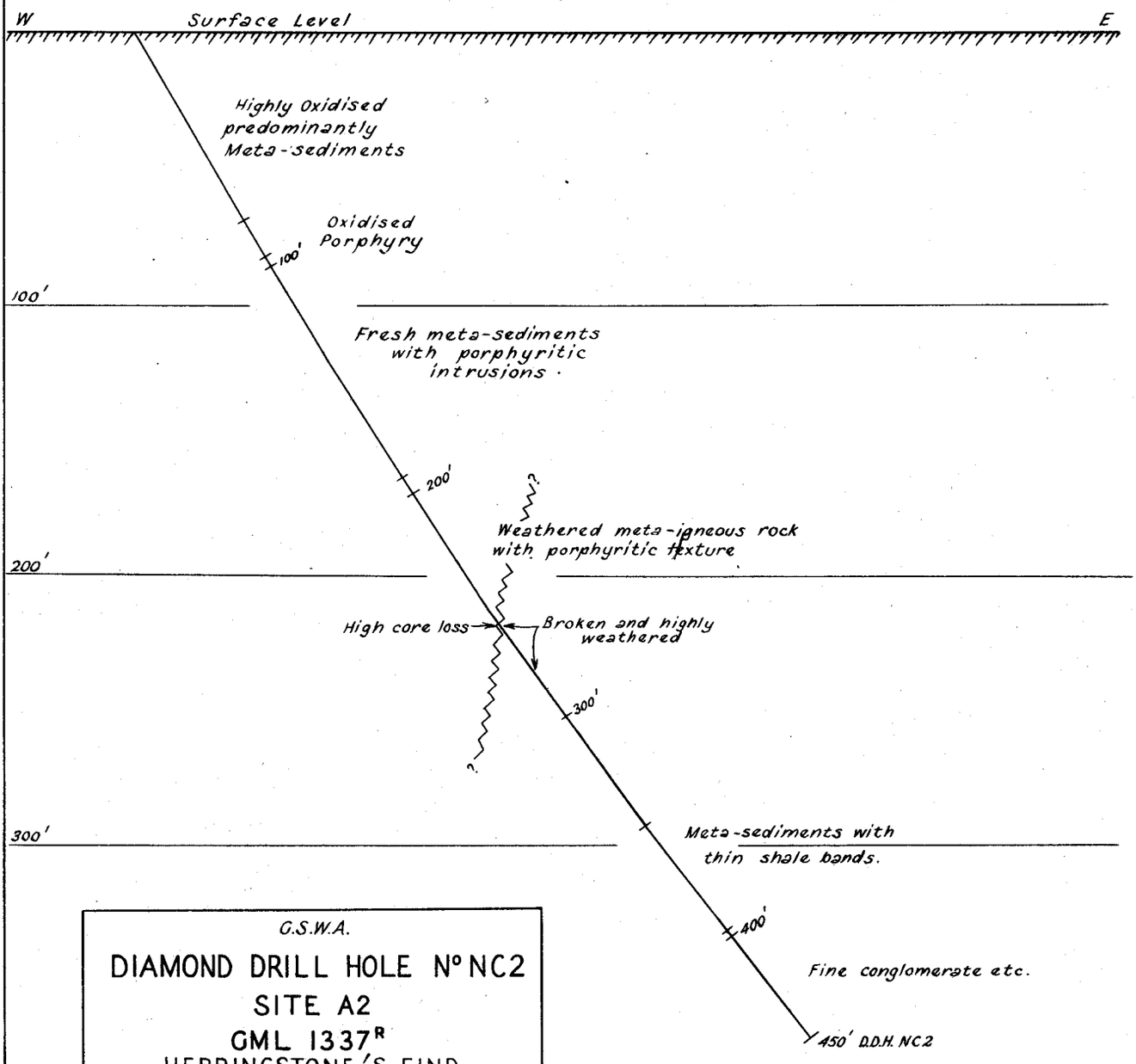
CROSS SECTION

PLATE VIII



PLAN PROJECTION

Plotted assuming zero deflection 0-200'



G.S.W.A.

DIAMOND DRILL HOLE Nº NC2

SITE A2

GML 1337R

HEPPINGSTONE'S FIND

North East Coolgardie Goldfield

Scale: 60 feet to an inch

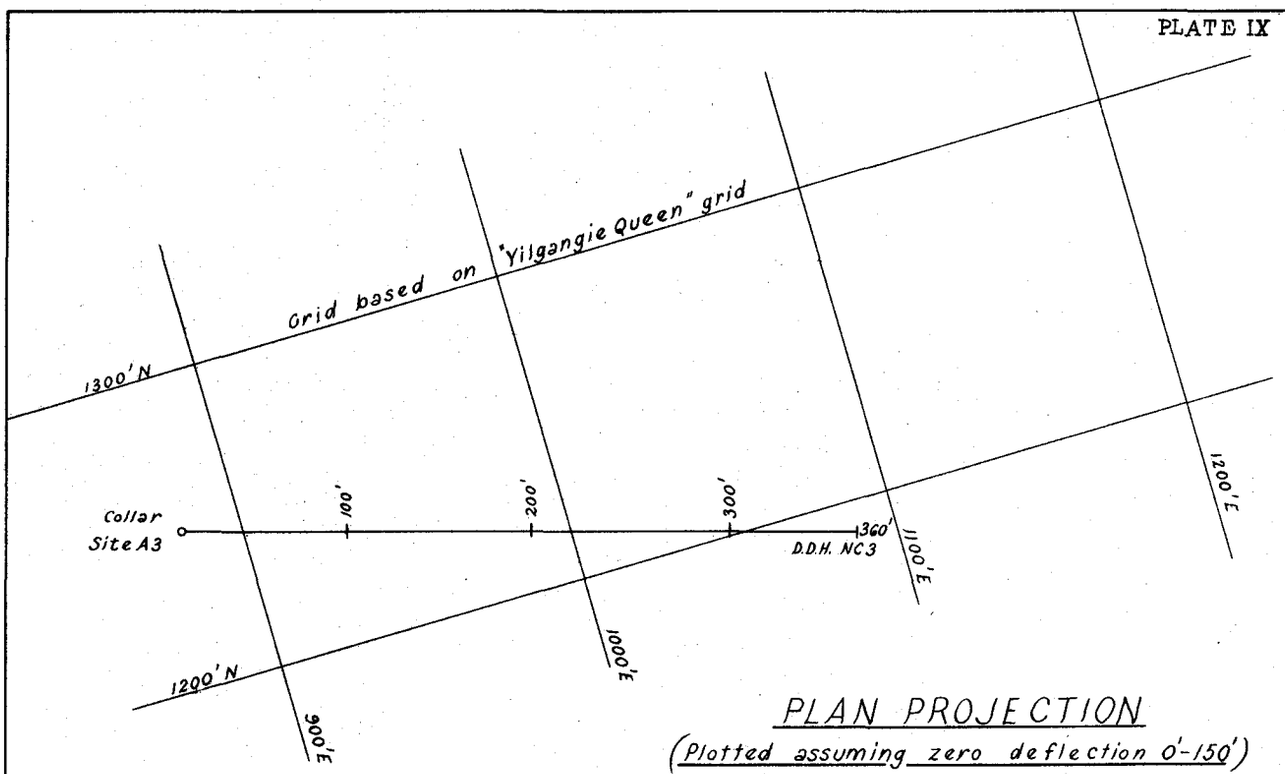
Geometrical construction by A.J. Noldart

April 1959

CROSS SECTION

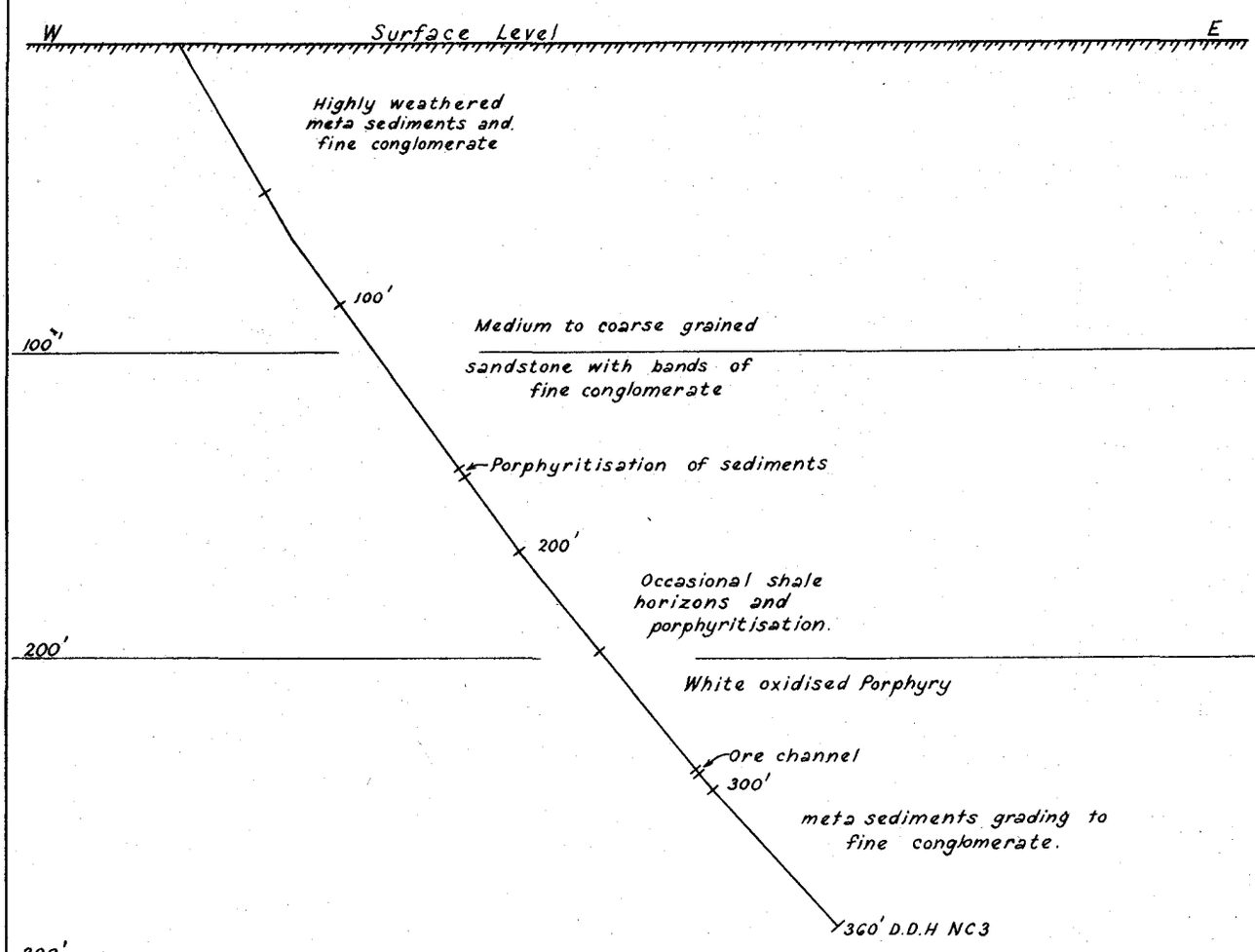
J.N.C.

PLATE IX



PLAN PROJECTION

(Plotted assuming zero deflection 0'-150')



G.S.W.A.

DIAMOND DRILL HOLE N° NC3

SITE A3

GML 1337R

HEPPINGSTONE'S FIND

North East Coolgardie Goldfield

Scale: 60 feet to an inch

Geometrical construction by A.J. Noldart
May 1959

CROSS SECTION

J.R.C.

General Geology.

The only published geological information available on this mining centre is a report by Jutson* in 1917. A local surface examination only was carried out for this programme and reference should be made to the above publication for the broader geological pattern.

Briefly, the rocks in the locality are composed of interbedded, fine grained meta-sediments, conglomerate and acid porphyry bands trending a few degrees west of north, with either a vertical or very steep easterly dip.

The rock types encountered in the drillholes were consistent with the surface outcrops, but a wider range of meta-sedimentary rocks were recognisable in the fresh unweathered rocks. Rock types included shales, fine grained tuffaceous (?) rocks, fine conglomerate bands in finer meta-sedimentary horizons, white acid porphyry and younger, narrow, greyish coarsely porphyritic intrusives. Pebbles in the conglomerate horizons showed strong shearing and elongation in a highly sheared tuffaceous (?) matrix. The pebbles comprise fragments of mudstones, granite, white sheared acid porphyry, hornblendite, granodiorite, etc. Porphyritisation of the sediments was apparent in some sections and strong dendritic pyrite disseminations were a feature of the acid porphyry.

Mineralisation.

The ore body in the "Yilgangie Queen"-"Melody" mine is a fissure type quartz reef with an apparent movement on the fissure of west side (H/W) south, possibly slightly down-thrown to the south. Wall striae are unreliable due to cross shear movement, but in general appear to be flat (15°?) to the south. No definite indications of the plunge of the ore body were noted.

The width of the reef varies from a few inches to an occasional five feet averaging between 18 and 30 inches. Numerous pillars have been left throughout the mine where the reef width and values were insufficient to carry the necessary stoping and development width. The orebody dips at 40° to the west in the lower levels, transgressive to the dip of the country rocks. Finely disseminated galena, pyrite and arseno-pyrite mineralisation was noted in the quartz.

Drilling Results.

Test assays were carried out on several sections of the hole during the course of the first hole, but no gold values were present in any of the samples assayed, and similar assays were not considered warranted in the later holes.

The ore body was intersected in the first hole at a depth of 334 feet 9 inches (core length 24 inches of quartz), and in the third hole at a depth of 290 feet 6 inches (core length 22 inches of highly sheared porphyry carrying 1 inch of quartz). The second hole passed obliquely through a faulted zone in the anticipated vicinity of the ore body and no intersection was made.

No new gold mineralisation was found during the course of the drilling programme and where intersected the main reef carried trace values only.

A complete table of assay samples, depths of samples, core lengths and results accompanies the summarised core logs of each hole.

A. J. NOLDART,
Geologist.

12/5/59.

HEPPINGSTONE'S FIND DRILLING
North Coolgardie G.F.
D.D.H. No. NC1

Hole No.: NC1, Site A1.

Collar Position: Distant 223 feet, bearing 147½°T., from the N.W. corner peg of G.M.L. 1337R. Grid Reference (Western Mining Corporation Ltd. grid): 1391′ N., 925′ E.

Angle of Depression: 59°. **Machine Used:** Mindrill A2000.

Azimuth: 83°T. **Core Size:** AX.

Date Commenced: 30/1/59. **Driller:** H. Cant.

Date Completed: 25/2/59. **Completed Depth:** 431 feet.

Object: To test for the possible continuation, into G.M.L. 1337R, of the "Yilgangie Queen"-"Melody" ore body.

Logged by: A. J. Noldart.

Assays by: School of Mines, Kalgoorlie.

Summarised Core Log

From	To	Description
ft. ins.	ft. ins.	
0 0	85 0	NX core size—Highly oxidised greenstones—interbedded porphyry, meta-sediments and fine conglomerate.
85 0	147 0	BX core size—oxidised greenstones highly sheared 70° to core axis—mainly porphyritic.
147 0	190 0	BX core size—oxidised greenstones highly sheared 70° to core axis—mainly meta-sediments.
190 0	198 6	AX core size—fine grained meta-sediments.
198 6	202 6	Fine grained acid porphyry.
202 6	223 3	Fine grained meta-sediments—occasional shaley bands—syngenetic pyrite and secondary pyrite.
223 3	224 9	Quartz vein with traces of fine grained sulphides.
224 9	226 0	Quartz stringers in fine grained meta-sediments.
226 0	270 3	Fine grained meta-sediments as above—small fault zone at 236 feet—syngenetic pyrite in bedding planes 60° to core axis.
270 3	290 4	Silicified meta-sediments with pyrite.
290 4	297 0	Fine grained felspar porphyry.
297 0	305 0	Silicified meta-sediments with strong secondary pyrite.
305 0	314 6	Very silicified meta-sediments.
314 6	321 6	Silicified meta-sediments.
321 6	334 9	Very silicified meta-sediments becoming highly sheared.
334 9	336 9	Quartz vein with fine grained pyrite, galena and (?) arsenopyrite with coarse pyrite blebs.
336 9	338 0	Highly silicified sheared porphyry as above.
338 0	386 0	Sheared medium grained meta-sediments—shaley in part and possibly tuffaceous.
386 0	431 0	Fine conglomerate bands in a medium grained matrix of meta-sediments—bedding 70°–80° to core axis. (Conglomerate contains pebbles of above rocks ?).
		END OF HOLE.

Assay Results
D.D.H. NC1, Site A1

Sample No.	From	To	Core	Assay	Remarks
	ft. ins.	ft. ins.	ins.	dwts./ton	
NC 1	220 3	223 3	36	Trace	H/W meta-sediments.
NC 2	223 3	224 9	18	Trace	Quartz vein.
NC 3	224 9	226 0	15	Trace	Quartz veinlets.
NC 4	226 0	229 0	36	Trace	Meta-sediments.
NC 5	297 0	301 0	48	Trace	Silicified Porphyry.
NC 6	301 0	305 0	48	Trace	do.
NC 7	305 0	309 0	48	Trace	do.
NC 8	309 0	313 0	48	Trace	do.
NC 9	313 0	317 0	48	Trace	do.
NC10	317 0	321 0	48	Trace	do.
NC11	321 0	325 0	48	Trace	do.
NC12	325 0	329 0	48	Trace	do.
NC13	329 0	333 0	48	Trace	do.
NC14	333 0	334 9	21	Trace	do.
NC15	334 9	336 9	24	Trace	Quartz vein.
NC16	336 9	338 0	15	Trace	Silicified Porphyry.
NC17	338 0	342 0	48	Trace	F/W meta-sediments.

* 1917—JUTSON, J. T. The Geology of the North Coolgardie Goldfield. Part I. The Yerilla District. *G.S.W.A. Bull. No. 73, Appendix I.*

Note:

(i) Possible ore body 223′ 3″-226′ 0″ = 33″ (core length) assay value *Trace* dwts/ton —may be "Melody" Lode.

(ii) "Yilgangie Queen" ore body—334′ 9″-336′ 9″ assay value *Trace* dwts/ton.

(iii) "Yilgangie Queen" ore body dimensions within limits of ore body as worked in "Yilgangie Queen-Melody" mine.

A. J. NOLDART,
Geologist.

12/3/59.

HEPPINGSTONE'S FIND DRILLING.

G.M.L. 1337R.

North Coolgardie G.F.

D.D.H. No. NC2.

Hole No.: NC2, Site A2.

Collar Position: Distant 361 feet bearing 161°T, from the N.W. corner peg of G.M.L. 1337R. Grid Reference (Western Mining Corporation Ltd. grid): 1250′ N., 864′ E.

Angle of Depressions: 60°. Machine Used: Mindrill A2000.

Azimuth: 83°T. Core Size: AX.

Date Commenced: 9/3/59. Driller: H. Cant.

Date Completed: 6/4/59. Completed Depth: 450 feet.

Object: To test for the possible continuation into G.M.L. 1337R of the "Yilgangie Queen"—"Melody" ore body.

Logged by: A. J. Noldart.

Assays: No mineralisation of significance, or quartz veins in excess of 1 inch width was encountered in the hole, and no samples were submitted for assay.

Summarised Core Log.

From	To	Description
ft. in.	ft. in.	
0 0	20 0	No core.
20 0	80 0	NX core size—sheared and highly weathered, broken sediments and fine conglomerates.
80 0	96 0	BX core size—medium grained rock, partly weathered, pinkish colour and with porphyritic texture.
96 0	193 0	Medium to fine grained clastic rocks, unweathered between 110 feet and 180 feet. Possibly mainly tuffaceous with several thin porphyry intrusions and small lenses of fine conglomerates. Numerous pseudomorphs of hematite after pyrite and occasional pyrite cubes
193 0	231 0	Meta-igneous rock with porphyritic texture—part weathered throughout.
231 0	251 0	AX core size—meta-igneous rock as above.
251 0	304 0	Meta-igneous rock as above—very broken and fractured in what appears to be a vuggy fault zone. Occasional 1 inch stringers of quartz.
304 0	350 0	Highly sheared rock—appears to be of porphyritic origin—greyish-white colour.
350 0	402 0	Medium-fine grained meta-sediments tuffaceous in part and with thin horizons of mudstones or shales.
402 0	450 0	Fine conglomerate horizons with bands of medium grained meta-sediments and occasional greyish porphyry intrusives. END OF HOLE.

Core Recovery.

The following is a summarised core recovery log covering the main weathered section between 241 feet and 310 feet down the hole. Core recovery in the balance of the hole was 100 per cent. with the exception of the surface weathering zone:—

From	To	Core	Remarks
ft. in.	ft. in.	in.	
241 0	251 0	84	Broken and slichensided.
251 0	261 0	24	Main loss zone—1 inch quartz stringer.
261 0	271 0	62	Very broken—1 inch quartz stringer.
271 0	281 0	94	Broken.
281 0	291 0	70	Broken.
291 0	295 0	30	Broken and slichensided.
295 0	300 0	42	Broken and slichensided.
300 0	310 0	120	Highly sheared, acute to core.

N.B.:—

(i) The depth of intersection of the fine conglomerates in this hole is some 17 feet deeper than in the first hole, suggesting only a small horizontal dislocation of the beds if faulting has taken place.

(ii) There is no definite evidence forthcoming on the surface to suggest large scale faulting in this vicinity.

(iii) The history of the operating mine is one of minor faulting with small dislocations, with the exception of one displacement of approximately 160 feet, the dislocation being south side east.

A. J. NOLDART,
Geologist.

10/4/59.

HEPPINGSTONE'S FIND DRILLING.

G.M.L. 1337R.

North Coolgardie G.F.

D.D.H. No. NC3.

Hole No.: NC3, Site A3.

Collar Position: Distant 521 feet, bearing 161°T., from the N.W. corner peg of G.M.L. 1337R. Grid Reference (Western Mining Corporation Ltd. Grid) 1250′ N., 881′ E.

Angle of Depression: 60°. Machine Used: Mindrill A2000.

Azimuth: 83°T. Core Size: AX.

Date Commenced: 16/4/59. Driller. H. Cant.

Date Completed: 6/5/59. Completed Depth: 360 feet.

Object: To test for the extension of the "Yilgangie Queen"—"Melody" ore body into the adjoining G.M.L. 1337R.

Logged by: A. J. Noldart.

Assays: No mineralisation of any significance was encountered, but four samples were submitted for assay from the vicinity of the lode channel.

Summarised Core Log.

From	To	Description
ft. in.	ft. in.	
0 0	50 0	NX core—Very highly weathered and oxidised meta-sediments and fine conglomerates.
50 0	52 0	BX core—as above.
52 0	57 0	BX core—as above, becoming fresh at 56½ feet.
57 0	105 0	BX core—meta-sediments, medium to coarse grained with occasional fine grained bands. Gritty appearance marked in places.
105 0	165 0	AX core—as above—rock mainly medium to coarse grained sandstone or fine grit type with numerous narrow bands of fine conglomerate with a gritty matrix.

PLATE X

D.D.H. F3-F4

1000'N

500'N

00'

500'S

1000'S

1500'S

1000'

2000'

Plan projection of Drill Holes

D.D.H. F5-F6

1000' projection of 2000' Drill Holes.

D.D.H F4

D.D.H F3

ST ALBAN'S SHAFT

342'-3·25 VD 3200'

96' T.V. 2980'

D.D.H. F2 (Abandoned 1708')

D.D.H. F1 — Abandoned 1130'

240'-1·6 (Cub sw.) VD 3030'

D.D.H F5

D.D.H F6

255'-2·40 (uta) VD 3020' (Diversion)

240'-3·43 (uncut) VD 3137'

54'-42·25 VD 3309'

96'-7·42 - VD 3352'

209 D

119 D

213 D

212 D

225 D

159 D

158 D

1017'

916

211 D

663 D

573 D

673 D

576 D

675 D

MOUNTAIN VIEW WORKINGS

No 7 LEVEL

Depth

Line of Outcrop

ARMSTRONG'S SHAFT

HEFFERNAN'S SHAFT

DAY DAWN SHAFT

WALLACES SHAFT

GOLDEN CROWN WORKINGS

MAIN SHAFT

No 1 LEVEL 1188'

No 2 LEVEL 1098'

No 3 LEVEL 1008'

No 4 LEVEL 918'

No 5 LEVEL 828'

No 6 LEVEL 738'

No 7 LEVEL 648'

No 8 LEVEL 558'

No 9 LEVEL 468'

No 10 LEVEL 378'

No 11 LEVEL 288'

No 12 LEVEL 198'

No 13 LEVEL 108'

No 14 LEVEL 18'

No 15 LEVEL 72'

No 16 LEVEL 162'

No 17 LEVEL 252'

No 18 LEVEL 342'

No 19 LEVEL 432'

No 20 LEVEL 522'

No 21 LEVEL 612'

No 22 LEVEL 702'

No 23 LEVEL 792'

No 24 LEVEL 882'

No 25 LEVEL 972'

No 26 LEVEL 1062'

No 27 LEVEL 1152'

No 28 LEVEL 1242'

No 29 LEVEL 1332'

No 30 LEVEL 1422'

No 31 LEVEL 1512'

No 32 LEVEL 1602'

No 33 LEVEL 1692'

No 34 LEVEL 1782'

No 35 LEVEL 1872'

No 36 LEVEL 1962'

No 37 LEVEL 2052'

No 38 LEVEL 2142'

No 39 LEVEL 2232'

No 40 LEVEL 2322'

No 41 LEVEL 2412'

No 42 LEVEL 2502'

No 43 LEVEL 2592'

No 44 LEVEL 2682'

No 45 LEVEL 2772'

No 46 LEVEL 2862'

No 47 LEVEL 2952'

No 48 LEVEL 3042'

No 49 LEVEL 3132'

No 50 LEVEL 3222'

No 51 LEVEL 3312'

No 52 LEVEL 3402'

No 53 LEVEL 3492'

No 54 LEVEL 3582'

No 55 LEVEL 3672'

No 56 LEVEL 3762'

No 57 LEVEL 3852'

No 58 LEVEL 3942'

No 59 LEVEL 4032'

No 60 LEVEL 4122'

No 61 LEVEL 4212'

No 62 LEVEL 4302'

No 63 LEVEL 4392'

No 64 LEVEL 4482'

No 65 LEVEL 4572'

No 66 LEVEL 4662'

No 67 LEVEL 4752'

No 68 LEVEL 4842'

No 69 LEVEL 4932'

No 70 LEVEL 5022'

No 71 LEVEL 5112'

No 72 LEVEL 5202'

No 73 LEVEL 5292'

No 74 LEVEL 5382'

No 75 LEVEL 5472'

No 76 LEVEL 5562'

No 77 LEVEL 5652'

No 78 LEVEL 5742'

No 79 LEVEL 5832'

No 80 LEVEL 5922'

No 81 LEVEL 6012'

No 82 LEVEL 6102'

No 83 LEVEL 6192'

No 84 LEVEL 6282'

No 85 LEVEL 6372'

No 86 LEVEL 6462'

No 87 LEVEL 6552'

No 88 LEVEL 6642'

No 89 LEVEL 6732'

No 90 LEVEL 6822'

No 91 LEVEL 6912'

No 92 LEVEL 7002'

No 93 LEVEL 7092'

No 94 LEVEL 7182'

No 95 LEVEL 7272'

No 96 LEVEL 7362'

No 97 LEVEL 7452'

No 98 LEVEL 7542'

No 99 LEVEL 7632'

No 100 LEVEL 7722'

No 101 LEVEL 7812'

No 102 LEVEL 7902'

No 103 LEVEL 7992'

No 104 LEVEL 8082'

No 105 LEVEL 8172'

No 106 LEVEL 8262'

No 107 LEVEL 8352'

No 108 LEVEL 8442'

No 109 LEVEL 8532'

No 110 LEVEL 8622'

No 111 LEVEL 8712'

No 112 LEVEL 8802'

No 113 LEVEL 8892'

No 114 LEVEL 8982'

No 115 LEVEL 9072'

No 116 LEVEL 9162'

No 117 LEVEL 9252'

No 118 LEVEL 9342'

No 119 LEVEL 9432'

No 120 LEVEL 9522'

No 121 LEVEL 9612'

No 122 LEVEL 9702'

No 123 LEVEL 9792'

No 124 LEVEL 9882'

No 125 LEVEL 9972'

No 126 LEVEL 10062'

No 127 LEVEL 10152'

No 128 LEVEL 10242'

No 129 LEVEL 10332'

No 130 LEVEL 10422'

No 131 LEVEL 10512'

No 132 LEVEL 10602'

No 133 LEVEL 10692'

No 134 LEVEL 10782'

No 135 LEVEL 10872'

No 136 LEVEL 10962'

No 137 LEVEL 11052'

No 138 LEVEL 11142'

No 139 LEVEL 11232'

No 140 LEVEL 11322'

No 141 LEVEL 11412'

No 142 LEVEL 11502'

No 143 LEVEL 11592'

No 144 LEVEL 11682'

No 145 LEVEL 11772'

No 146 LEVEL 11862'

No 147 LEVEL 11952'

No 148 LEVEL 12042'

No 149 LEVEL 12132'

No 150 LEVEL 12222'

No 151 LEVEL 12312'

No 152 LEVEL 12402'

No 153 LEVEL 12492'

No 154 LEVEL 12582'

No 155 LEVEL 12672'

No 156 LEVEL 12762'

No 157 LEVEL 12852'

No 158 LEVEL 12942'

No 159 LEVEL 13032'

No 160 LEVEL 13122'

No 161 LEVEL 13212'

No 162 LEVEL 13302'

No 163 LEVEL 13392'

No 164 LEVEL 13482'

No 165 LEVEL 13572'

No 166 LEVEL 13662'

No 167 LEVEL 13752'

No 168 LEVEL 13842'

No 169 LEVEL 13932'

No 170 LEVEL 14022'

No 171 LEVEL 14112'

No 172 LEVEL 14202'

No 173 LEVEL 14292'

No 174 LEVEL 14382'

No 175 LEVEL 14472'

No 176 LEVEL 14562'

No 177 LEVEL 14652'

No 178 LEVEL 14742'

No 179 LEVEL 14832'

No 180 LEVEL 14922'

No 181 LEVEL 15012'

No 182 LEVEL 15102'

No 183 LEVEL 15192'

No 184 LEVEL 15282'

No 185 LEVEL 15372'

No 186 LEVEL 15462'

No 187 LEVEL 15552'

No 188 LEVEL 15642'

No 189 LEVEL 15732'

No 190 LEVEL 15822'

No 191 LEVEL 15912'

No 192 LEVEL 16002'

No 193 LEVEL 16092'

No 194 LEVEL 16182'

No 195 LEVEL 16272'

No 196 LEVEL 16362'

No 197 LEVEL 16452'

No 198 LEVEL 16542'

No 199 LEVEL 16632'

No 200 LEVEL 16722'

No 201 LEVEL 16812'

No 202 LEVEL 16902'

No 203 LEVEL 16992'

No 204 LEVEL 17082'

No 205 LEVEL 17172'

No 206 LEVEL 17262'

No 207 LEVEL 17352'

No 208 LEVEL 17442'

No 209 LEVEL 17532'

No 210 LEVEL 17622'

No 211 LEVEL 17712'

No 212 LEVEL 17802'

No 213 LEVEL 17892'

No 214 LEVEL 17982'

No 215 LEVEL 18072'

No 216 LEVEL 18162'

No 217 LEVEL 18252'

No 218 LEVEL 18342'

No 219 LEVEL 18432'

No 220 LEVEL 18522'

No 221 LEVEL 18612'

No 222 LEVEL 18702'

No 223 LEVEL 18792'

No 224 LEVEL 18882'

No 225 LEVEL 18972'

No 226 LEVEL 19062'

No 227 LEVEL 19152'

No 228 LEVEL 19242'

No 229 LEVEL 19332'

No 230 LEVEL 19422'

No 231 LEVEL 19512'

No 232 LEVEL 19602'

No 233 LEVEL 19692'

No 234 LEVEL 19782'

No 235 LEVEL 19872'

No 236 LEVEL 19962'

No 237 LEVEL 20052'

No 238 LEVEL 20142'

No 239 LEVEL 20232'

No 240 LEVEL 20322'

No 241 LEVEL 20412'

No 242 LEVEL 20502'

No 243 LEVEL 20592'

No 244 LEVEL 20682'

No 245 LEVEL 20772'

No 246 LEVEL 20862'

No 247 LEVEL 20952'

No 248 LEVEL 21042'

No 249 LEVEL 21132'

No 250 LEVEL 21222'

No 251 LEVEL 21312'

No 252 LEVEL 21402'

No 253 LEVEL 21492'

No 254 LEVEL 21582'

No 255 LEVEL 21672'

No 256 LEVEL 21762'

No 257 LEVEL 21852'

No 258 LEVEL 21942'

No 259 LEVEL 22032'

No 260 LEVEL 22122'

No 261 LEVEL 22212'

No 262 LEVEL 22302'

No 263 LEVEL 22392'

No 264 LEVEL 22482'

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No 266 LEVEL 22662'

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No 272 LEVEL 23202'

No 273 LEVEL 23292'

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No 277 LEVEL 23652'

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No 281 LEVEL 24012'

No 282 LEVEL 24102'

No 283 LEVEL 24192'

No 284 LEVEL 24282'

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No 287 LEVEL 24552'

No 288 LEVEL 24642'

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No 291 LEVEL 24912'

No 292 LEVEL 25002'

No 293 LEVEL 25092'

No 294 LEVEL 25182'

No 295 LEVEL 25272'

No 296 LEVEL 25362'

No 297 LEVEL 25452'

No 298 LEVEL 25542'

No 299 LEVEL 25632'

No 300 LEVEL 25722'

No 301 LEVEL 25812'

No 302 LEVEL 25902'

No 303 LEVEL 25992'

No 304 LEVEL 26082'

No 305 LEVEL 26172'

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No 307 LEVEL 26352'

No 308 LEVEL 26442'

No 309 LEVEL 26532'

No 310 LEVEL 26622'

No 311 LEVEL 26712'

No 312 LEVEL 26802'

No 313 LEVEL 26892'

No 314 LEVEL 26982'

No 315 LEVEL 27072'

No 316 LEVEL 27162'

No 317 LEVEL 27252'

No 318 LEVEL 27342'

No 319 LEVEL 27432'

No 320 LEVEL 27522'

No 321 LEVEL 27612'

No 322 LEVEL 27702'

No 323 LEVEL 27792'

No 324 LEVEL 27882'

No 325 LEVEL 27972'

No 326 LEVEL 28062'

No 327 LEVEL 28152'

No 328 LEVEL 28242'

No 329 LEVEL 28332'

No 330 LEVEL 28422'

No 331 LEVEL 28512'

No 332 LEVEL 28602'

No 333 LEVEL 28692'

No 334 LEVEL 28782'

No 335 LEVEL 28872'

No 336 LEVEL 28962'

No 337 LEVEL 29052'

No 338 LEVEL 29142'

No 339 LEVEL 29232'

No 340 LEVEL 29322'

No 341 LEVEL 29412'

No 342 LEVEL 29502'

No 343 LEVEL 29592'

No 344 LEVEL 29682'

No 345 LEVEL 29772'

No 346 LEVEL 29862'

No 347 LEVEL 29952'

No 348 LEVEL 30042'

No 349 LEVEL 30132'

No 350 LEVEL 30222'

No 351 LEVEL 30312'

No 352 LEVEL 30402'

No 353 LEVEL 30492'

No 354 LEVEL 30582'

No 355 LEVEL 30672'

No 356 LEVEL 30762'

No 357 LEVEL 30852'

No 358 LEVEL 30942'

No 359 LEVEL 31032'

No 360 LEVEL 31122'

No 361 LEVEL 31212'

No 362 LEVEL 31302'

No 363 LEVEL 31392'

No 364 LEVEL 31482'

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No 387 LEVEL 33552'

No 388 LEVEL 33642'

No 389 LEVEL 33732'

No 390 LEVEL 33822'

No 391 LEVEL 33912'

No 392 LEVEL 34002'

No 393 LEVEL 34092'

No 394 LEVEL 34182'

No 395 LEVEL 34272'

No 396 LEVEL 34362'

No 397 LEVEL 34452'

No 398 LEVEL 34542'

No 399 LEVEL 34632'

No 400 LEVEL 34722'

No 401 LEVEL 34812'

No 402 LEVEL 34902'

No 403 LEVEL 34992'

No 404 LEVEL 35082'

No 405 LEVEL 35172'

No 406 LEVEL 35262'

No 407 LEVEL 35352'

No 408 LEVEL 35442'

No 409 LEVEL 35532'

No 410 LEVEL 35622'

No 411 LEVEL 35712'

No 412 LEVEL 35802'

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No 414 LEVEL 35982'

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No 416 LEVEL 36162'

No 417 LEVEL 36252'

No 418 LEVEL 36342'

No 419 LEVEL 36432'

No 420 LEVEL 36522'

No 421 LEVEL 36612'

No 422 LEVEL 36702'

No 423 LEVEL 36792'

No 424 LEVEL 36882'

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No 427 LEVEL 37152'

No 428 LEVEL 37242'

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No 431 LEVEL 37512'

No 432 LEVEL 37602'

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No 436 LEVEL 37962'

No 437 LEVEL 38052'

No 438 LEVEL 38142'

No 439 LEVEL 38232'

No 440 LEVEL 38322'

No 441 LEVEL 38412'

No 442 LEVEL 38502'

No 443 LEVEL 38592'

No 444 LEVEL 38682'

No 445 LEVEL 38772'

No 446 LEVEL 38862'

No 447 LEVEL 38952'

No 448 LEVEL 39042'

No 449 LEVEL 39132'

No 450 LEVEL 39222'

No 451 LEVEL 39312'

No 452 LEVEL 39402'

No 453 LEVEL 39492'

No 454 LEVEL 39582'

No 455 LEVEL 39672'

No 456 LEVEL 39762'

No 457 LEVEL 39852'

No 458 LEVEL 39942'

No 459 LEVEL 40032'

No 460 LEVEL 40122'

No 461 LEVEL 40212'

No 462 LEVEL 40302'

No 463 LEVEL 40392'

No 464 LEVEL 40482'

No 465 LEVEL 40572'

No 466 LEVEL 40662'

No 467 LEVEL 40752'

No 468 LEVEL 40842'

No 469 LEVEL 40932'

No 470 LEVEL 41022'

No 471 LEVEL 41112'

No 472 LEVEL 41202'

No 473 LEVEL 41292'

No 474 LEVEL 41382'

No 475 LEVEL 41472'

No 476 LEVEL 41562'

No 477 LEVEL 41652'

No 478 LEVEL 41742'

No 479 LEVEL 41832'

No 480 LEVEL 41922'

No 481 LEVEL 42012'

No 482 LEVEL 42102'

No 483 LEVEL 42192'

No 484 LEVEL 42282'

No 485 LEVEL 42372'

No 486 LEVEL 42462'

No 487 LEVEL 42552'

No 488 LEVEL 42642'

No 489 LEVEL 42732'

No 490 LEVEL 42822'

No 491 LEVEL 42912'

No 492 LEVEL 43002'

No 493 LEVEL 43092'

No 494 LEVEL 43182'

No 495 LEVEL 43272'

No 496 LEVEL 43362'

No 497 LEVEL 43452'

No 498 LEVEL 43542'

No 499 LEVEL 43632'

No 500 LEVEL 43722'

No 501 LEVEL 43812'

No 502 LEVEL 43902'

No 503 LEVEL 43992'

No 504 LEVEL 44082'

No 505 LEVEL 44172'

No 506 LEVEL 44262'

No 507 LEVEL 44352'

No 508 LEVEL 44442'

No 509 LEVEL 44532'

No 510 LEVEL 44622'

No 511 LEVEL 44712'

No 512 LEVEL 44802'

No 513 LEVEL 44892'

No 514 LEVEL 44982'

No 515 LEVEL 45072'

No 516 LEVEL 45162'

No 517 LEVEL 45252'

No 518 LEVEL 45342'

No 519 LEVEL 45432'

No 520 LEVEL 45522'

No 521 LEVEL 45612'

No 522 LEVEL 45702'

No 523 LEVEL 45792'

No 524 LEVEL 45882'

No 525 LEVEL 45972'

No 526 LEVEL 46062'

No 527 LEVEL 46152'

No 528 LEVEL 46242'

No 529 LEVEL 46332'

No 530 LEVEL 46422'

No 531 LEVEL 46512'

No 532 LEVEL 46602'

No 533 LEVEL 46692'

No 534 LEVEL 46782'

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No 538 LEVEL 47142'

No 539 LEVEL 47232'

No 540 LEVEL 47322'

No 541 LEVEL 47412'

No 542 LEVEL 47502'

No 543 LEVEL 47592'

No 544 LEVEL 47682'

No 545 LEVEL 47772'

No 546 LEVEL 47862'

No 547 LEVEL 47952'

No 548 LEVEL 48042'

No 549 LEVEL 48132'

No 550 LEVEL 48222'

No 551 LEVEL 48312'

No 552 LEVEL 48402'

No 553 LEVEL 48492'

No 554 LEVEL 48582'

No 555 LEVEL 48672'

No 556 LEVEL 48762'

No 557 LEVEL 48852'

No 558 LEVEL 48942'

No 559 LEVEL 49032'

No 560 LEVEL 49122'

No 561 LEVEL 49212'

No 562 LEVEL 49302'

No 563 LEVEL 49392'

No 564 LEVEL 49482'

No 565 LEVEL 49572'

No 566 LEVEL 49662'

No 567 LEVEL 49752'

No 568 LEVEL 49842'

No 569 LEVEL 49932'

No 570 LEVEL 50022'

No 571 LEVEL 50112'

No 572 LEVEL 50202'

No 573 LEVEL 50292'

No 574 LEVEL 50382'

No 575 LEVEL 50472'

No 576 LEVEL 50562'

No 577 LEVEL 50652'

No 578 LEVEL 50742'

No 579 LEVEL 50832'

No 580 LEVEL 50922'

No 581 LEVEL 51012'

No 582 LEVEL 51102'

No 583 LEVEL 51192'

No 584 LEVEL 51282'

No 585 LEVEL 51372'

No 586 LEVEL 51462'

No 587 LEVEL 51552'

No 588 LEVEL 51642'

No 589 LEVEL 51732'

No 590 LEVEL 51822'

No 591 LEVEL 51912'

No 592 LEVEL 52002'

No 593 LEVEL 52092'

No 594 LEVEL 52182'

No 595 LEVEL 52272'

No 596 LEVEL 52362'

No 597 LEVEL 52452'

No 598 LEVEL 52542'

No 599 LEVEL 52632'

No 600 LEVEL 52722'

No 601 LEVEL 52812'

No 602 LEVEL 52902'

No 603 LEVEL 52992'

No 604 LEVEL 53082'

No 605 LEVEL 53172'

No 606 LEVEL 53262'

No 607 LEVEL 53352'

No 608 LEVEL 53442'

No 609 LEVEL 53532'

No 610 LEVEL 53622'

No 611 LEVEL 53712'

No 612 LEVEL 53802'

No 613 LEVEL 53892'

No 614 LEVEL 53982'

No 615 LEVEL 54072'

No 616 LEVEL 54162'

No 617 LEVEL 54252'

No 618 LEVEL 54342'

No 619 LEVEL 54432'

No 620 LEVEL 54522'

No 621 LEVEL 54612'

No 622 LEVEL 54702'

No 623 LEVEL 54792'

No 624 LEVEL 54882'

No 625 LEVEL 54972'

No 626 LEVEL 55062'

No 627 LEVEL 55152'

No 628 LEVEL 55242'

No 629 LEVEL 55332'

No 630 LEVEL 55422'

No 631 LEVEL 55512'

No 632 LEVEL 55602'

No 633 LEVEL 55692'

No 634 LEVEL 55782'

No 635 LEVEL 55872'

No 636 LEVEL 55962'

No 637 LEVEL 56052'

No 638 LEVEL 56142'

No 639 LEVEL 56232'

No 640 LEVEL 56322'

No 641 LEVEL 56412'

No 642 LEVEL 56502'

No 643 LEVEL 56592'

No 644 LEVEL 56682'

No 645 LEVEL 56772'

No 646 LEVEL 56862'

No 647 LEVEL 56952'

No 648 LEVEL 57042'

No 649 LEVEL 57132'

No 650 LEVEL 57222'

No 651 LEVEL 57312'

No 652 LEVEL 57402'

No 653 LEVEL 57492'

No 654 LEVEL 57582'

No 655 LEVEL 57672'

No 656 LEVEL 57762'

No 657 LEVEL 57852'

No 658 LEVEL 57942'

No 659 LEVEL 58032'

No 660 LEVEL 58122'

No 661 LEVEL 58212'

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No 704 LEVEL 62082'

No 705 LEVEL 62172'

No 706 LEVEL 62262'

No 707 LEVEL 62352'

No 708 LEVEL 62442'

No 709 LEVEL 62532'

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No 711 LEVEL 62712'

No 712 LEVEL 62802'

No 713 LEVEL 62892'

No 714 LEVEL 62982'

No 715 LEVEL 63072'

No 716 LEVEL 63162'

No 717 LEVEL 63252'

No 718 LEVEL 63342'

No 719 LEVEL 63432'

No 720 LEVEL 63522'

No 721 LEVEL 63612'

No 722 LEVEL 63702'

No 723 LEVEL 63792'

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No 725 LEVEL 63972'

No 726 LEVEL 64062'

No 727 LEVEL 64152'

No 728 LEVEL 64242'

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No 730 LEVEL 64422'

No 731 LEVEL 64512'

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No 746 LEVEL 65862'

No 747 LEVEL 65952'

No 748 LEVEL 66042'

No 749 LEVEL 66132'

No 750 LEVEL 66222'

No 751 LEVEL 66312'

No 752 LEVEL 66402'

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No 772 LEVEL 68202'

No 773 LEVEL 68292'

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No 777 LEVEL 68652'

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No 851 LEVEL 75312'

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No 888 LEVEL 78642'

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No 892 LEVEL 79002'

No 893 LEVEL 79092'

No 894 LEVEL 79182'

No 895 LEVEL 79272'

No 896 LEVEL 79362'

No 897 LEVEL 79452'

No 898 LEVEL 79542'

No 899 LEVEL 79632'

No 900 LEVEL 79722'

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No 910 LEVEL 80622'

No 911 LEVEL 80712'

No 912 LEVEL 80802'

No 913 LEVEL 80892'

No 914 LEVEL 80982'

No 915 LEVEL 81072'

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No 918 LEVEL 81342'

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No 921 LEVEL 81612'

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No 924 LEVEL 81882'

No 925 LEVEL 81972'

No 926 LEVEL 82062'

No 927 LEVEL 82152'

No 928 LEVEL 82242'

No 929 LEVEL 82332'

No 930 LEVEL 82422'

No 931 LEVEL 82512'

No 932 LEVEL 82602'

No 933 LEVEL 82692'

No 934 LEVEL 82782'

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No 938 LEVEL 83142'

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No 941 LEVEL 83412'

No 942 LEVEL 83502'

No 943 LEVEL 83592'

No 944 LEVEL 83682'

No 945 LEVEL 83772'

No 946 LEVEL 83862'

No 947 LEVEL 83952'

No 948 LEVEL 84042'

No 949 LEVEL 84132'

No 950 LEVEL 84222'

No 951 LEVEL 84312'

No 952 LEVEL 84402'

No 953 LEVEL 84492'

No 954 LEVEL 84582'

No 955 LEVEL 84672'

No 956 LEVEL 84762'

No 957 LEVEL 84852'

No 958 LEVEL 84942'

No 959 LEVEL 85032'

No 960 LEVEL 85122'

No 961 LEVEL 85212'

No 962 LEVEL 85302'

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No 970 LEVEL 86022'

No 971 LEVEL 86112'

No 972 LEVEL 86202'

No 973 LEVEL 86292'

No 974 LEVEL 86382'

No 975 LEVEL 86472'

No 976 LEVEL 86562'

No 977 LEVEL 86652'

No 978 LEVEL 86742'

No 979 LEVEL 86832'

No 980 LEVEL 86922'

No 981 LEVEL 87012'

No 982 LEVEL 87102'

No 983 LEVEL 87192'

No 984 LEVEL 87282'

No 985 LEVEL 87372'

No 986 LEVEL 87462'

No 987 LEVEL 87552'

No 988 LEVEL 87642'

No 989 LEVEL 87732'

No 990 LEVEL 87822'

No 991 LEVEL 87912'

No 992 LEVEL 88002'

No 993 LEVEL 88092'

No 994 LEVEL 88182'

No 995 LEVEL 88272'

No 996 LEVEL 88362'

No 997 LEVEL 88452'

No 998 LEVEL 88542'

No 999 LEVEL 88632'

No 1000 LEVEL 88722'

Assays in dwts

STOPING SHOWN THUS

Collar Armstrong Shaft = Datum R.L.'s

C. S. W. A.:

COMPOSITE PLAN

GREAT FINGALL WORKINGS

SHOWING

OLD MINE OPERATIONS & EXPLORATORY DIAMOND DRILLING

D.D.H.s F1 & F2 by Gt. Fingall Exploration N.L. 1949-50

D.D.H's F3, F4, F5 & F6 by W.A. Dept of Mines 1954 - 59

DAY DAWN — MURCHISON G.F.

Scale 300 feet to an inch.

Summarised Core Log—*continued*

From	To	Description
ft. ins.	ft. ins.	
165 0	168 0	Quartz silicification and impregnation of grits—porphyritisation in part.
168 0	227 0	Medium grained meta-sediments with occasional narrow shale horizons—considerable siliceous impregnation has taken place giving a porphyry effect—where porphyritised quartz veinlets occur strongly marked with blackish dendritic pyrite spreading into the surrounding rock.
227 0	241 0	Porphyritised sediments—some evidence of intrusive porphyritic rock.
241 0	290 6	Whitish porphyritic rock as in preceding holes—becoming progressively oxidised with depth.
290 6	292 6	As above—highly schisted with two ½ inch quartz stringers representing the ore channel.
292 6	329 0	Medium to fine grained meta-sediments.
329 0	360 0	Fine conglomerate beds in fine grained matrix.
		END OF HOLE.

Assay Results.
D.D.H. No. NC3, Site A3.

Sample No.	From	To	Core	Assay	Remarks
	ft. in.	ft. in.	in.	dwts./ton	
NC 18	165 0	168 0	36	Trace	Strong Porphyritisation.
NC 19	287 6	290 6	36	Trace	H/W White Porphyry.
NC 20	290 6	292 6	22	Trace	Heavily Sheared Porphyry.
NC 21	292 6	295 6	36	Trace	F/W Meta-sediments.

Note:—

(i) Sample No. NC 18 corresponds approximately to sample No. NC2 of first hole, but in this case is not a defined quartz reef.

(ii) Sample No. NC 20 represents the main ore channel and is in the ore channel as anticipated from the results of the first two drill holes. In this case the ore body is represented by less than 1 inch of quartz.

A. J. NOLDART,
Geologist.

12/5/59.

HISTORICAL SUMMARY OF EXPLORATORY DIAMOND DRILLING OF THE "GREAT FINGALL" QUARTZ REEF IN DEPTH.

By A. J. Noldart, B.Sc., Geological Survey of W.A.

Introductory.

Two attempts have now been made to explore the ore prospects of the "Great Fingall" quartz reef in depth. Four surface holes, with two major diversionary holes and one short sampling diversion have been drilled.

In all, a total of 16,458 feet has been drilled, much of it abortive, and five intersections with the ore body have been made. Detailed reports on the individual holes are contained in the following references:—

1950—McMath, J. C.: Report on the Great Fingall Venture 1949-50, *G.S.W.A. Ann. Rep. 1950,* pp. 23.

1956—Duggan, J. W.: Report on Diamond Drilling of "Great Fingall" Quartz Reef in Depth, *G.S.W.A. Ann. Rep. 1956.*

1957—Duggan, J. W.: Report on Diamond Drilling of "Great Fingall" Quartz Reef in Depth, *G.S.W.A. Ann. Rep. 1957.*

1959—Noldart, A. J.: Report on Diamond Drilling of "Great Fingall" Quartz Reef in Depth, D.D.H. No. F5. *G.S.W.A. Ann. Rep. 1959.*

1959—Noldart, A. J.: Report on Diamond Drilling of "Great Fingall" Quartz Reef in Depth, D.D.H. No. F6. *G.S.W.A. Ann Rep. 1959.*

The geology of the area is fully described by McMath (1950) and will not be discussed here.

First Venture.

General.

Mr. H. J. C. Conolly, then Chief Geologist for Western Mining Corporation Ltd., became interested in the "Great Fingall" quartz reef whilst carrying out an investigation into the ore prospects during 1935; however, it was not until 1946 that any further interest was shown in the prospect. In March of that year Conolly, by then in practice as a private consultant, applied for two Temporary Reserves covering the reef in depth with the intention of exploring the ore prospects by a series of controlled, deep level, diamond drill holes.

Mr. H. A. Ellis, the Government Geologist, fully realising the importance of deep exploration to encourage the mining industry, strongly supported the application and recommended State Governmental participation in the venture.

Administrative.

The "Great Fingall Exploration Co. Ltd.," was eventually formed, backed by State Government technical and financial assistance. McMath (1950) gives full details of the Company, but a brief summary of the Governmental assistance is as follows:—

(i) £10,000 State Government Loan fully repayable only in the event of the development of an operating mine;

(ii) Field investigations and preparation of geological plans and sections by officers of the Geological Survey and Mines Department Drafting Section;

(iii) The provision of a resident geologist (J. C. McMath) for core logging and drill hole surveys at the drill site.

Anglo-Westralian Mining Pty., Ltd., held the controlling interest and in this Company was vested managerial control of the venture with Conolly as the consultant geologist. The responsible officers concerned recognized the extreme difficulties entailed in drilling a successful hole and the all important aspect of practical drilling operations was entrusted to Australian Drillers Pty., Ltd., an organization reputed to have had considerable practical experience in the type of drilling, drill control and wedging techniques which would be required.

Drilling Operations.

The final decision on procedure was to drill one hole controlled to verticality by means of Hall Rowe wedging equipment, and to drill such diversionary holes as were considered necessary from this parent hole. The hole was collared at coordinates 121′ S., 1460′ W., on 12th December, 1949.

This hole proved abortive, due to excessive drill "creep" in conjunction with bad wedging techniques and drilling control, and was abandoned on 6th July, 1950, at a vertical depth of 1,130 feet.

A second hole was subsequently collared at coordinates 62′ N., 1650′ W., on 24th July, 1950, but again poor wedging techniques resulted in loose wedges giving trouble, and operations were suspended on 13th November, 1950 due to the exhaustion of available finances. This hole was left in an accessible condition with a cement block protecting the collar of the hole.

A total of 2,947 feet was drilled in the venture.

Second Venture.

General.

The Temporary Reserve granted to Conolly for the first venture was later withdrawn and converted to Ministerial Reserves, and the position remained stagnant until August, 1954, when the Government Geologist again drew the attention of the Under Secretary for Mines to the area as a suitable drilling prospect.

The Government of the day was committed to a widespread Goldfields' diamond drilling programme and in September, 1954, the Government Geologist, with the approval of the Under Secretary for Mines, and accompanied by the State Mining Engineer, approached Mr. R. Burt of Cue, a Director of Mountain View Gold N.L., with the following proposals:—

(i) The Mines Department provide all finance, plant, personnel and technical advice and drill the reef at its own cost. The prospect would then be sold to the highest bidder if the drilling disclosed a payable ore body;

(ii) The Mines Department release the Temporary Reserves to Mountain View Gold N.L., and allow that Company to drill the prospect at its own cost;

(iii) The Mines Department would retain the Reserves, supply all equipment, drilling crews and technical planning and supervision, subject to Mountain View Gold N.L., paying half the costs involved. Should the venture disclose payable ore bodies, the Company would retain the right to exploit the prospects, and the Mines Department would be reimbursed its portion of the drilling costs from gold recovered from the prospect. A royalty on later production was also stipulated.

The latter proposal was accepted by Mr. Burt on behalf of his Company and formal acknowledgment of the conditions was duly made by the Company.

Administrative.

The agreement reached was basically a £ for £ arrangement for actual drilling costs such as wages, fuel, equipment repairs, etc., to a maximum of £25,000 liability. The Mines Department was to supply the equipment and plant in full working order as capital outlay. Technical control would be retained by the State Mining Engineer, and all geological matters were to be the sole responsibility of the Government Geologist.

No further liability was to attach to the participating Company should the venture be a failure.

In the event of an economic ore body being located the participating Company was to have the right of exploitation, and all Mines Department drilling costs would be reimbursed from gold recovered together with a small royalty per ounce.

The agreement was ratified by Mountain View Gold N.L., on 7th April, 1955 and a new Company, Day Dawn Gold Pty. Ltd., formed as the participating Company.

The details of this Company as published in the "Kalgoorlie Miner" on 9th April, 1955 gave the following composition:—

Nominal Capital £100,000 in 500,000 shares at 4s.

Shareholders:

Mountain View Gold N.L.	75,000
Western Queen (1936) N.L.	1,000
W. L. W. Dray, Director	1,000
T. A. James, Director	1,000
G. Moss, Director	1,000
A. R. Williams, Director	1,000
R. P. S. Burt, Director	1,000
	155,000

No public issue was to be made to the public and payment for the major holdings was to come from the company funds.

In December, 1957 Western Queen (1936) N.L., took up a further 50,000 shares payable over a period of 15 months.

Drilling Operations, D.D.H.F3.—A preliminary investigation of the surface geology in the vicinity of the prospect was carried out and the Government Geologist, after careful study of the information thus obtained together with such underground information as was available, decided to utilize the drill "creep" which could normally be expected when drilling this type of country in an attempt to drill a hole controlled entirely by rotary speeds and bit pressures. The use of corrective deflecting wedges was contemplated only as an emergency measure should the "creep" prove to be excessive or contrary to that anticipated.

Discussions were held with Mr. J. Langford, Engineer in charge of Great Western Corporation's deep drilling programme, and the information on survey data and special drilling equipment supplied by Western Mining Corporation provided the basis on which the first drill hole (D.D.H.F3) of this venture was sited at co-ordinates 1010′ N., 3166′ W., by the Government Geologist in December, 1954.

This first hole was to be regarded as a "sighting" hole to a depth of approximately 2,000 feet, but would be continued to the target area if the bearing and dip were considered satisfactory. Should the hole prove unsuccessful to that depth, the "creep" data obtained would be used to site a further hole.

Drilling commenced on 16th June, 1955 under the field supervision of foreman J. Grill (Duggan, 1956).

The first hole proved abortive due to excessive deflection below 800 feet and was stopped at a depth of 1,326 feet. The foreman at this stage left the organization to take over a private drilling contract for the Mines Department and a new foreman, O. Koski, was appointed.

Foreman Koski had had considerable experience in deep drilling techniques in both Australia and Canada, and bit speeds and pressures were rigidly controlled from that time. A deflection was affected from the abortive hole at a depth of 260 feet, without the use of wedging equipment, and drilling proceeded without further difficulty until a successful intersection was made at a depth of 3,786 feet down the hole on 10th June, 1956 close to the presumed northern limit of the ore body.

The hole was completed at a depth of 4,137 feet and no further mineralization was encountered. A total of 5,203 feet was drilled with an abortive footage of 1,066 feet.

D.D.H.F4 (Duggan, 1957).—At a meeting between representatives of the Company and the responsible Departmental officers in the latter part of June, the Government Geologist outlined a diversionary drilling programme designed to obtain a further intersection with the ore body approximately 250 feet southerly along the strike of the reef.

Thompson retrievable wedging equipment was to be used in an attempt to leave the parent hole at a depth of 2,600 feet maintaining the azimuth direction of the parent hole, but with a considerably increased rate of dip deflection.

The wedge was set at 2,581 feet down the hole, but unfortunately the complete arc cutting assembly was not available and the diversion was made using a Hall Rowe assembly. The two units proved to be incompatible, resulting in the failure of the wedge locking device after 406 feet of progress had been made. The wedge fell to the bottom of the parent hole rendering the diversion inaccessible.

The wedge was recovered and reset at 2,466 feet and drilling proceeded ahead from this point.

In November, foreman Koski resigned following a loss of harmony in the supply of urgent drilling equipment, and was replaced by foreman J. Fitzpatrick, formerly in charge of the Failing Plant then operating on the Collie Coalfield.

The azimuth of the diversionary hole was unsatisfactory throughout and the position finally became untenable at a depth of 3,567 feet when the hole was stopped. A diversion was then made at a depth of 3,522 feet without the use of wedges, but proved abortive and was abandoned at 3,587 feet.

A further wedgeless diversion was effected at 3,504 feet and intersections were made with reef quartz at depth of 3,656 feet, 3.810 feet, 3,840 feet and 3,890 feet. The first intersection was interpreted as the main ore body and the hole was stopped on 28th May, 1957 at a depth of 4,021 feet.

Further attempts to divert from D.D.H.F4 resulted in the dislocation of the parent wedge set at 2,466 feet and the position was compulsorily abandoned on 5th June, 1957. A total of 2,140 feet was drilled with an abortive footage of 585 feet.

D.D.H.F5 (Noldart, 1959).—On the 19th June, 1957, a decision was made by the Mines Department and the participating Company to attempt another penetration of the ore body from another surface hole under the same general conditions of association as pertained to the previous hole. The Government Geologist accordingly selected a site at co-ordinates 2680' W., 494' N., for a hole designed to follow a parallel course to D.D.H.F3 and penetrate the ore body at the same vertical depth some 700 feet southerly along the strike from the D.D.H.3 penetration.

The hole was commenced on 28th August, 1957, once again under the supervision of foreman Koski. Foreman Koski remained with the organization for the balance of the venture.

The first two attempts were abortive due to excessive flattening at a shallow depth and wedgeless diversions were made at depths of 201 feet and again at 261 feet. From this point the vagaries of diamond drill holes were demonstrated in the tendency of the new drill hole to maintain a steeper dip than D.D.H.F3 and to develop a marked southerly swing in azimuth as against the steady northerly swing apparent in the earlier hole. The southerly swing persisted with depth and three Hall Rowe wedges set to full azimuth control were set between 2,460 feet and 2,600 feet. The deflection from the third wedge was insufficient and a fourth wedge was set immediatetly below it and drilling proceeded on a satisfactory azimuth bearing from that point although at a steeper dip than had been planned.

On 2nd September, 1958, a successful intersection was made at a depth of 3,350 feet down the hole some 350 feet earlier than anticipated, suggesting a strong southerly swing in the strike of the ore body. The hole was continued into the footwall to confirm the identity of the intersection and further small intersections of reef quartz were made at depths of 3,433 feet, 3,606 feet and 3,663 feet. The hole was completed at a depth of 4,199 feet on 25th November, 1958.

A short sampling diversion was then drilled penetrating the ore body approximately 9 feet up dip from the parent hole. Drilling ceased on 27th February, 1959, at a depth of 3,378 feet.

A total of 4,686 feet was drilled with an abortive footage of 340 feet.

D.D.H.F6 (Noldart, 1959).—On the 17th April, 1959, the Under Secretary for Mines, State Mining Engineer and Government Geologist representing the Mines Department, and Messrs. Moss, Williams and Burt representing Day Dawn Gold Pty., Ltd., discussed the possibility of drilling a major diversionary hole from the parent hole D.D.H.F5. The Government Geologist strongly recommended that no further drilling be undertaken by the Mines Department in the venture due to the low results encountered in the four previous penetrations, but a subsequent decision was made by the Mines Department to proceed with a major diversionary hole. The hole was intended to test the ore body approximately 200 feet southerly of the penetration made in D.D.H.F5.

The deflection was made at 2,270 feet on 6th May, 1959, and the new hole allowed to proceed in the approximate direction of the parent hole prior to the wedging operations. The course of the hole was satisfactory throughout and the ore body was encountered at a depth of 3,460 feet on 4th August, 1959. Further small reef quartz intersections were made at depths of 3,671 feet and 3,732 feet, and the hole finally abandoned at a depth of 3,752 feet due to the mechanical failure of the plant at depth.

The Thompson wedge was successfully retrieved on 15th September, 1959, and the plant dismantled.

A total of 1,482 feet was drilled in the hole.

Survey Methods and Control.

Azimuth and dip surveys were carried out at regular intervals with Tro-Pari drill hole survey instruments. Surveys were made at a maximum of 200 feet intervals throughout the course of the drilling. The interval between survey points depended on the rate of deflection and type of drilling involved at the time, and intervals of 25 feet were not uncommon, particularly where corrective measures were to be undertaken.

Initially, only one BX-NX instrument was available, and considerable time was lost due to unserviceability of the instrument at critical junctures. During the early stages of D.D.H. F5 two more instruments became available and little further time was lost through instrument failure.

It was realized that the venture depended to a large extent on the reliability of the drill hole surveys and every effort was made to ensure the efficiency of the instruments used. All instruments were fully tested by officers of the Geological Survey and State Mining Engineer's Branch for compass, dip and time calibration errors, and each instrument was "bed" tested by the drill foreman immediately before lowering into the hole.

For the purposes of compass calibration a true bearing base line was laid down between two surveyed lease pegs and a series of secondary marker pegs were laid off from this line. The pegs were set at 12½° intervals in the anticipated direction of the drill hole, i.e., in the south-east quadrant, so that at all times the direction of the hole would fall within a few degrees of a known true bearing line, and the instruments were checked frequently against the pegs most nearly approximating the current trend of the hole.

For the purposes of day to day serviceability, a concrete "bed" was constructed at the drill site, designed to seat the instrument in a position approximating the bearing and dip of the hole at a depth of 1,000 feet. The drill foreman was then responsible for carrying out pre-survey checks of the instrument in the "bed" immediately before lowering into the hole. In these tests the same time settings were used as would be required for the actual survey.

A log book was kept by the drill foreman and all readings were entered in accordance with a survey procedure laid down by the Government Geologist.

Summary of Results.

General.—A total of 2,947, feet was drilled in the first venture of which 1,239 feet was abortive. The first hole was a complete failure and is not now accessible. The second hole was abandoned at a depth of 1,708 feet and is still accessible, although still cemented at one wedge point. The venture failed through bad drilling techniques and lack of finance.

The second venture resulted in a total of 13,511 feet drilled with an abortive footage of 1,991 feet. Five penetrations were made through the main ore body from two surface holes, one small diversion and two major diversions. D.D.H.F3 is fully accessible, D.D.H.F5 is accessible to the ore body through the sampling diversion only, and D.D.H's. F4 and F6 are not accessible due to retrieved or dislodged wedges.

Administrative Position—July, 1959.—At the completion of the venture the participating Company had contributed £25,000. The total costs incurred in this drilling were NOT the concern of the Geological Survey and were not available to the author at the time of compiling this summary.

Although the Temporary Reserves covering the prospect have been retained as Ministerial Reserves, full authority has now been vested in the participating Company, or its nominees, to explore the area reserved and to exploit any economic ore deposits occurring on the Reserves. Reimbursement to the State Government will take the form

of a royalty of 7s. 6d. per ounce of gold produced from the Great Fingall Mine to a total of £40,000 and a subsequent royalty of 2s. 6d. per ounce during the remainder of the life of the mine.

Economic Results.—A comprehensive economic appraisal of the prospect was submitted to the Under Secretary for Mines by the Government Geologist on 29th September, 1959. This report fully covers the position at the termination of drilling and is quoted here in its entirety:

1. My recommendation to the Department that it participate financially and operationally in the exploration by diamond drilling of the Great Fingall quartz reef in depth, was based on the following premises:—

(a) A geological study of the structure of the large, rich portion of the reef (from mine plans and reports only) worked from the surface to a vertical depth of 1,185 feet, and the poorer portion of the reef worked from a vertical depth of 1,185 feet to a vertical depth of 2,304 feet, suggested the geological possibility of a recurrence of thick, good grade ore in the vicinity of 3,200 feet vertical depth.

(b) The target was a prize of considerable potential value, but it was clearly understood that the depth of the potential ore made it vital that justification for continued exploration of the reef, once proved to exist at the anticipated depth, must be obtained by finding spectacular values in the first three or four penetrations.

2. The position now (29/9/59) is that the reef has been proved to exist at the predicted horizon, but five penetrations have failed to produce the spectacular results anticipated by me and so necessary to justify further exploration.

3. Since drilling commenced on 16/6/55, five penetrations from two main drill-holes have been made in the Fingall Reef in the vicinity of the target depth of 3,200 feet vertical. Although visible gold occurred in two intersections, average values of the order visualized by me as justifying further exploration have not materialized. Average values have to be in ounces per ton in order to attract interest in exploring such deep ore at the existing cost structure in gold mining.

4. Anticipated reef thicknesses have been established, but there has been a change in the attitude of the reef, the exact nature and extent of which cannot be established for certain without further reef intersections. Existing borehole data indicates that the strike has swung to the south as compared to the last known strike in the bottom of the old workings.

5. Penetrations and assay values are as follows:—

1st Penetration.—Main reef—near N-W end.
Vertical depth: 3,200 feet.
Core Length: 28 feet 6 inches.
True width: 13 feet 6 inches.
Average value: 03.25 dwts per long ton.

2nd Penetration.—Main reef—near N-W end and some 240 feet up-dip from 1st Penetration.
Vertical depth: 2,990 feet.
Core length: 8 feet.
True width: 4 feet.
Average value: traces only.

3rd Penetration.—Main reef—about 400 feet southerly from the 1st Penetration in the plane of the reef, but 200 feet higher up.
Vertical depth: 3,000 feet.
Core length: 21 feet, 3 inches.
True width: probably about 17 feet, 6 inches.
Average value: 02.4 dwts. per long ton.
(One sample from this intersection, being 12 inches of core, assayed 9.4 dwts. per long ton.)

4th Penetration.—Main reef—about 9 feet up-dip from No. 3 Penetration in the plane of the ore body and four feet along the strike
Core length: 20 feet.
True width: probably about 17 feet, 6 inches.
Average value: 01.6 dwts. per long ton.
(One sample from this intersection, being 12 inches of core assayed 5.1 dwts. per long ton.)

5th Penetration.—Main reef—about 160 feet along the strike southerly from the 4th Penetration and approximately 110 feet deeper.
Vertical depth of the top of the quartz penetration was 3,132 feet.
Core length: 20 feet.
True width: about 17 feet.
Average value 3.43 dwts. per long ton. (Highest assay 14.90 dwts. for 1 foot.)

6. Penetrations 3, 4 and 5 were made in the favourable target area, the existence of which in depth was successfully predicted, but the spectacular values considered by me as being likely to occur in it at this particular part of the reef have not materialized.

7. The requirements of premise (b) para. 1, have not been met and the incentive to continue this costly exploration has not been provided by the results of drilling done to date. In my opinion, further exploration of the prospect by diamond drilling is not justified, as all ore prospects lie below a vertical depth of 2,400 feet.

Conclusions:

(a) The exploratory diamond drilling as outlined above has established the existence of the Fingall quartz reef at a vertical depth of approximately 3,200 feet, approximately 17 feet thick true width over a length of at least 600 feet.

(b) The spectacular values needed to provide incentive for the further exploration of this ore body have not materialized, and in my opinion the prospect is not worthy of further exploration.

(c) The ore body could possibly continue perhaps for another 400 feet to the south, but a host rock change could be anticipated at that distance which would probably terminate the reef. No rock change is anticipated in the direction of the dip in the ore body in the present host rock and the thick quartz could continue for some considerable distance in this direction.

(d) A persistent series of two distinguishable footwall reefs, occurring at intervals in a maximum distance of 300 feet in the footwall below the main ore body and carrying good values in places, does not add any value to the prospect since the main ore body has failed to live up to expectations. If the main ore body had proved to be mineable at depth below 2,400 feet, these footwall reefs, although thin, could have provided additional ore.

A. J. NOLDART,
Geologist.

PLATE XI

GEOLOGICAL MAP OF LEONORA AREA

Scale : 20chains to an inch

Compiled from 20chain Geological Field Sheets with survey and geology by W.M.Bock. Sept.1959.

G.S.W.A.

LEGEND

- Alluvium: Lake deposits.
- Soil covered areas.
- Conglomeratic Cement.
- Ironstone capping.
- Iron. (Fe)
- Quartz.
- Granite and Granite/Gneiss.
- Basic Igneous Rocks: Basalts, Dolerites, Amygdaloidal Lavas etc.
- Meta-igneous Rocks: sheared "epidiorites", chloritic shists.
- Meta-sedimentary Rocks: Quartz schists, spotted schists, sericite schists etc.
- Banded Iron Formation.

SIGNS

- Strike and dip of bedding
- Strike and dip of cleavage
- Strike of vertical cleavage
- Strike and plunge of dragfold
- Plunge of minor fold.

PLATE XII

To Wiluna

LANDING GROUND

LEONORA TOWNSITE

Mine

RAILWAY LINE

PLATE XI

To Malcolm

From Kalgoorlie

G.S.W.A.

GEOLOGICAL STRUCTURE MAP OF PORTION OF Mt MALCOLM DISTRICT Mt MARGARET G.F.

Scale: 1 mile to 1 inch

Geology by W. M. Bock, supervision and interpretation by A. J. Noldart. Sept 1959

Note: Field sheets, on a scale of 20 chns to one inch covering the area of this plan are available for perusal at Geological Survey of W.A.

J.M.C.

LEGEND

- Alluvium: Lake Deposits
- Soil covered areas
- Granite and Granite/Gneiss.
- Basic Igneous Rocks: Basalts, Dolerites, Amygdaloidal Lavas etc...
- Meta-igneous Rocks: sheared "epidiorites", chloritic schists
- Meta-sedimentary Rocks: Quartz schists, spotted schists, sericite schists etc..
- Banded iron formation.
- Quartz.

SIGNS

- Strike and dip of bedding.
- Plunge of minor fold.
- Axis of major anticlinal fold.
- Axis of major synclinal fold.
- Overturned minor anticlinal fold.
- Overturned minor synclinal fold.

NOTES ON THE GEOLOGY OF PORTION OF THE MT. MALCOLM DISTRICT, MT. MARGARET GOLDFIELD.

By A. J. Noldart, B.Sc., W. M. Bock, B.Sc.

CONTENTS

Introduction.

General.

The area dealt with in this report is situated approximately between longitudes 121° 15′ E. and 121° 30′ E., and latitudes 28° 40′ S. and 29° 10′ S. It occupies roughly 400 square miles centred on Mt. Leonora.

Situate immediately north and south of Mt. Leonora are the townships of Leonora and Gwalia respectively, population 500, and distant 520 road miles (536 rail miles) from Perth. Gwalia is populated almost entirely by employees of the "Sons of Gwalia" goldmine, but general business in Leonora is mainly dependent on the neighbouring pastoral properties.

Regular rail and air services operate from Perth, via Kalgoorlie.

The purpose of the survey was to obtain as much information as was available on the surface geology in the close vicinity of the "Sons of Gwalia" goldmine. The possibility of structural repetitions favourable to the occurrence of further large auriferous deposits could then be determined.

Previous Geological Work.

E. de C. Clarke carried out a regional survey of portion of the Mt. Margaret Goldfield, including the Area under consideration, in 1917-1918 (published 1925) but no other surface mapping, except in the vicinity of the "Sons of Gwalia" mine, had been carried out prior to this survey.

An unpublished report on the underground and surface geology of the mine, completed by Dr. M. McLaren in 1910, was made available by the mine management.

A list of the principal publications dealing with the Area is given below:

1904—Jackson, C. F. V.; Geology and Auriferous Deposits of Leonora, Mt. Margaret Goldfield. *G.S.W.A. Bull. No. 13.*

1925—Clarke, E. de C.: The Field Geology and Broader Mining Features of the Leonora-Duketon District. *G.S.W.A. Bull. No. 84.*

1930—Blatchford, T.: Report on the Sons of Gwalia Mine. *G.S.W.A. Ann. Rep. 1930,* pp. 5.

1951—Hobson, R. A. and Miles, K. R.: Geology of Portion of the Mt. Margaret Goldfield. *G.S.W.A. Bull. No. 103.*

Annual reports of the Geological Survey of W.A. for the years 1903, 1909, 1913, 1917, 1918, 1928 and 1949 carry additional information, mainly concerning individual mining centres.

The report by Hobson and Miles has been included as pertinent due to the lithological similarity of the rock types in the two (adjoining) localities.

Field Work.

Field mapping was commenced by Noldart in August, 1958, but due to other commitments no further work was carried out until Bock completed the field work in September-October, 1959.

Full use was made of aerial photographs, line compilations, and uncontrolled photo mosaics at a scale of 20 chains to 1 inch, supplied by the Mapping Branch of the Lands Department of W.A.

Examinations were made of such development faces and stopes as were available in the mine workings at the time of the survey. These examinations were necessarily of a superficial nature and no underground mapping was attempted.

Present Mining Activity.

The "Sons of Gwalia Ltd." is the only large scale mine in the district and is operating on full production.

Attempts to retrace the "Tower Hill" ore bodies were commenced in October, 1959, by a small working party. Several small mines are held under existing leases but are not operative, and general activities are mainly restricted to "week-end" prospecting.

Acknowledgments.

The authors are indebted to the Government Geologist, Mr. H. A. Ellis, for advice and assistance both during the course of the field work and the compilation of this report.

The authors also wish to acknowledge the co-operation extended by the mine management, and the office space and ready assistance offered by the Mining Registrar, Leonora.

The Drafting Branch of the Mines Department was responsible for the drafting of the accompanying geological maps.

Physiography.

The Area lies within Jutson's[1] Salinaland Physiographic Division of Western Australia. The Area contains the usual features characteristic of Salinaland, which have been fully discussed by Jutson, and the major features only are mentioned here.

In general, the Area is flat to gently undulating with occasional prominent hills and ridges. The most conspicuous of the ridges is that extending in a northerly direction from Gwalia through Mt. Leonora and Mt. George. The ridge extends for many miles northerly of the Area mapped. It is not continuous but is broken by water gaps in various stages of development, the most noticeable being in the vicinity of Mt. George.

The country easterly of the main ridge and northerly of Lake Raeside (the north-east quarter) is gently undulating with several smaller northerly trending ridges and hills. Mt. Malcolm is the most prominent feature in this section. The valleys and drainage channels in this section are generally very broad and flat bottomed with gently sloping sides. The drainage channels are not sharply defined. Occasional remnants of lateritic cappings form small buttes and mesas at a level intermediate between the valley floors and the general ridge level.

To the west of the main ridge and covering vast areas southerly of Lake Raeside, the terrain is remarkably even, broken only by very scattered breakaways and small granite outcrops or quartz blows. Outcrop is virtually nil in this section, almost the entire area being covered with a thick mantle of alluvial soil.

The most marked feature of the low country is Lake Raeside, a typical example of the "dry" or "salt" lakes found throughout Salinaland. The lake, the recipient of all drainage from the Area, extends unbroken for some 160 miles in a N.W.-S.E. direction. The lake has numerous ill defined meanders and generally indefinite margins. Nowhere in the Area is the lake surface broken by rock outcrop, but dune formations on the edges and dune type islands are common features.

[1] 1934 Jutson, J. T., G.S.W.A. Bull. No. 95.

General Geology.

Classification of Rock Types.

Due to the limited extent of the survey, the classification submitted below is purely tentative and is based on the classification put forward by Hobson and Miles[2] for the rocks occurring in other parts of the Mt. Margaret Goldfield.

In brief, three age groups are suggested:

A—*Quaternary.*—A covering mantle consisting of eluvial and alluvial soils, lake deposits, surface cements and laterites.

B—*Late Tertiary* (?).—High level iron cappings.

C—*Pre-Cambrian.*

Intrusives.—Granitic rocks, quartz reefs.
Margaret "System."

(a) Sedimentary Rocks: jaspilites, quartz-kyanite schists, sericitic schists etc.

(b) Igneous Rocks: basic lavas, epidiorites.

Summary Description of Rock Types.

A.—*Quaternary.*

General.—Many of the rock types occurring on the surface of the Area are of comparatively recent origin. The separation Quaternary and Late Tertiary is based on formation levels and erosion patterns.

Alluvial Deposits.—75 per cent. of the Area is overlain with alluvium associated with the general drainage pattern, and Lake Raeside in particular. The majority of the mantle is composed of a reddish, sandy soil of unknown depth in the vicinity of Lake Raeside. The soil grades into a more yellow, sandy soil with a correspondingly shallower depth in the more distant drainage channels. Some loamy material occurs but distribution is limited to small outcrops of basic rocks.

The depth of the alluvium westerly of the main ridge is not known, but old shafts and wells sunk in the alluvium show a depth of at least 50 feet in some localities.

Lake Deposits.—These deposits are mainly restricted to Lake Raeside and its major contributaries. They consist of a more clayey type of soil containing small amounts of gypsum etc., and the surface salts usually associated with this type of deposit in other parts of Western Australia.

Surface Cements and Laterites.—Low level cappings and fillings of ferruginous, siliceous and calcareous types of cements are a common feature of the Area. They occur in patches throughout the more broken terrain, and the recementation of eluvial deposits and scree was often noted. Travertinous cements are common in localities underlain by more basic rock types. Cap thicknesses are variable but generally very thin.

B.—Late Tertiary.

High Level Iron Cappings.—Jackson[3] remarked on the occurrence of high level, highly ferruginous, pisolitic laterite. These deposits are in the form of knolls and mesas, remnants only remaining of the original deposits. Westerly of Mt. George a prominent mesa-like cap with 15 feet vertical sides typifies this type of deposit. Other occurrences noted in the Area are now weathered to rounded hills with recementation of the scree becoming apparent. In all cases examined this type of deposit rests on highly weathered and kaolinised basic rocks, probably lavas, and sharp contacts occur between the two rock types.

A second type of iron capping is displayed immediately north of the "Sons of Gwalia" mine. In this outcrop the iron rich cap rock is much darker in colour and more blocky in texture, although the pisolitic structure is still present. The most noticeable feature of this outcrop is the complete replacement, at the surface at least, of the underlying schisted rocks by hematitic iron as distinct from the weathering of underlying rocks previously mentioned. The replacement has been such that all the structures of the original rocks have been retained and no definite line of demarcation can be found between the capping and the replaced rock. The depth to which replacements have taken place is not known. This type of deposit has not been seen elsewhere in the Area.

C. *Pre-Cambrian*

General.—The folded and metamorphosed rocks together with the granitic rocks have been classified as Archeozoic and are portion of the Archean basement. No younger Pre-Cambrian rocks were seen.

Intrusives

Quartz Reefs.—The occurrence of quartz reefs of varying size has been noted in most localities. The most prominent outcrops occur as a set of large, milky-white quartz reefs in the belt of granitised country west of Mt. Leonora. The majority of these reefs are barren of mineralisation but the "Tower Hill" and "Forrest" sets of reefs carry low values.

Auriferous quartz reefs are associated with all the known mine workings but, with the exception of the "Sons of Gwalia" mine, these reefs are small and irregular.

Granitic Rocks.—Almost the whole of the Area that is underlain by granite, or presumed granitic rocks, is covered with a deep mantle of alluvial soil and outcrops are very few. Two small outcrops were found in the most western section, but the only reasonably continuous outcrops are located on the western flank of the granite.

Granitisation has taken place at the contact between the granite and rocks of the Margaret "System," and the majority of the outcrops in this belt are of hybrid rock types. Where seen, the purer specimens are composed of a pink, coarse grained quartz-felspar granite with a low ferro-magnesian content.

Basic Intrusives.—No recognisable basic intrusives were located during the course of the survey. It is possible that pre-shear intrusives are present, but identification was not possible in the field.

Margaret "System"

Igneous Rocks.—Included here are all rocks of a definite or probable igneous origin. In the main they consist of basaltic, doleritic, andesitic and related lavas. It is probable that some agglomeratic and tuffaceous bands are present, but shearing and metamorphic effects have masked the original structures.

In the vicinity of Melita Station to the south-east of Leonora, the lavas are predominantly blocky, fine grained black basalts, but to the east and north through the Mt. Malcolm belt doleritic and andesitic lavas are more pronounced.

Relationships between the various lava types are seldom obtainable, but an excellent example of lava "pile" was noted 1½ miles east of Mt. George. The "pile" is up to one mile in width with individual flows readily discernible in several places. In one instance at approximately the centre of the "pile," four separate flows are to be seen in a cross-strike section of 60 yards. A "flow breccia" consisting of large whitish fragments caught in a fine grained basaltic matrix forms the apparent bottom of one of the flows. The flows do not appear to be overturned from the field evidence available.

Special mention is made here of the "epidiorite" rock forming the Gwalia "dyke". McLaren (Unpublished report, 1910) and Blatchford[4] considered the "epidiorite" host rock of the "Sons of Gwalia" Goldmine to be a long, narrow, diabase or dolerite dyke intrusive into the older sediments, and subsequently altered by shearing and metamorphism into an epidiorite—epidioriteschist—hornblende schist.

[2] 1951—HOBSON, R. A. and MILES, K. R., G.S.W.A. Bull. No. 103 pp. 31.

[3] 1904—JACKSON, C. F. V., G.S.W.A. Bull. No. 13, pp. 15.

[4] 1930—BLATCHFORD, T., G.S.W.A. Ann. Rept. 1930, pp. 5.

Both of these investigators remark on the variation in composition of the dyke from a siliceous or acid mica schist on the eastern margin, to a basic biotitic schist on the western margin, and on localised differences in the degree of foliation, and have suggested differential magmatic segregation as the basic factor responsible for the variations.

In view of the results of this survey the authors suggest that the Gwalia "dyke" was originaly a lava "pile" similar to that observed east of Mt. George, and that the variations in present composition and schistosity are directly related to the differences in the composition of the original flows. The basic mineral assemblages composing the present rock are common to most intermediate—basic meta-igneous rocks, irrespective of the origin of those rocks, and are equally applicable to extrusive and intrusive rocks.

Other smaller "epidiorite" or hornblende schists occur within the meta-sediments flanking the main "dyke" to the east, in a manner closely resembling thin horizons of identifiable extrusives lying within meta-sedimentary rocks in other parts of the Area. In some localities "epidiorite" was found to occur in intimate association with recognised lava horizons showing marked graduation of shearing intensity across the strike.

Sedimentary Rocks. — Meta-sedimentary schists ranging from andalusite-quartz schists to talc-sericitic schists occur throughout the north-east section of the Area. They are usually closely associated with lava flows and contain several horizons of jaspilite. Bedding is not determinable in the schists and in most cases their origin is doubtful although argillaceous, arenaceous and grit horizons were located.

The most important of the sedimentary rocks are the jaspilites as these rocks provide the only bedding data available and have been used as the basis for structure patterns. They vary in composition from well banded, iron rich rocks, through grey chert-like masses to a quartzitic rock. Graduations from one type to the other occur along the strike of the rocks.

The most extensive and prominent jaspilite is that forming the main ridge from Lake Raeside northwards through Mt. George, a mapped distance of more than 15 miles. The bed is usually well banded, although poorly banded chert zones are present, and due to association with a grit horizon forms an easily identifiable marker bed. The grit bed occurs as semi-continuous lenses on either side of the jaspilite and in places occurs on both flanks. This bed has not been located in any other portion of the Area.

Structural Geology

General.

The limited extent of the Area investigated precludes structural interpretations on a regional scale from the results of this survey alone, and only a generalised outline, based on the work of previous investigators, has been attempted. The lack of outcrop in all but the north-east section further restricts the information available.

Major faulting was not observed in the field, and although small scale faulting is present in most of the mine workings it has been reported to have had little or no effect on the ore deposits.

Regional Structure.

The Area forms portion of the western flank of a large synclinorium extending in a general north-north-west direction from Kookynie, through Leonora to beyond Mt. Clifford. The immediate section is arcuate (concave westerly) with a marked westerly swing in the vicinity of the Gorge, 1½ miles north of Leonora township.

Variations in the trends of the jaspilitic horizons suggest strong west-north-westerly trending anticlinal cross-folding through the point of maximum flexure of the main range. A similar, and probably stronger crossfold, is postulated following approximately along the drainage channel occupied by Lake Raeside.

Due to alluvium, no field evidence is available on this crossfold, but southerly of the lake, bedding and schistosity strikes in the few outcrops located have a marked north easterly trend in variance with the slight westerly trend prevailing northerly of the lake.

Minor Structures.

Easterly of the main range is a system of subparallel anticlines and synclines trending in the same general direction as the range. Overturning of the folds to the west is suggested from dip data, but no field evidence of overturning was found. Repetition of the jaspilite beds by isoclinal folding has probably taken place, but again no evidence is available.

Localised flexing and "knotting" of some jaspilite beds along the approximate axis of the Gorge crossfold, particularly in the Mt. Malcolm district, has resulted in intricate fold patterns. Some of the "knots" are almost indecipherable with numerous cross strikes and rapid reversals of dip and plunge directions. Fracture cleavage is strongly developed in the "knots", and the regional schistosity present in the associated schists is almost invariably parallel to the regional trends.

In less contorted beds, small dragfolds were noted plunging away from the Gorge crossfold. Approximately one mile northerly along the strike from Mt. George a prominent dragfold occurs in the main jaspilite horizon. Several minor folds with sharp reversals of dip occur within the main fold, but the overall plunge is to the north at approximately 40°.

The drag fold has offset the jaspilite approximately 400 yards. This is the only dragfold noted in this horizon and no intraformational folding was seen.

Economic Geology.

General.

Gold is the only mineral of importance in the area. The larger (auriferous) deposits are situated within one mile of the eastern flank of the granitic suite, and in two cases located in the granitised belt. Several smaller deposits are scattered throughout the Mt. Malcolm greenstone belt extending north-westerly from Mt. Malcolm.

Of the deposits the "Sons of Gwalia" mine is the only large producer and underground investigations were restricted to the deeper levels of this deposit. Descriptions of the majority of the smaller, now inaccessible mines are given by Jackson[5] in his report.

Mineralisation.

McLaren describes the mineralisation in the "Sons of Gwalia" mine as: "Channels of impregnation and replacement characterised by quartz, sericitic mica, calcite and sulphides", occurring within a highly schistose zone in the eastern portion of the Gwalia "dyke". The gold content is intimately associated with the quartz impregnations and is almost invariably higher in zones where the quartz veins are larger or more numerous, and particularly where the veins are most contorted.

The lateral limits of the ore bodies for economic mining purposes are usually decided by sampling and assay methods due to gradation of mineral content away from the centres of the ore bodies. The mineralisation also diminishes in strength along the line of strike, thus the limits of the shoots outlined on mine plans and sections are economic limits and do not necessarily represent the termination of mineralisation.

The quartz appears to have been injected along pre-existing fold and shear patterns. Reversals of dragfold attitudes are common in the mine, but the overall direction of movement noted in the faces examined was west side north, with an apparent overthrust noted where cross sections were available. Private discussions with Mr. K. Finucane,

[5] 1904 Jackson, C. F. V., G.S.W.A. Bull. No. 13.

Consultant Geologist for the operating Company, confirmed these observations as applicable to the entire mine with an interpreted overthrust of approximately 20°.

Structural Relationships.

The ore shoots in the "Sons of Gwalia" mine are arranged en échelon in a north shoot east pattern in plan view, and an east side overthrust in cross section. The overall dip of the ore shoots is approximately 43° to the east, with a 70° rake to the south. The strike of the individual shoots is oblique to the regional schistosity, and the regional bedding strike as represented by the neighbouring jaspilite, trending from 10° to 20° easterly of those strikes.

In microscopic examinations of the host rock of the ore body McLaren remarks: "The most striking feature (of the host rock) is the presence of abundant biotite-mica, *crossing* the schistosity, and therefore pointing to an origin later than the actual deformation of the rock."

These factors, in conjunction with the observed distribution of the quartz injections, indicate a localised shearing superimposed on both the original rock folding and/or deformation, and the regional shearing. This type of localised shearing has not been found to date in any other part of the area, and the cause of localisation is still a matter of conjecture.

In view of the lack of clear occurrences of recognisable intrusive basic rocks in the area, the authors have reached the following conclusions:—

(a) That the "Sons of Gwalia" ore deposit is not associated with the shearing of an intrusive basic dyke.

(b) That mineralisation has been confined to a favourable horizon, or horizons within a lava "pile." Deformation and folding of the "pile" has resulted in the development of small, thrust faulted dragfolds on the limb of a larger structure during the original orogenic movements. Subsequent regional shearing, and still later localised shearing, has resulted in access channels for the mineralizing agents.

Should these conditions exist, then it is possible that repetitive fold-dragfold structures could occur in the vicinity of the present known structure. It is doubtful if any larger repetitive structure would occur to the south as surface mapping indicates a constriction of the favourable rocks in this direction. A more favourable position would be northerly of the mine where interbedding of igneous and sedimentary rock types is indicated by surface mapping.

Lateritic cover prevents close surface investigations in this locality and diamond drilling would be necessary to test the prospect.

Conclusions and Recommendations.

In general, the results of this survey were negative. No field evidence was obtained on which to base an exploration programme aimed at the location of repetitive auriferous structures.

Structural interpretations are tentative due to the small size of the Area and the paucity of outcrop, particularly in the critical section southerly of the "Sons of Gwalia" goldmine.

It is believed that repetitions of the Gwalia structure could exist, but that any repetitions would be buried, necessitating a long term diamond drilling programme of exploration. No accurate prediction can be given for the position of further structures, but two suggestions are given for testing the most favourable positions immediately adjacent to the mine. Further prospecting would depend on the results obtained from these first test holes.

A.—North of the Mine.

Probably the most favourable area is located within 1,500 feet north-westerly of the present workings. The extension of underground bore hole No. 180, collared at the north end of No. 27 level, to a minimum distance of 1,500 feet would adequately test this prospect.

B.—South of the Mine.

Smaller structures may exist in this area and a horizontal drill hole 1,500 feet long, drilled south-easterly from the south end of one of the intermediate depth levels (e.g. No. 14 level) is recommended.

A. J. NOLDART,
Geologist.
W. M. BOCK,
Geologist.

5/1/60.

NOTES ON THE DIAMOND DRILLING OF THE BANDICOOT BAR DIVERSION DAMSITE, ORD RIVER. EAST KIMBERLEY DIVISION.

Approximate Latitude 15° 46′ 42″ S.

Approximate Longitude 128° 42′ 0″ E.

By J. D. Wyatt, B.A.

Introduction.

Following a request from the Hydraulics Section of the Public Works Department, a diamond drill-hole programme was laid out to test the structure of Bandicoot Bar, as a possible site for a diversion dam.

Bandicoot Bar is a natural quartzite dam crossing the Ord River at a point approximately 45 miles south-east of Wyndham.

Four holes were initially planned, but these were eventually increased to ten, in order to outline a persistent shale horizon which was intersected in the early stages of the drilling.

Two drill rigs were used, a Mindrill F20 petrol machine and a Mindrill E500 air driven machine. A total of 720 feet of drilling was carried out with an overall core recovery of 86.6 per cent.

Drilling commenced on the 10th June, 1959 and was completed on the 21st September, 1959.

Two features of interest in the programme were firstly the use of split inner tube core barrels in hard-rock drilling, namely quartzites of Pre-Cambrian age and secondly, the fact that a complete photographic record was made of all core recovered during the season.

Geology.

The general geology of the Bandicoot Bar area is confined to a series of interbedded quartzites, slatey shales (phyllitic) and lavas of undifferentiated Proterozoic, which strike N55E-N65E and dip south at angles which vary from 45°-60°.

This series is overlain by horizontal ferruginous sandstones, strongly crossbedded and with conglomeratic facies. These beds are part of the Cockatoo Series, Devonian in age.

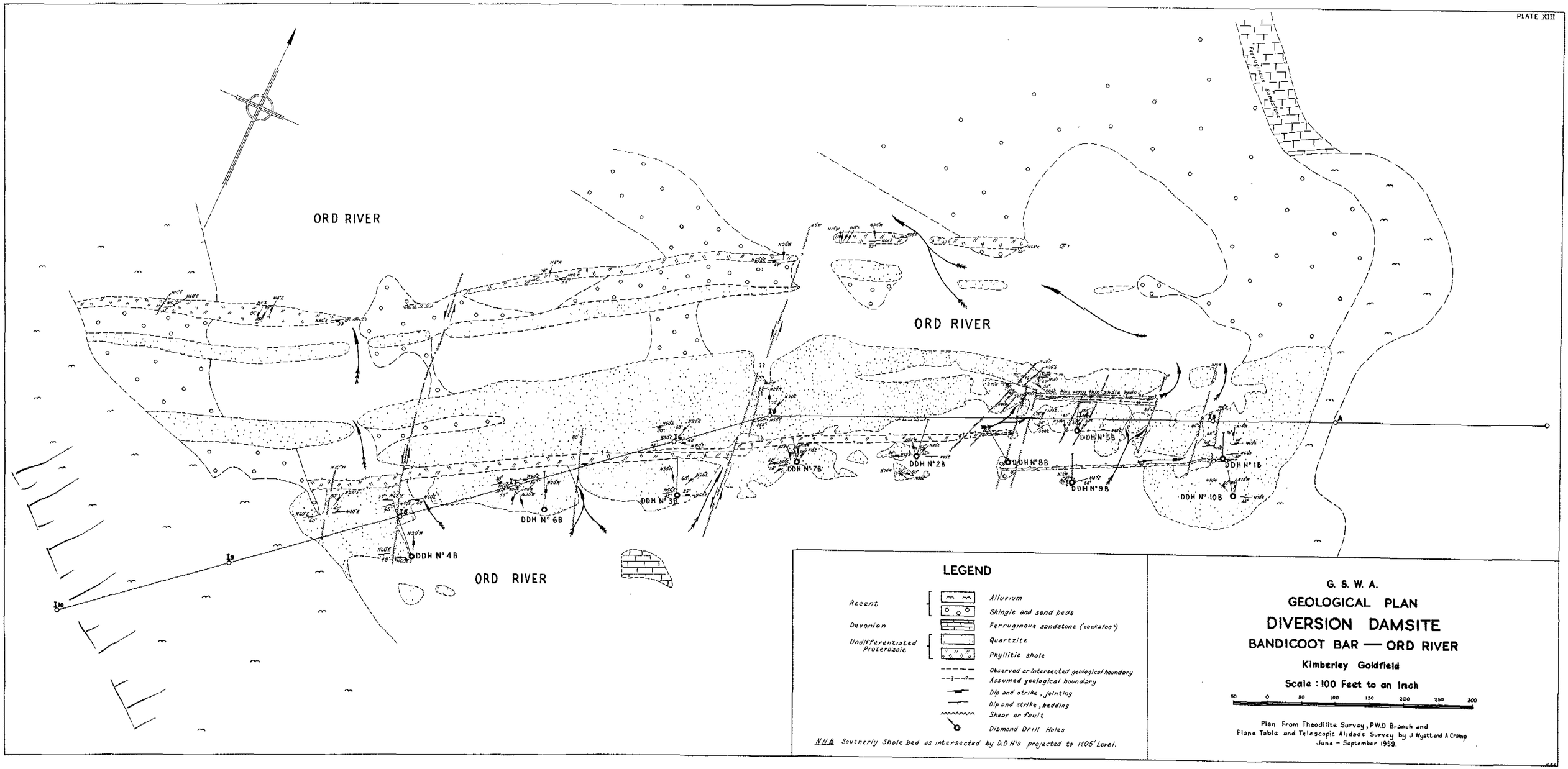
The geology in the immediate vicinity of the proposed damsite consists essentially of a quartzite outcrop which strikes across the Ord River on a bearing of N65°E and dips upstream to the south-east at approximately 50°.

Interbedded with this quartzite in the main body of the bar, but not exposed on the surface, are a series of thin beds and lenses of phyllitic shale. One bed is persistent along the full length of the bar, a distance of some 1,600 feet and having an average thickness of 7 feet 6 inches. This bed has its greatest width on the western side of the Ord where it is 18 feet 6 inches wide but lenses out to a few inches on the eastern side.

Some 300 feet downstream from the bar, phyllitic shale outcrops at the surface as a thin 10 feet-20 feet wide bed which also extends across the full width of the Ord; upstream a fine grained basaltic rock is in evidence and is either interbedded with the quartzite or overlying it.

The quartzite is strongly crossbedded, and in places shows minor drag-folding. All evidence of this nature points to the beds being right side up.

Field evidence also shows the quartzite to be more thinly bedded upstream from the shale horizon than it is downstream from this bed. Such bedding contrasts being most evident in the vicinity of baseline Stations I_3 and I_4.



LEGEND

Recent		Alluvium
		Shingle and sand beds
Devonian		Ferruginous sandstone ("cockatoo")
Undifferentiated Proterozoic		Quartzite
		Phyllitic shale
		Observed or intersected geological boundary
		Assumed geological boundary
		Dip and strike, jointing
		Dip and strike, bedding
		Shear or fault
		Diamond Drill Holes

N.N.E. Southerly Shale bed as intersected by D.D.H's projected to 1105' Level.

G. S. W. A.

GEOLOGICAL PLAN

DIVERSION DAMSITE

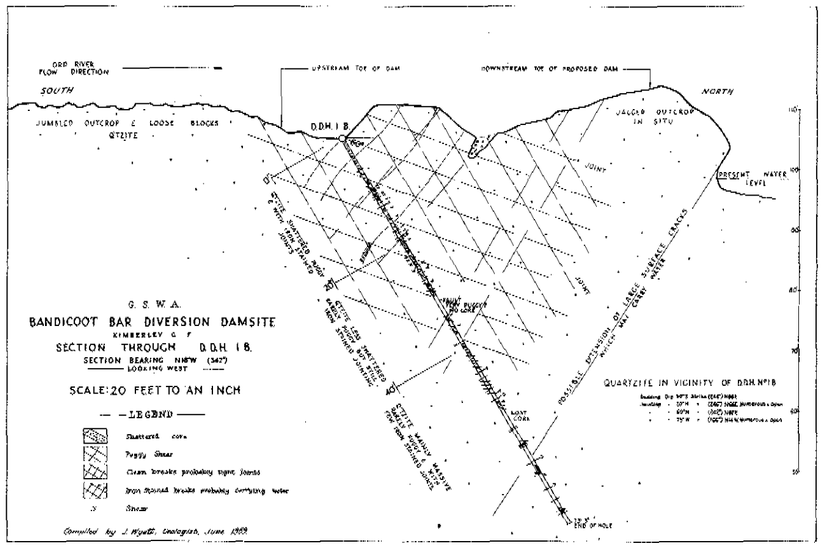
BANDICOOT BAR — ORD RIVER

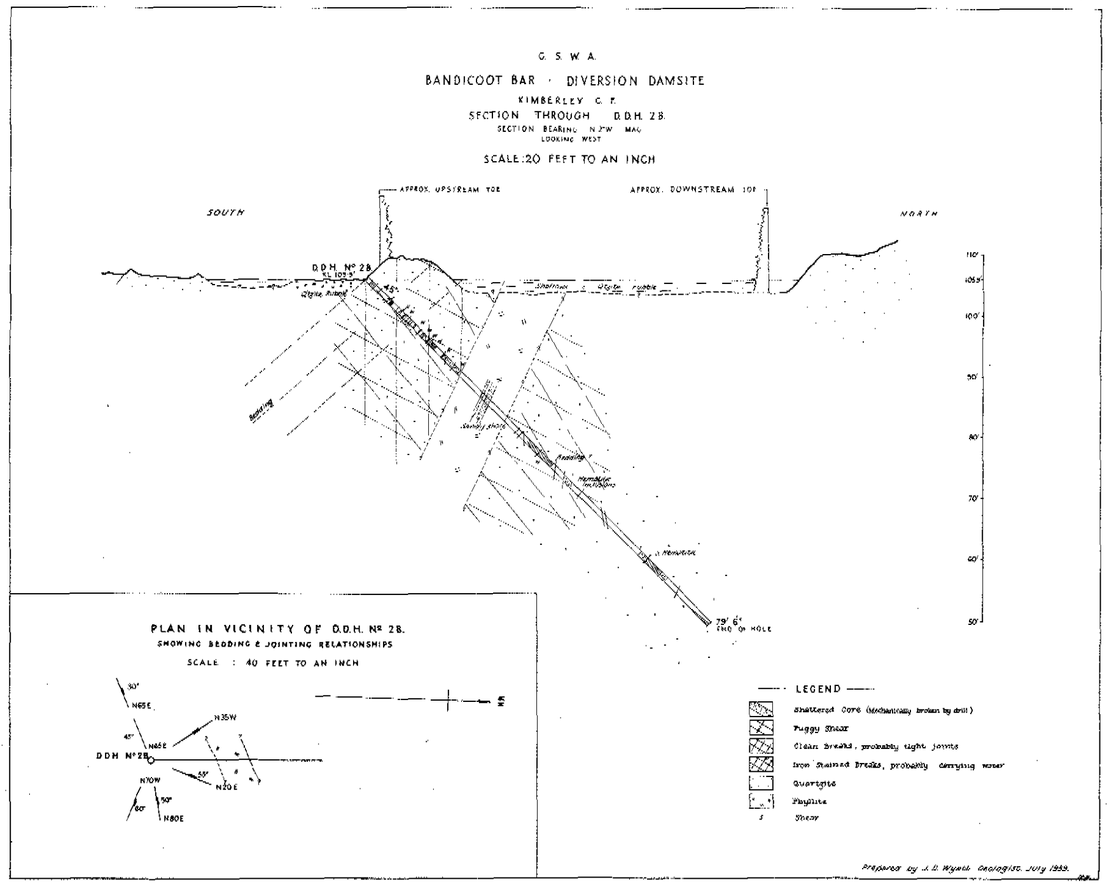
Kimberley Goldfield

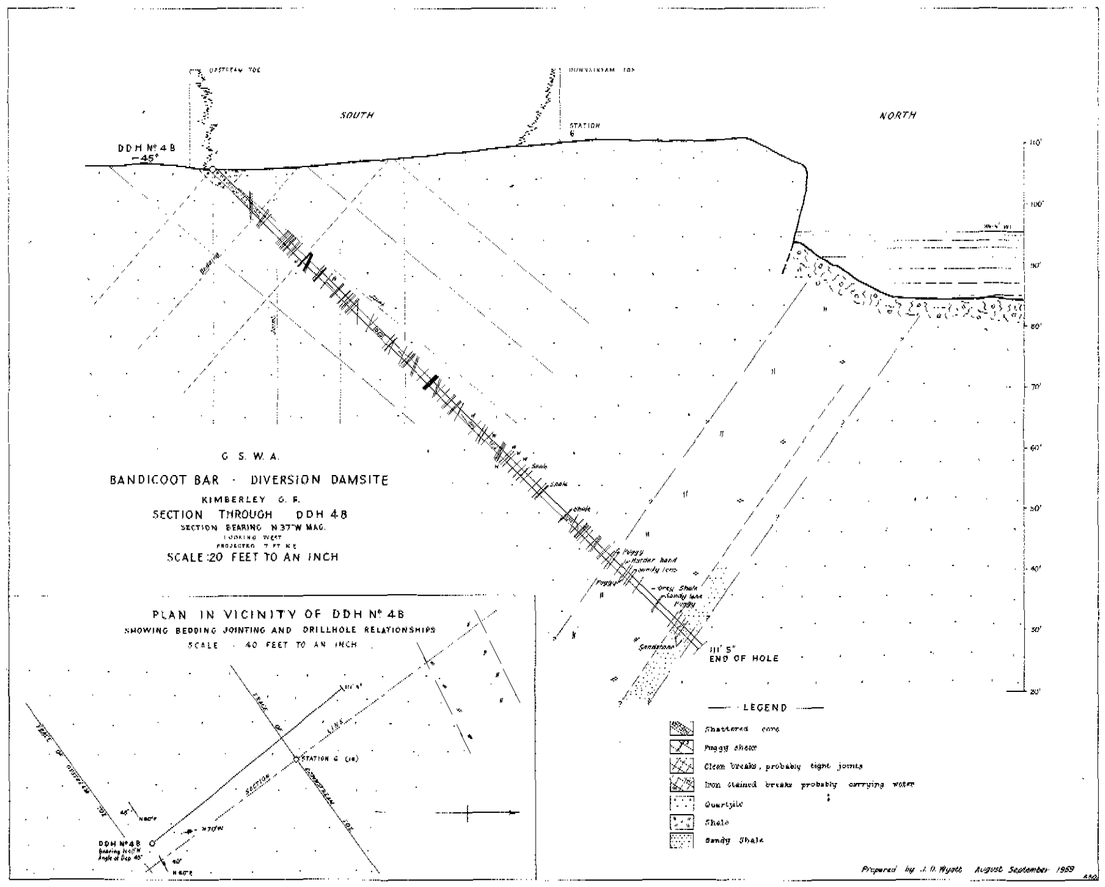
Scale : 100 Feet to an Inch

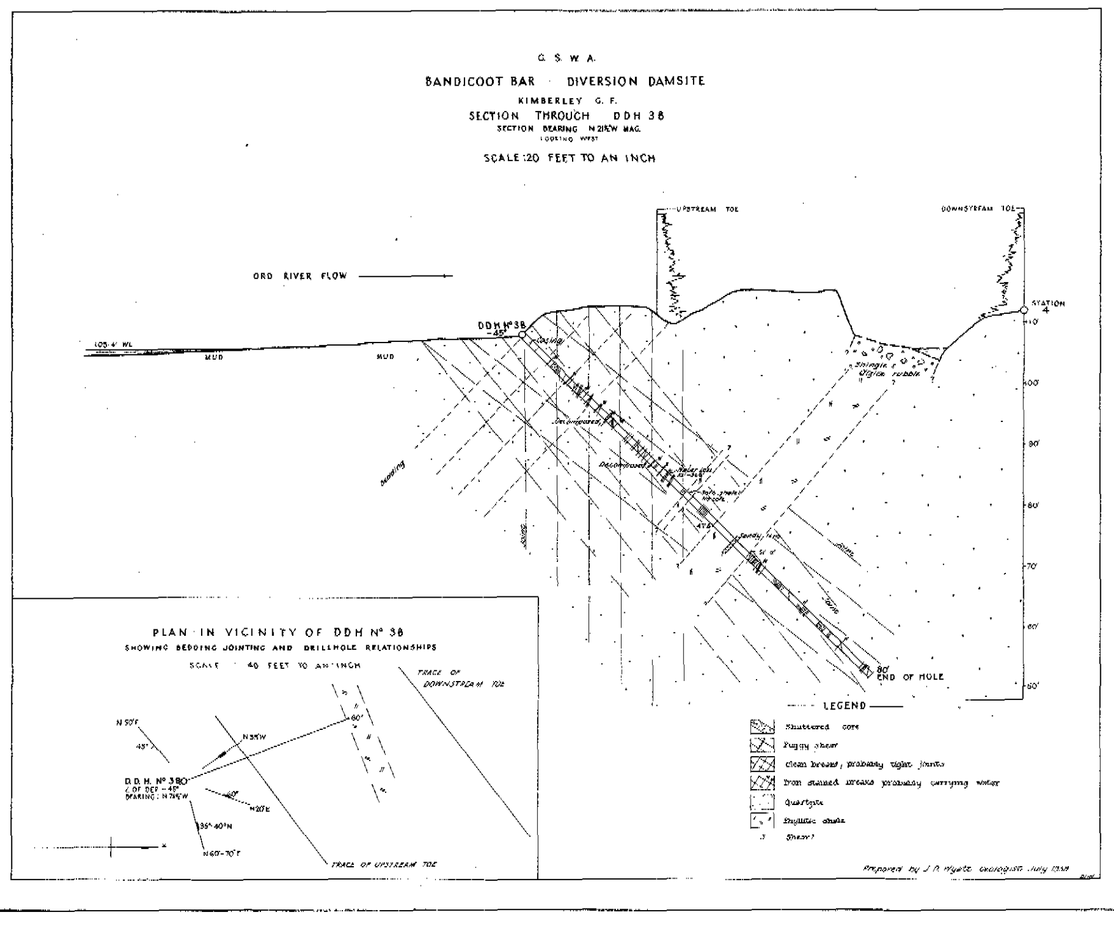
50 0 50 100 150 200 250 300

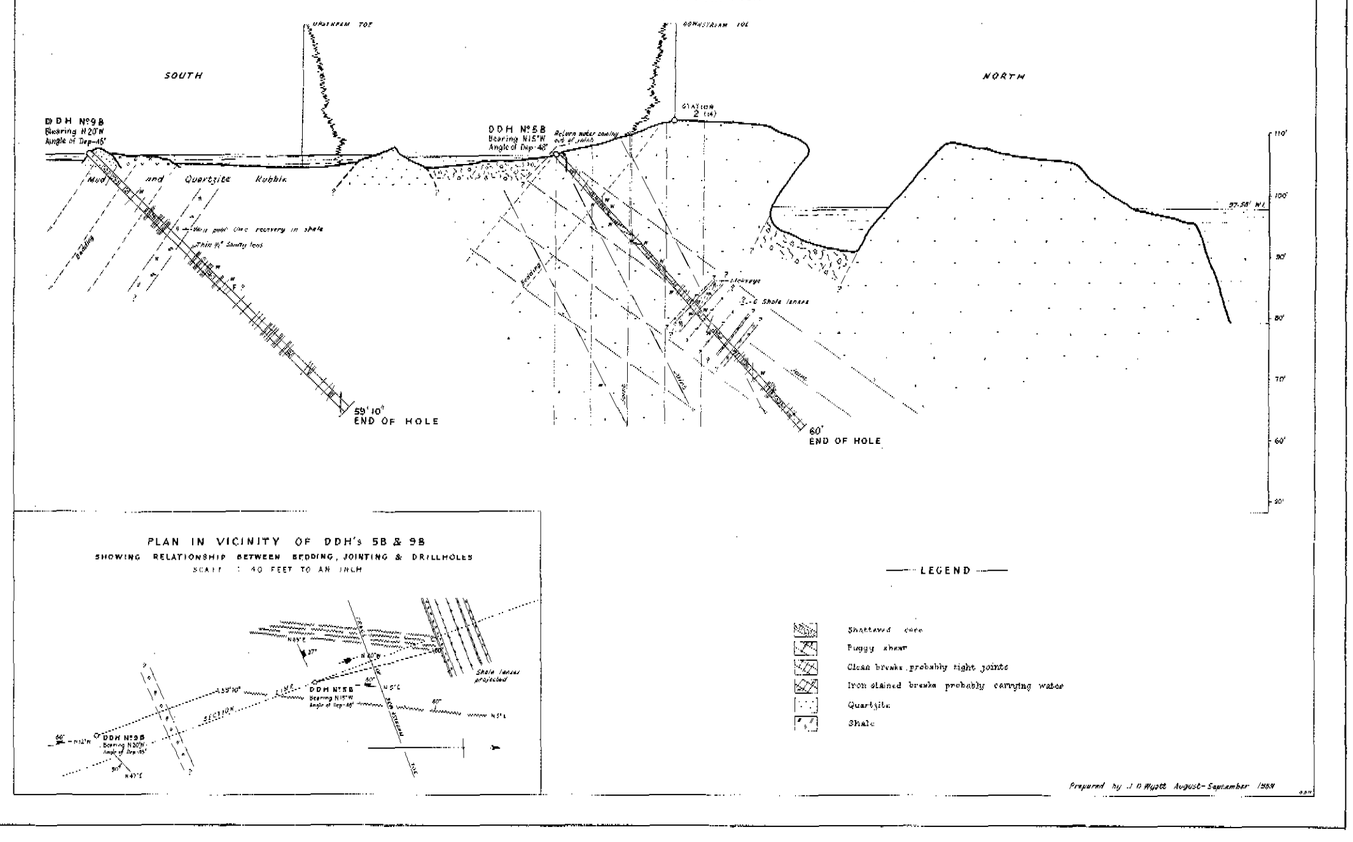
Plan From Theodilite Survey, P.W.D Branch and
Plane Table and Telescopic Alidade Survey by J Wyatt and A Cramp
June - September 1959.


ORD RIVER FLOW DIRECTION
UPSTREAM TOE OF DAM
DOWNSTREAM TOE OF PROPOSED DAM
SOUTH
NORTH
JUMBLED OUTCROP & LOOSE BLOCKS QTZITE
D.D.H. 1 B
JOINT
PRESENT WATER LEVEL
POSSIBLE EXPANSION OF LEAKS SURFACE LEAKS
MAIN LODE
END OF HOLE
G. S. W. A.
BANDICOOT BAR DIVERSION DAMSITE
KIMBERLEY G. F.
SECTION THROUGH D.D.H. 1 B.
SECTION BEARING N 45° W (342°)
LOOKING WEST
SCALE: 20 FEET TO AN INCH
— LEGEND —
Shattered core
Puggy Shear
Clean breaks probably tight joints
Iron stained breaks probably carrying water
Shear
QUARTZITE IN VICINITY OF D.D.H. N° 1 B
Compiled by J. Hyatt, Geologist, June 1959


G. S. W. A.
BANDICOOT BAR · DIVERSION DAMSITE
KIMBERLEY G. F.
SECTION THROUGH D.D.H. 2 B.
SECTION BEARING N 3°W MAG.
LOOKING WEST
SCALE: 20 FEET TO AN INCH
APPROX. UPSTREAM TOE
APPROX. DOWNSTREAM TOE
SOUTH
NORTH
D.D.H. N° 2 B
RL 103'
79' 6" END OF HOLE
PLAN IN VICINITY OF D.D.H. N° 2 B.
SHOWING BEDDING & JOINTING RELATIONSHIPS
SCALE : 40 FEET TO AN INCH
D.D.H. N° 2 B
N65E
N35W
N20E
N10W
N80E
— LEGEND —
Shattered Core (Mechanically broken by drill)
Puggy Shear
Clean Breaks, probably tight joints
Iron Stained Breaks, probably carrying water
Quartzite
Phyllite
Shear
Prepared by J. D. Hyatt, Geologist, July 1959.


UPSTREAM TOE
DOWNSTREAM TOE
SOUTH
NORTH
STATION 6
D.D.H. N° 4 B
-45°
111' 5" END OF HOLE
G. S. W. A.
BANDICOOT BAR · DIVERSION DAMSITE
KIMBERLEY G. F.
SECTION THROUGH D.D.H. 4 B
SECTION BEARING N 37°W MAG.
LOOKING WEST
PROJECTED 7.47 RL
SCALE: 20 FEET TO AN INCH
PLAN IN VICINITY OF D.D.H. N° 4 B
SHOWING BEDDING JOINTING AND DRILLHOLE RELATIONSHIPS
SCALE : 40 FEET TO AN INCH
TRACE OF UPSTREAM TOE
SECTION
DOWNSTREAM TOE
STATION 6 (4)
D.D.H. N° 4 B
Bearing N 37° W
Angle of Dip 45°
— LEGEND —
Shattered core
Puggy shear
Clean breaks, probably tight joints
Iron stained breaks probably carrying water
Quartzite
Shale
Sandy Shale
Prepared by J. D. Hyatt, August-September 1959.


G. S. W. A.
BANDICOOT BAR · DIVERSION DAMSITE
KIMBERLEY G. F.
SECTION THROUGH D.D.H. 3 B
SECTION BEARING N 21°W MAG.
LOOKING WEST
SCALE: 20 FEET TO AN INCH
ORD RIVER FLOW
UPSTREAM TOE
DOWNSTREAM TOE
STATION 4
D.D.H. N° 3 B
-45°
105·4' W.L.
MUD
80' END OF HOLE
PLAN IN VICINITY OF D.D.H. N° 3 B
SHOWING BEDDING JOINTING AND DRILLHOLE RELATIONSHIPS
SCALE : 40 FEET TO AN INCH
TRACE OF DOWNSTREAM TOE
D.D.H. N° 3 B
∠ OF DEP. = 45°
BEARING: N 39°W
N 57°E
N 35°W
N 20°E
N 60-70°E
TRACE OF UPSTREAM TOE
— LEGEND —
Shattered core
Puggy shear
Clean breaks; probably tight joints
Iron stained breaks probably carrying water
Quartzite
Phyllitic shale
Shear?
Prepared by J. D. Hyatt, Geologist, July 1959.


G. S. W. A.
BANDICOOT BAR · DIVERSION DAMSITE
KIMBERLEY G. F.
SECTION THROUGH D.D.H's N° 5 B & N° 9 B
SECTION BEARING N 20°W MAG.
LOOKING WEST
SCALE: 20 FEET TO AN INCH
UPSTREAM TOE
DOWNSTREAM TOE
SOUTH
NORTH
D.D.H. N° 9 B
Bearing N 20° W
Angle of Dip -45°
D.D.H. N° 5 B
Bearing N 15° W
Angle of Dip -60°
STATION 2 (4)
97·58' W.L.
59' 10" END OF HOLE
60' END OF HOLE
PLAN IN VICINITY OF D.D.H's 5 B & 9 B
SHOWING RELATIONSHIP BETWEEN BEDDING, JOINTING & DRILLHOLES
SCALE : 40 FEET TO AN INCH
SECTION
— LEGEND —
Shattered core
Puggy shear
Clean breaks probably tight joints
Iron stained breaks probably carrying water
Quartzite
Shale
Prepared by J. D. Hyatt, August-September 1959.

G. S. W. A.

BANDICOOT BAR · DIVERSION DAMSITE

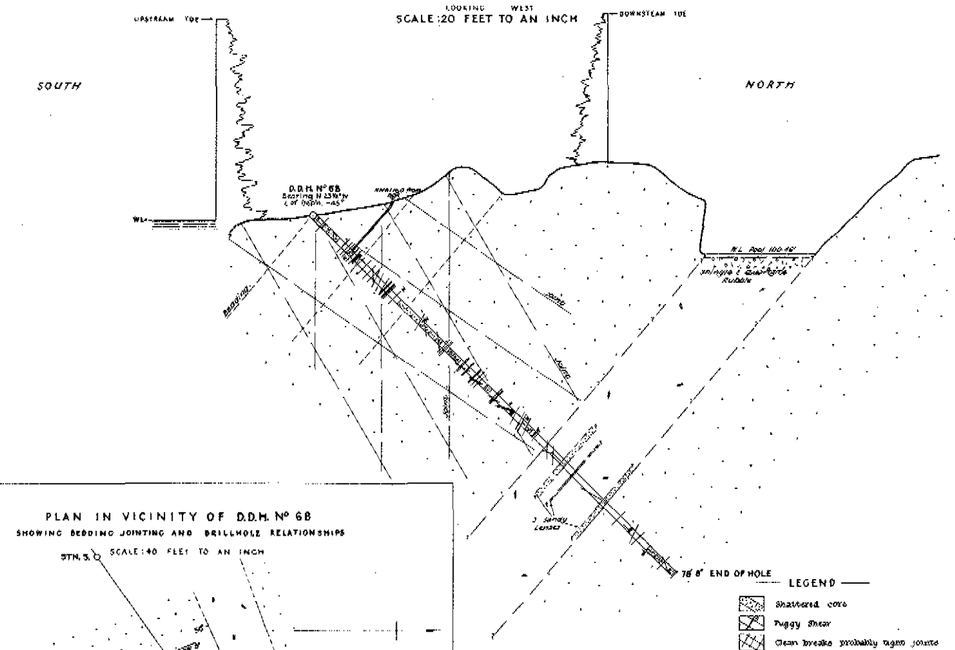
KIMBERLEY G. F.

SECTION THROUGH D D H 6B

SECTION BEARING N 26°W MAG
(DRILL HOLE PROJECTED A FEW FEET ONTO SECTION)

LOOKING WEST

SCALE: 20 FEET TO AN INCH

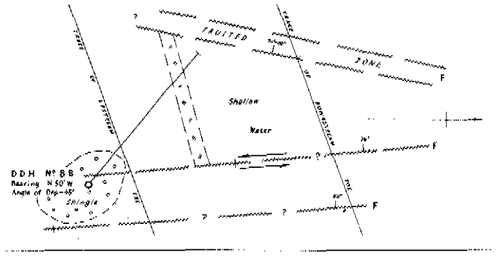


LEGEND

- Shattered core
- Puggy Shear
- Clean breaks probably tight joints
- Iron stained breaks, probably carrying water
- Quartzite
- Shale.
- 3 Shear

PLAN IN VICINITY OF D.D.H. N° 6B

SHOWING BEDDING JOINTING AND DRILLHOLE RELATIONSHIPS



Prepared by J.D. Wyatt. Geologist. August 1958.

G. S. W. A.

BANDICOOT BAR DIVERSION DAMSITE

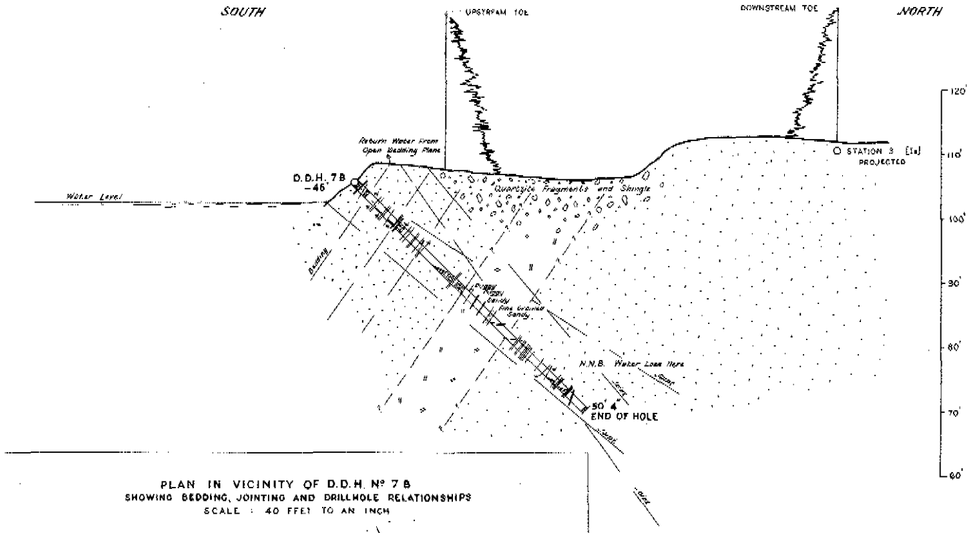
KIMBERLEY G. F.

SECTION THROUGH D.D.H. N° 7B

SECTION BEARING N 30°W

LOOKING WEST

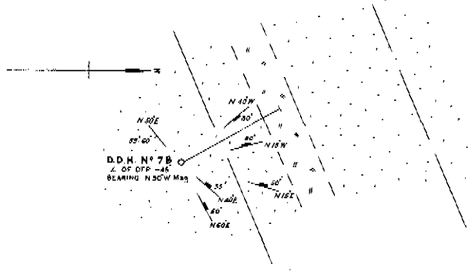
SCALE : 20 FEET TO AN INCH



PLAN IN VICINITY OF D.D.H. N° 7B

SHOWING BEDDING, JOINTING AND DRILLHOLE RELATIONSHIPS

SCALE : 40 FEET TO AN INCH



LEGEND

- Shattered core
- Puggy shear
- Clean breaks, probably tight joints
- Iron stained breaks probably carrying water
- Quartzite
- Shale

Prepared by J.D Wyatt Geologist. Sept. 1959

G. S. W. A.

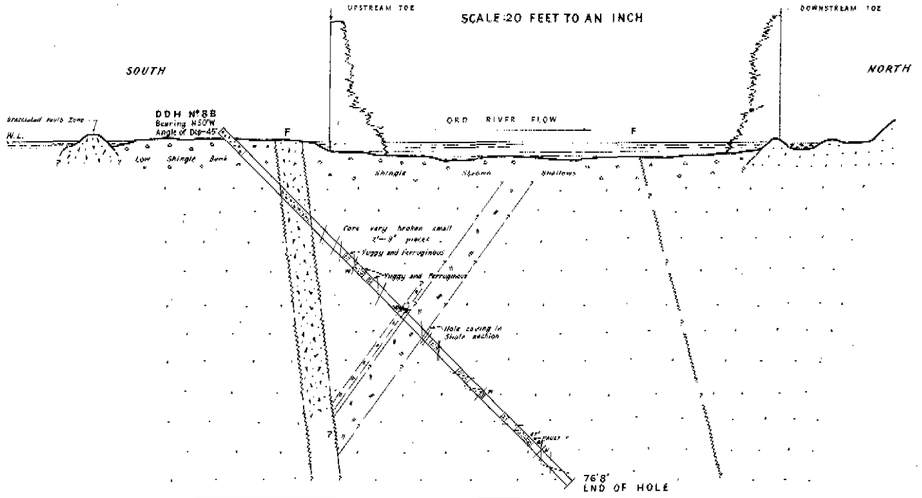
BANDICOOT BAR · DIVERSION DAMSITE

KIMBERLEY G. F.

SECTION THROUGH D D H N° 8B

SECTION BEARING N 50°W MAG
LOOKING WEST

SCALE: 20 FEET TO AN INCH



PLAN IN VICINITY OF D D H N° 8B

SHOWING RELATIONSHIP BETWEEN FAULTING AND DRILLHOLE

SCALE : 40 FEET TO AN INCH

LEGEND

- Shattered core
- Puggy shear
- Clean breaks probably tight joints
- Iron stained breaks probably carrying water
- Quartzite
- Shale
- Fault Breccia

Prepared by J.D.Wyatt August 1958

G. S. W. A.

BANDICOOT BAR DIVERSION DAMSITE

KIMBERLEY G. F.

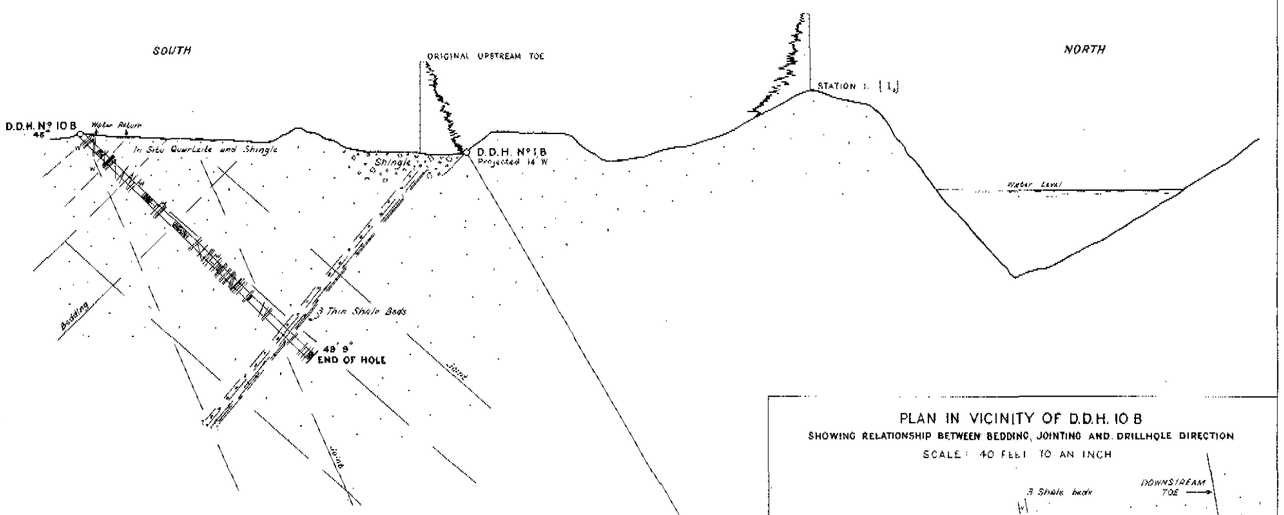
SECTION THROUGH D.D.H. N° 10 B

SECTION BEARING N 20°W

D.D.H PROJECTED 5 FT. WEST ONTO SECTION

LOOKING WEST

SCALE : 20 FEET TO AN INCH



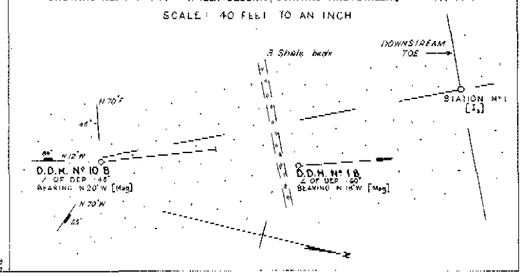
LEGEND

- Shattered core
- Puggy shear
- Clean breaks, probably tight joints
- Iron stained breaks probably carrying water
- Quartzite
- Shale

PLAN IN VICINITY OF D.D.H. 10 B

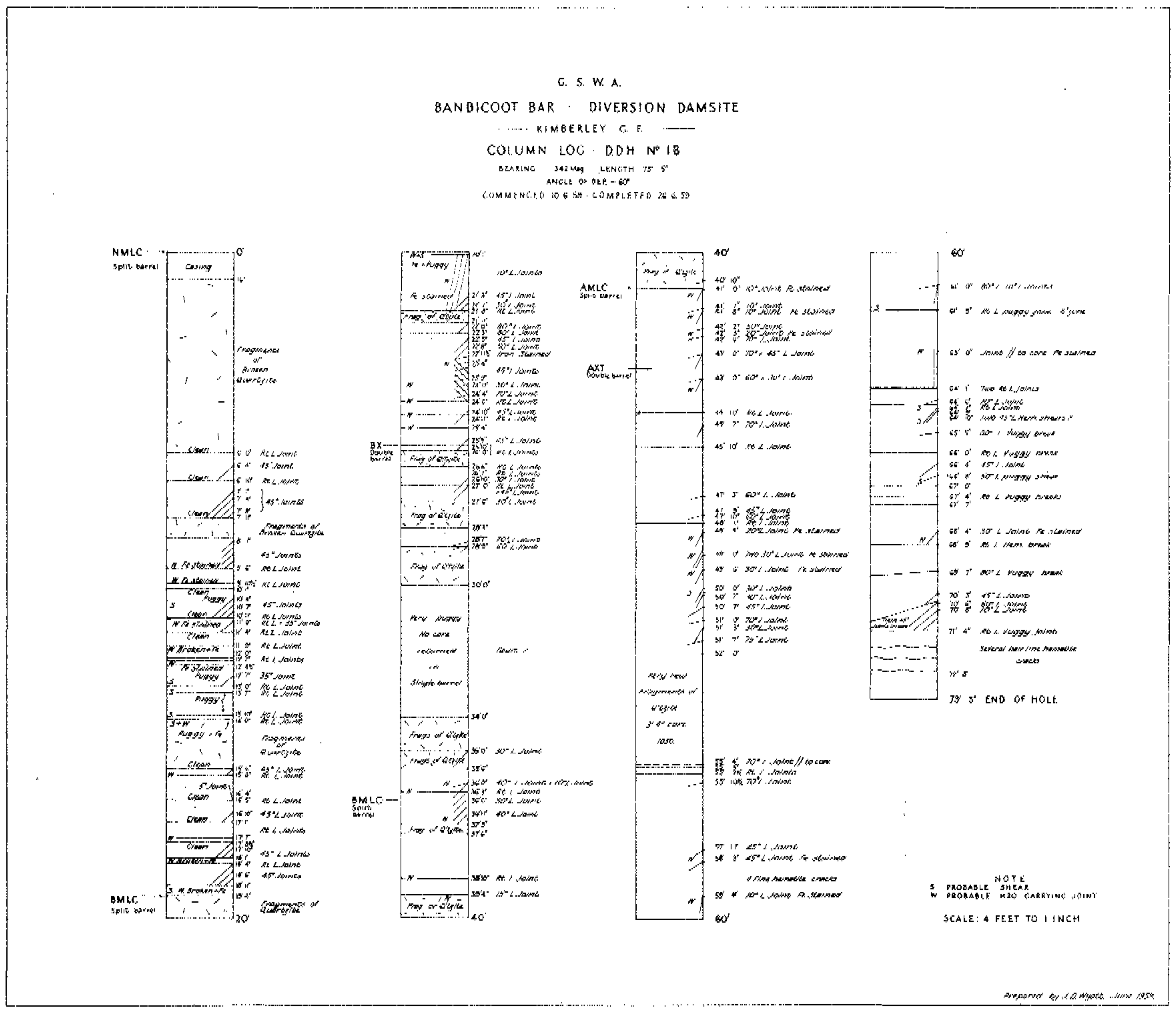
SHOWING RELATIONSHIP BETWEEN BEDDING, JOINTING AND DRILLHOLE DIRECTION

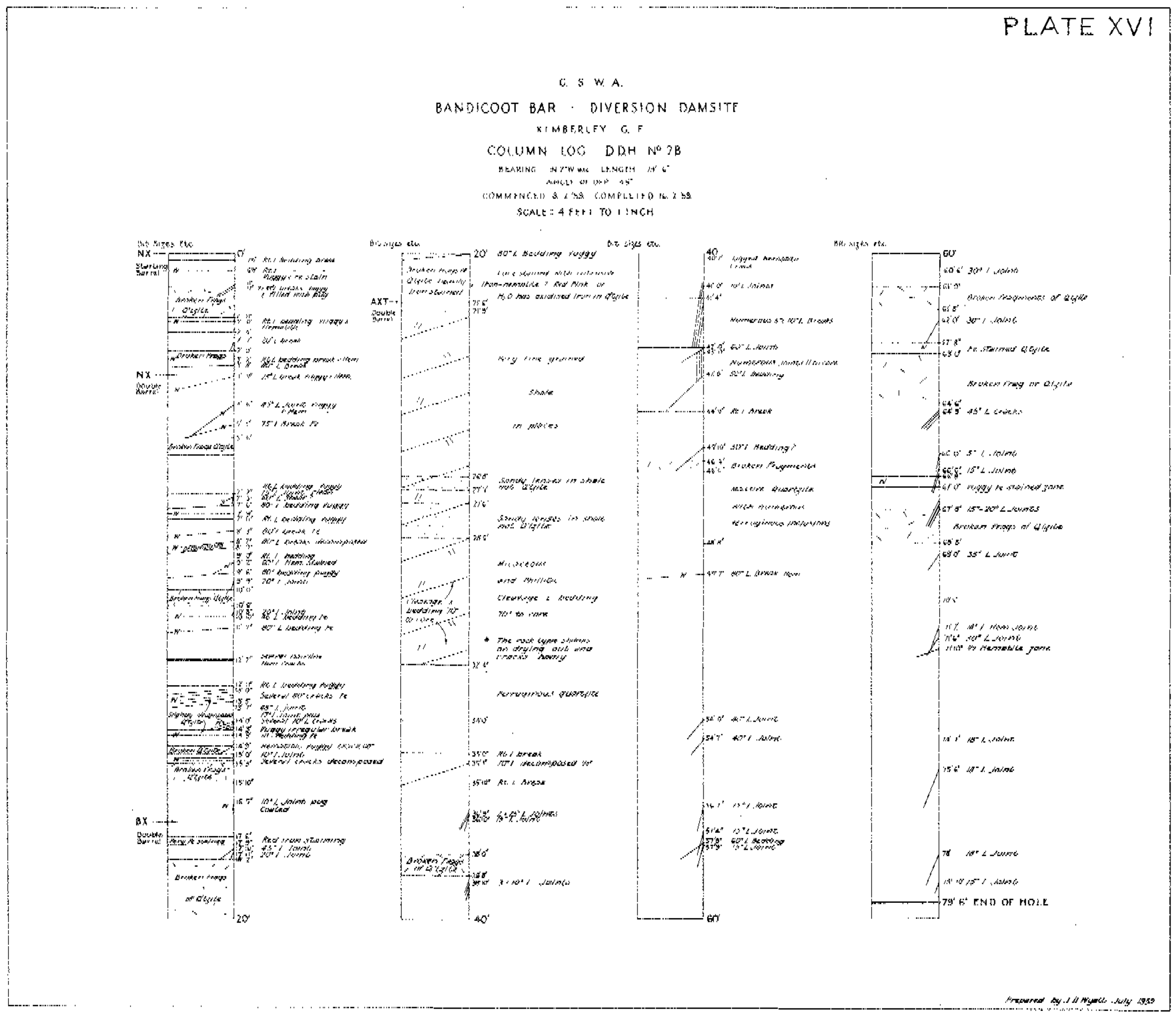
SCALE : 40 FEET TO AN INCH

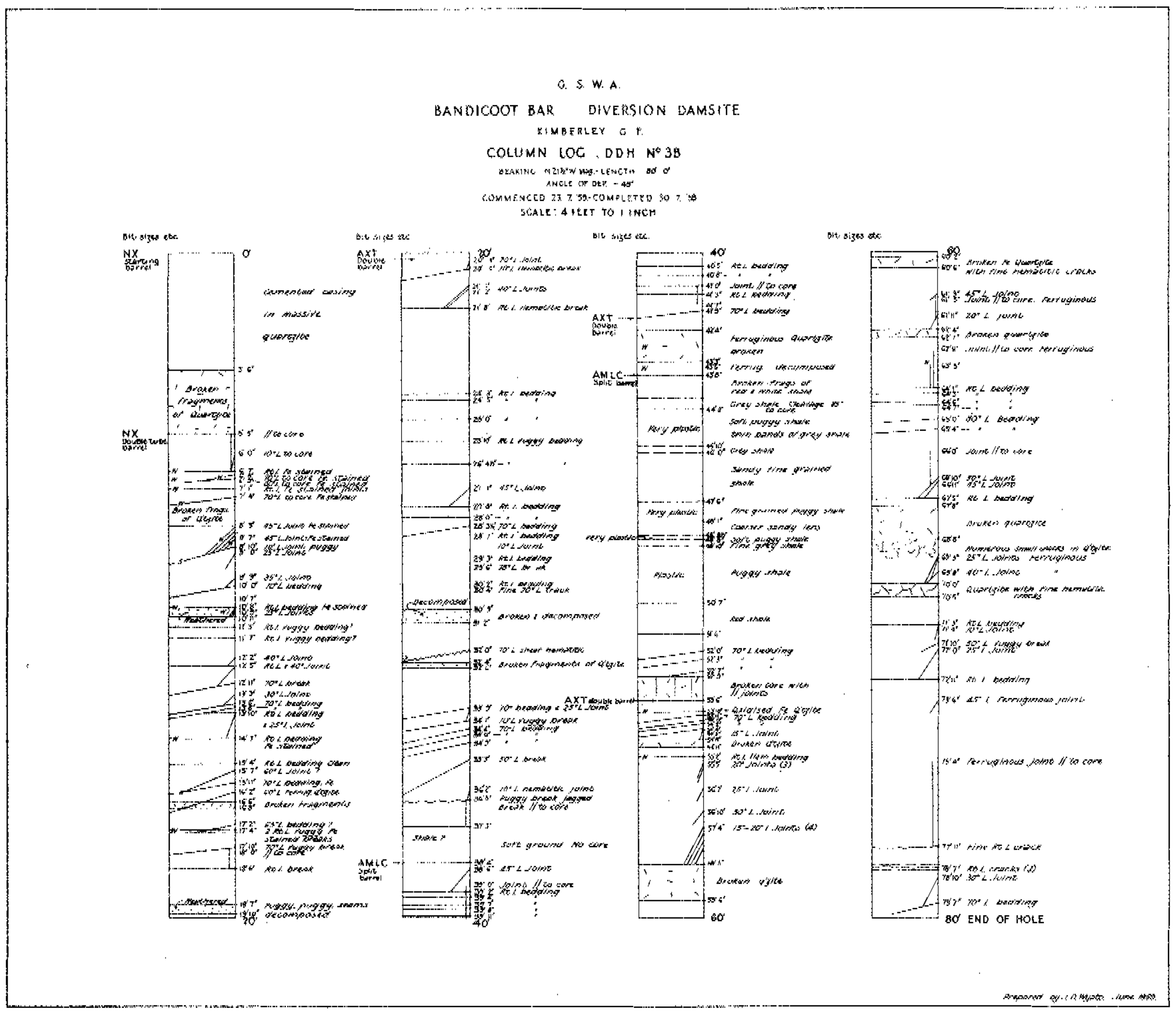


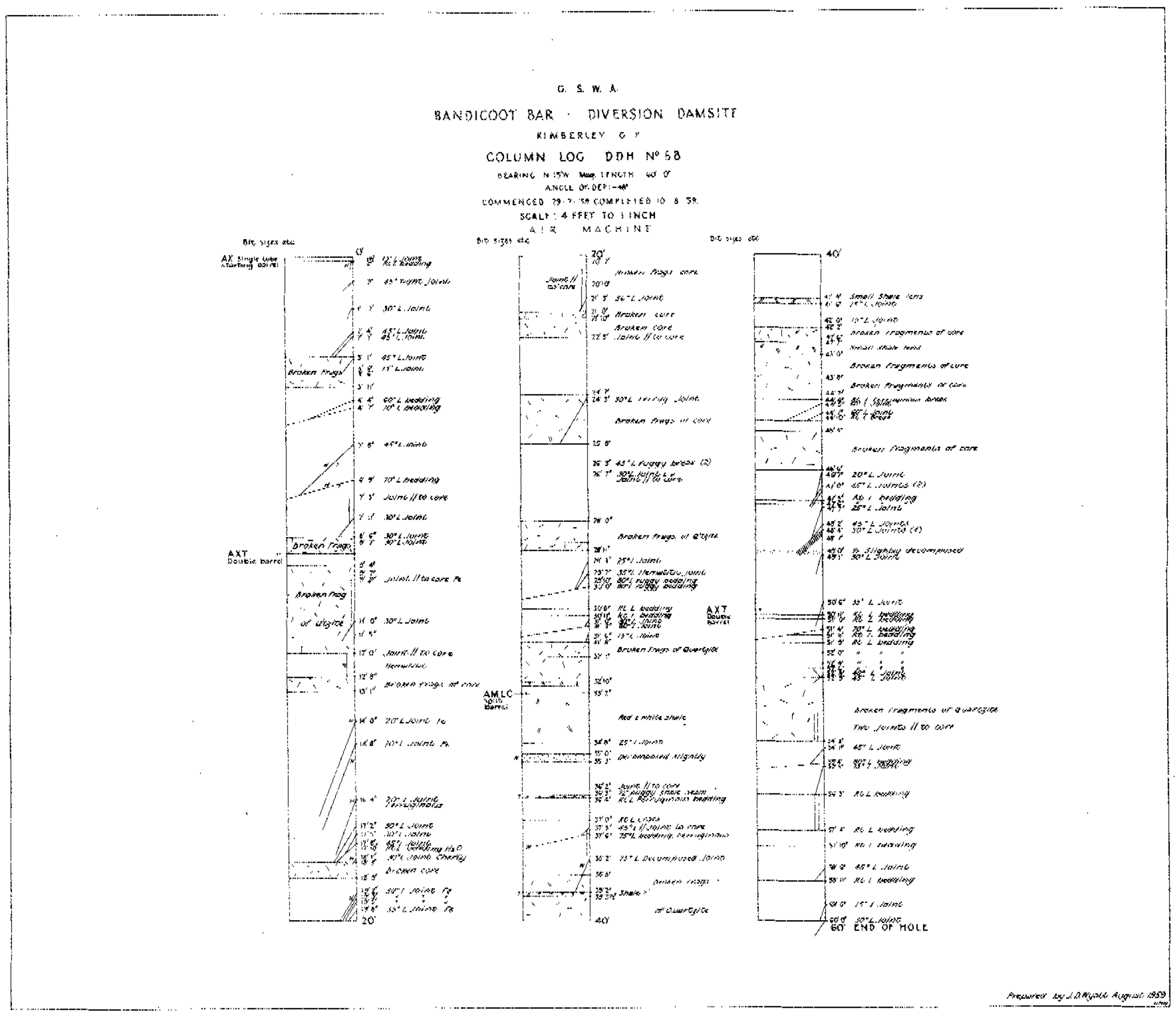
Prepared by J. D. Wyatt, Geologist, Sept 1958

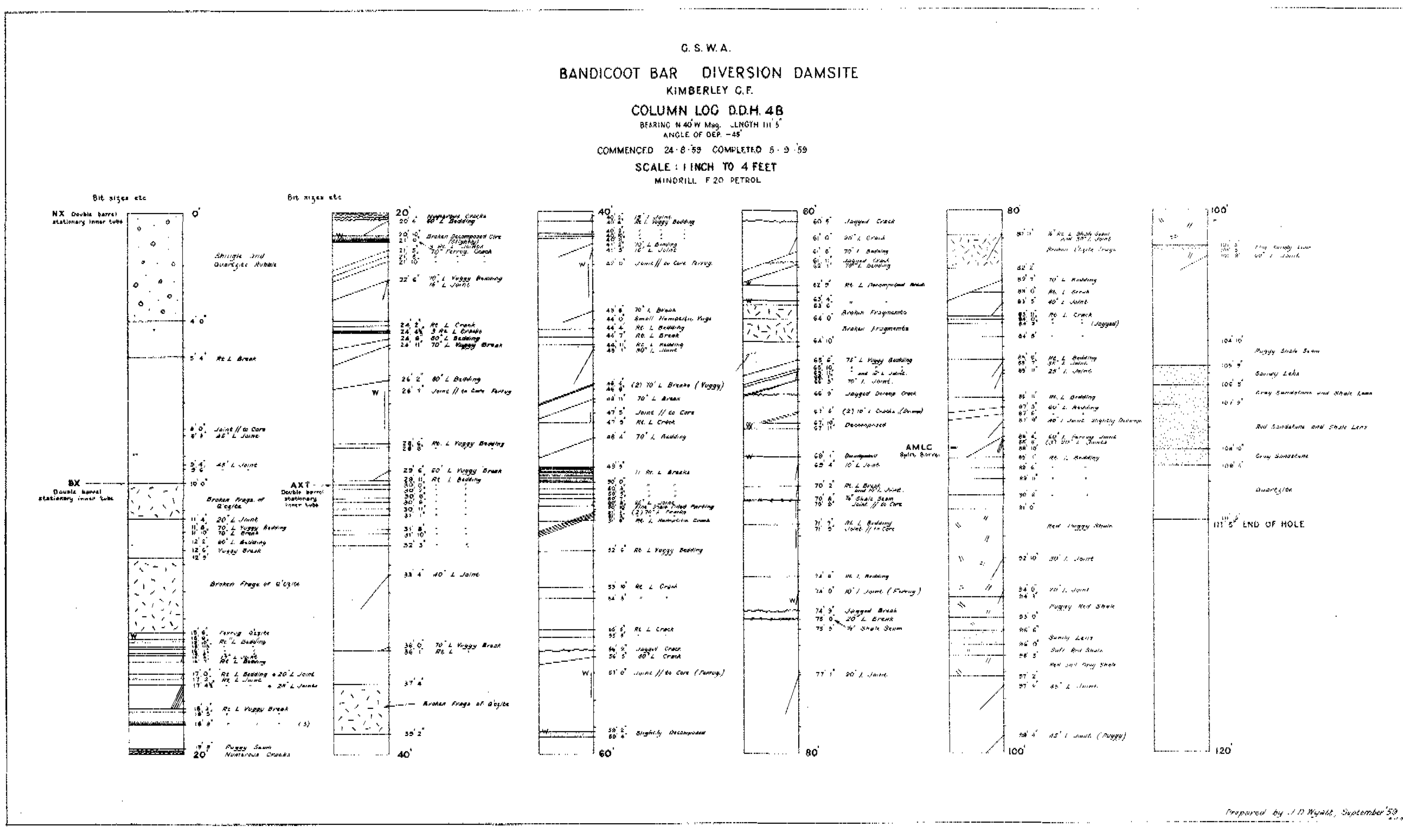
PLATE XVI


G. S. W. A.
BANDICOOT BAR · DIVERSION DAMSITE
KIMBERLEY G. F.
COLUMN LOG · DDH Nº 1B
BEARING 342 Mag LENGTH 73' 5"
ANGLE OF DEP. – 60°
COMMENCED 10.6.59 · COMPLETED 26.6.59
NMLC Split barrel
AMLC Split barrel
AXT Double barrel
BX Double barrel
BMLC Split barrel
73' 5" END OF HOLE
NOTE
S PROBABLE SHEAR
W PROBABLE H2O CARRYING JOINT
SCALE: 4 FEET TO 1 INCH
Prepared by J.D. Wyatt, June 1959.


G. S. W. A.
BANDICOOT BAR · DIVERSION DAMSITE
KIMBERLEY G. F.
COLUMN LOG DDH Nº 2B
SCALE: 4 FEET TO 1 INCH
NX Starting Barrel
NX Double Barrel
AXT Double Barrel
BX Double Barrel
79' 6" END OF HOLE
Prepared by J.D. Wyatt, July 1959


G. S. W. A.
BANDICOOT BAR DIVERSION DAMSITE
KIMBERLEY G. F.
COLUMN LOG . DDH Nº 3B
ANGLE OF DEP. – 45°
SCALE: 4 FEET TO 1 INCH
NX Starting barrel
NX Double tube barrel
AXT Double barrel
AMLC Split barrel
80' END OF HOLE


G. S. W. A.
BANDICOOT BAR · DIVERSION DAMSITE
COLUMN LOG DDH Nº 5B
SCALE: 4 FEET TO 1 INCH
AIR MACHINE
AXT Double barrel
AMLC Split barrel
60' END OF HOLE
Prepared by J.D. Wyatt, August 1959


G. S. W. A.
BANDICOOT BAR DIVERSION DAMSITE
KIMBERLEY G.F.
COLUMN LOG D.D.H. 4B
BEARING N 40°W Mag. LENGTH 111' 5"
ANGLE OF DEP. –45°
COMMENCED 24·8·59 COMPLETED 5·9·59
SCALE: 1 INCH TO 4 FEET
MINDRILL F 20 PETROL
Bit sizes etc
NX Double barrel stationary inner tube
BX Double barrel stationary inner tube
AXT Double barrel stationary inner tube
AMLC Split barrel
111' 5" END OF HOLE
Prepared by J.D. Wyatt, September '59

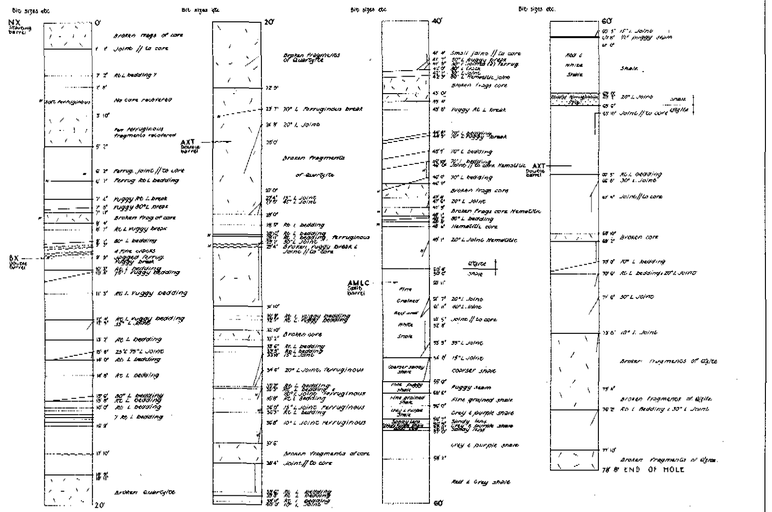
G. S. W. A.

BANDICOOT BAR - DIVERSION DAMSITE

KIMBERLEY G. F.

COLUMN LOG D.D.H. N° 6B

BEARING N 25°W Mag. LENGTH 78' 8"
ANGLE OF DEP - 45°
COMMENCED 5. 8. 59 COMPLETED 12. 8. 59
SCALE: 4 FEET TO 1 INCH



Prepared by J.D.Myatt August 1959

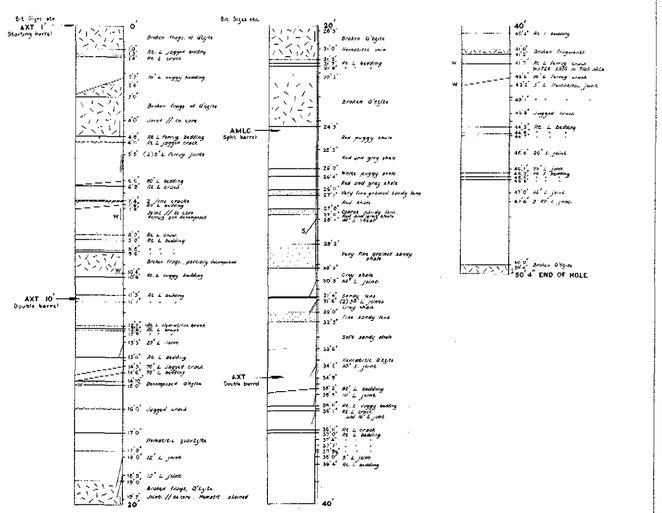
G. S. W. A.

BANDICOOT BAR - DIVERSION DAMSITE

KIMBERLEY G F

COLUMN LOG D.D.H. N° 7 B

BEARING N 30° W (mag) LENGTH 50' 4"
ANGLE OF DIP - 45°
COMMENCED 8. 9. 59 COMPLETED 14. 9. 59
SCALE : 1 INCH TO 4 FEET
MINDRILL E 500 AIR



Prepared by J. D. Myatt, September, 1959

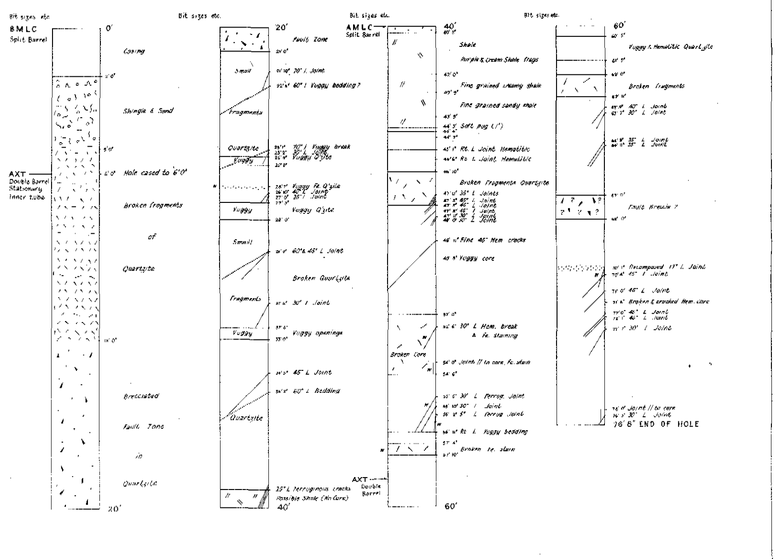
G. S. W. A.

BANDICOOT BAR DIVERSION DAMSITE

KIMBERLEY G. F.

COLUMN LOG D.D.H N° 8B

BEARING N 50°W Mag. LENGTH 78' 8"
ANGLE OF DEP - 45°
COMMENCED 13-8-59 COMPLETED 30-8-59
SCALE: 4 FEET TO 1 INCH
MINDRILL E 500 AIR



Prepared by J.D.Myatt August 1959

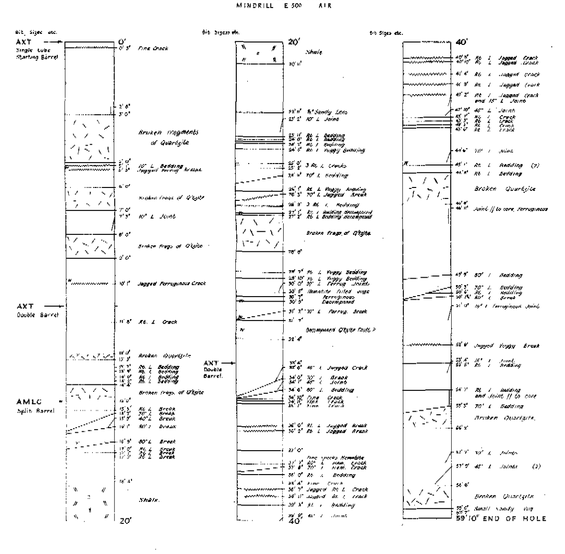
G. S. W. A.

BANDICOOT BAR DIVERSION DAMSITE

KIMBERLEY G. F.

COLUMN LOG DDH N° 9B

BEARING N 20°W Mag LENGTH 59' 10"
ANGLE OF DEP - 45°
COMMENCED 2. 9. 59 COMPLETED 7. 9. 59
SCALE: 4 FEET TO 1 INCH
MINDRILL E 500 AIR



Prepared by J. D. Myatt, September 1959

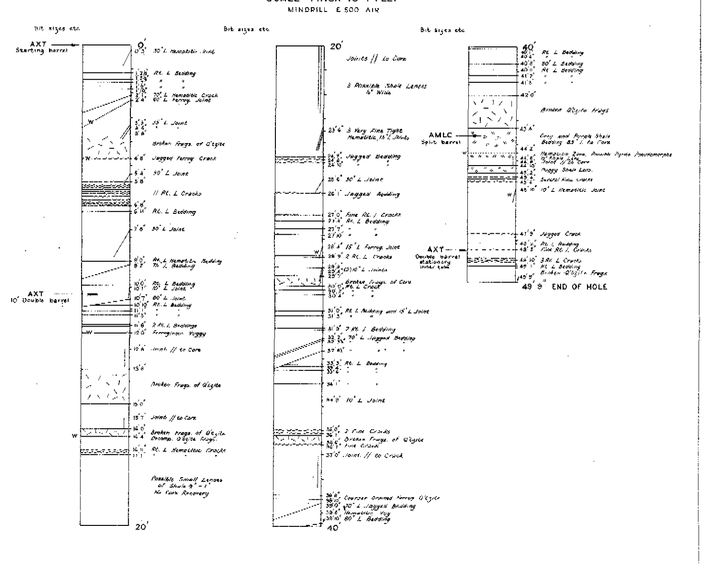
G. S. W. A.

BANDICOOT BAR DIVERSION DAMSITE

KIMBERLEY G.F.

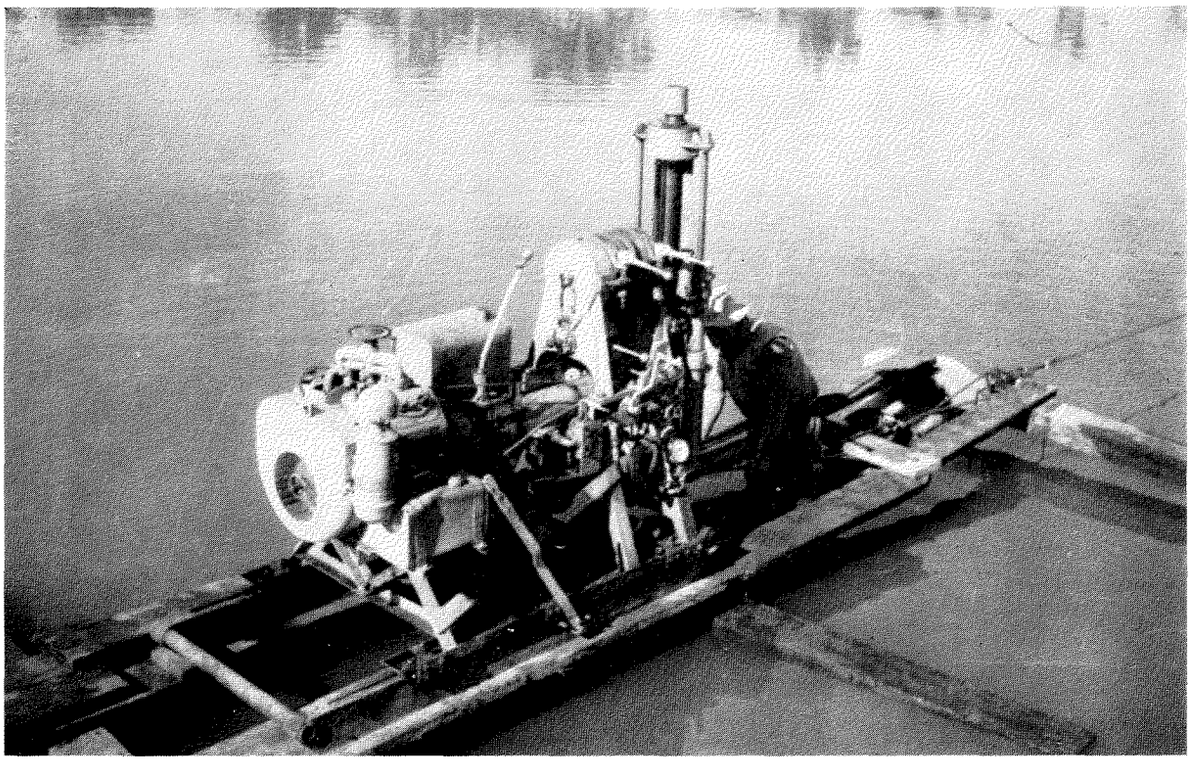
COLUMN LOG D.D.H N° 10 B

BEARING N 20° W (Mag.) LENGTH 49' 8"
ANGLE OF DIP - 45°
COMMENCED 17. 9. 59 COMPLETED 21. 9. 59
SCALE : 1 INCH TO 4 FEET.
MINDRILL E 500 AIR



Prepared by J. D. Myatt, September 1959

Shifting Petrol Rig Over Typically Rugged Surface of Bandicoot Bar.



Shifting Petrol Rig Over Water by Means of Improvised Bridge to Site of D.D.H.6B.

Air Machine Showing Rigging Horse and Anchoring Ropes. Site D.D.H.

Petrol Rig Showing Anchor Bolts. Site D.D.H.3B.

Diamond Drilling.

Two drills were used during the season, initially a Mindrill F20 petrol driven machine which was later supplemented by a Mindrill E500 air driven rig.

The larger petrol rig which weighed approximately 30 cwt. was in all cases but one, shifted manually from site to site. An average of six days was needed to accomplish the moves due to the extremely rugged terrain through which tracks had to be cut by blasting and due to the depth of intervening water which required improvised bridging. (See photos.)

The smaller air rig was more easily shifted but rather more difficult to rig, the machine being bolted to a steel two or four legged base and the whole anchored to the ground with cemented two feet long anchor bolts and wire ropes.

Even when secured in this fashion, some adjustment was always necessary to true up the machine during the drilling of the hole.

In the case of the more solid petrol rig, as long as the machine was secured to well bedded timber and then anchored to bed rock with cemeted bolts at the two front corners, no movement took place. (See photos.)

Bit Sizes.—With the petrol rig NX size bits were used during the first 10 or 20 feet with a reduction through BX at 30 feet, to a minimum of AX for the rest of the hole. When AMLC split barrell equipment was used at shale intersections the resultant core size was nearer EX.

With the smaller E500 machine most holes were drilled with AX size bits throughout.

Core Recovery.

During the 1959 season a total of 719 feet 7 inches was drilled with a recovery of 623 feet 6 inches or 86.6 per cent.

Total core recovery figures for the F20 rig were 7.8 per cent. better than those obtained with the E500 machine.

The following tables show the various recovery figures for each hole, total recovery percentages for each machine and the comparative results from each hole when using either the split barrel or double barrel equipment:—

TABLE I.

Hole No.	Drilled Footage	Recovered Footage	Recovery	Machine
	ft. ins.	ft. ins.	%	
1B	73 5	61 11	84·4	F20 Petrol
2B	79 6	72 3	90·9	do.
3B	80 0	76 3	95·3	do.
4B	111 5	103 2	93·3	do.
5B	60 0	56 0	93·3	E500 Air
6B	78 8	66 7	84·7	F20 Petrol
7B	50 4	42 1	83·6	E500 Air
8B	76 8	55 3	72·2	do.
9B	59 10	49 4	82·4	do.
10B	49 9	40 8	81·7	do.
	719 7	623 6	86·6	

TABLE II.

Machine	Total Drilled Footage	Total Recovered Footage	Recovery
	ft. ins.	ft. ins.	%
E500 Air	296 7	243 8	82·2
F20 Petrol	423 0	380 10	90·0

TABLE III.

Hole No.	Machine	Split Barrel Equipment			Double Barrel Equipment		
		Footage Drilled	Footage Lost	Loss	Footage Drilled	Footage Lost	Loss
		ft. ins.	ft. ins.	%	ft. ins.	ft. ins.	%
1B	F20 Petrol	32 10	1 8	5	40 7	9 10	24·1
2B	do.	Not Used			79 6	7 6	9·1
3B	do.	9 10	1	0·85	70 2	3 8	5·2
4B	do.	22 7	2 7	10·1	88 10	5 8	6·3
5B	E500 Air	17 6	1 6	8·6	42 6	2 6	5·9
6B	F20 Petrol	15 1	1 7	11·0	63 7	10 6	16·5
7B	E500 Air	10 3	1 0	9·7	40 1	7 3	18·1
8B	do.	18 10	2 4	12·4	57 10	19 2	33·0
9B	do.	18 4	5 2	28·3	41 6	5 6	13·2
10B	do.	4 8	6	10·7	45 1	8 7	19·1

From the above Table III it can be seen that in most of the ten holes drilled, better recovery figures were obtained using the split barrel than the ordinary double barrel with the stationary inner tube, although theoretically there is no reason to suppose that this should be the case. Especially as the split barrel should allow some water to circulate around the core itself with possible loss of the softer fraction.

The only reason that can be put forward is that when the split barrel was put on to intersect an important contact zone, more care was taken by the driller, with improved results.

In the three cases where the split barrel behaved poorly, namely in DDH's Nos. 4B, 5B and 9B, possible explanations can be found in 4B and 9B.

In DDH No. 4B the quartzite appeared to be less jointed and definitely gave the impression of drilling a lot more easily than previous holes. Maximum runs were more frequent with excellent core recoveries.

In the case of 9B, drilled with the air machine, the shale was very puggy, frequently plugging in both the water holes and the inside of the barrel, causing the shale to be ground away with resulting poor core recovery.

Even in view of the better recovery figures using split barrels, it is not advocated that they replace the double barrel stationary inner tube gear for the following reasons:—

(1) The drilling is slower and more expensive, especially in the NMLC and BMLC sizes.

(2) The split barrel equipment is only necessary in contact or highly faulted zones where detailed logging is required. In the more massive rock types, both recovery and logging were just as efficient with double barrel as with split barrel equipment.

Photographic Technique.

During the season a photographic record was kept of all core recovered, using a 35mm camera and black and white film.

Three methods of photographing were used as follows:—

Method I—

Vertical photographs were taken of all core recovered in split barrels, at the end of each run.

Method II—

Vertical photographs were taken of core laid out on 5 feet galvanised iron sheeting. It was found that each sheet held approximately 40 feet of core and two overlapping photographs were required to cover the 5 feet sheet from a vertical distance of 4½-5 feet.

Although the full field of view could be taken in one photograph from a greater height (approximately 10 feet) too much background was included with accompanying loss of detail.

Method III—

One oblique photograph was taken of the full amount of core laid out on galvanised iron at the completion of the hole.

Of the three methods, Method II was found to be most suitable from the reference point of view, due to the comparative effect of the core laid out in rows and the jointing detail exhibited.

With Method I, too many photographs were required, laid end to end and the effect was rather disjointed.

With Method III, the comparative effect was still obtained but the oblique photograph did not show the jointing detail obtained in the vertical shots.

Conclusions.

From the results of the season's drilling several conclusions have been reached with regard to future use of split barrel equipment, photographic methods and drill rig types.

Generally, the split barrel can be considered an admirable tool in contact zones between rocks of differing hardness, as experienced at Bandicoot Bar.

However, both before and after the contacts have been intersected normal equipment (i.e., double, not single barrel) is quite satisfactory.

If the change of rock type was not from hard to soft, but only between rocks of comparable hardness then it is possible that the split barrel could be eliminated altogether, but in the case of the Bandicoot Bar shale with its puggy seams, extraction of core (in a state suitable for logging) from the double barrel equipment would be almost impossible.

Further, from a purely geological point of view, zones of weakness and contact zones can be logged in their original state if split barrels are used.

With regard to the photographic technique used during the 1959 season, some change appears necessary. Firstly, it is not considered worth while to photograph each run of core separately as it is extracted from the barrel, whether split or double.

A much more satisfactory method being to photograph vertically the core on galvanised iron sheeting, and then take one oblique shot as a safeguard against any failure in either of the two overlapping vertical photographs.

As far as drilling equipment goes, whilst the larger F20 rig is the more efficient machine, the use of two additional smaller machines will be essential in the more difficult sites chosen at the main damsite. Further, it is considered that these machines should incorporate an hydraulic pulling device to replace the more cumbersome tripods used in the 1959 season, especially as most of the holes will be drilled from small cubby-holes excavated from the sides of the steep slopes, where in such a case there will be no room for the erection of tripods.

J. D. WYATT,
Geologist.

10/11/59.

REPORT ON DIAMOND DRILLING OF ABANDONED GOLD SHOWS D.D.H. No. C1., SITE A1, G.M.L. 336 "LADY LOCH" G.M. COOLGARDIE.

By R. R. Connolly,

Geological Survey of W.A.

Location and Access.

The "Lady Loch" G.M. is situated appoximately 2½ miles S.E. from the Government Offices in Coolgardie (refer Mines Litho L5A/20) and is accessible by track running through the State Battery reserve. The main shaft is still recognizable and the spoil from a now unused earth dam to the west of the main shaft is also an identifying feature. There are no buildings on the lease, no work having been done since 1906.

Production.

The ground which was last held as G.M.L. 336 in 1907, was first taken up in 1893 and later amalgamated with the "Forrest King" (G.M.L. 284) and "Ne Plus Ultra" (G.M.L. 745) to form the holdings of Lady Loch Gold Mines Ltd. Prior to this amalgamation, recorded production was 5,260 ozs. from 1,697 tons of ore, and this is probably the total production for the mine as the companies activities appeared to be confined to the "Forrest King" Lease.

The Ore Body.

Information on the attitude, dimensions and grade of the ore-body is very meagre, amounting to a level plan originally supplied by the company to the Mines Department, and a written description of the mine by Blatchford in 1898 (G.S.W.A. Bulletin No. 3 p. 68), these two sources of information being at variance in some places. From these sources a tabular quartz ore-body striking N76°W and 290 feet long, dipping north at 76° and 150 feet deep and 4 inches to 6 feet wide, has been deduced. No plunge information exists and a steep or vertical plunge has therefore been assumed.

Site A1 was laid out 380 feet N 90° 30' E from the main shaft to be drilled on an azimuth of 194° at a depressed angle of 50°. It was designed to cut the possible downward extension of the ore-body at 300 feet vertical depth and 70 feet from the western edge of the ore-body, assuming a vertical plunge. The proposed drill hole length was 520 feet, the reef being anticipated at 420 feet.

Mineralization and Assay.

A total of 18 samples were submitted for assay to the School of Mines, Kalgoorlie, with results as shown in the appended table. The ore-body, quartz in basic lavas, was intersected at 491' 9" which was approximately 70 feet deeper than planned. This indicates an increase in dip of the reef below the No. 2 (150') level. As a result, the drill hole was carried on to 590 feet to give the desired 100 feet footwall penetration.

The ore body was well developed with some pyritic mineralization but carried no gold.

Surveying.

The hole was surveyed at intervals of 100 feet and results of the survey are shown in the appended table.

Core Recovery.

An analysis of the core recovery is as follows:—

Depth		Core Recovered	Per Cent Recovered
From	To		
ft.	ft.	ins.	
0	100	372	31
100	590	5,627	95·7
0	590	5,999	84·7

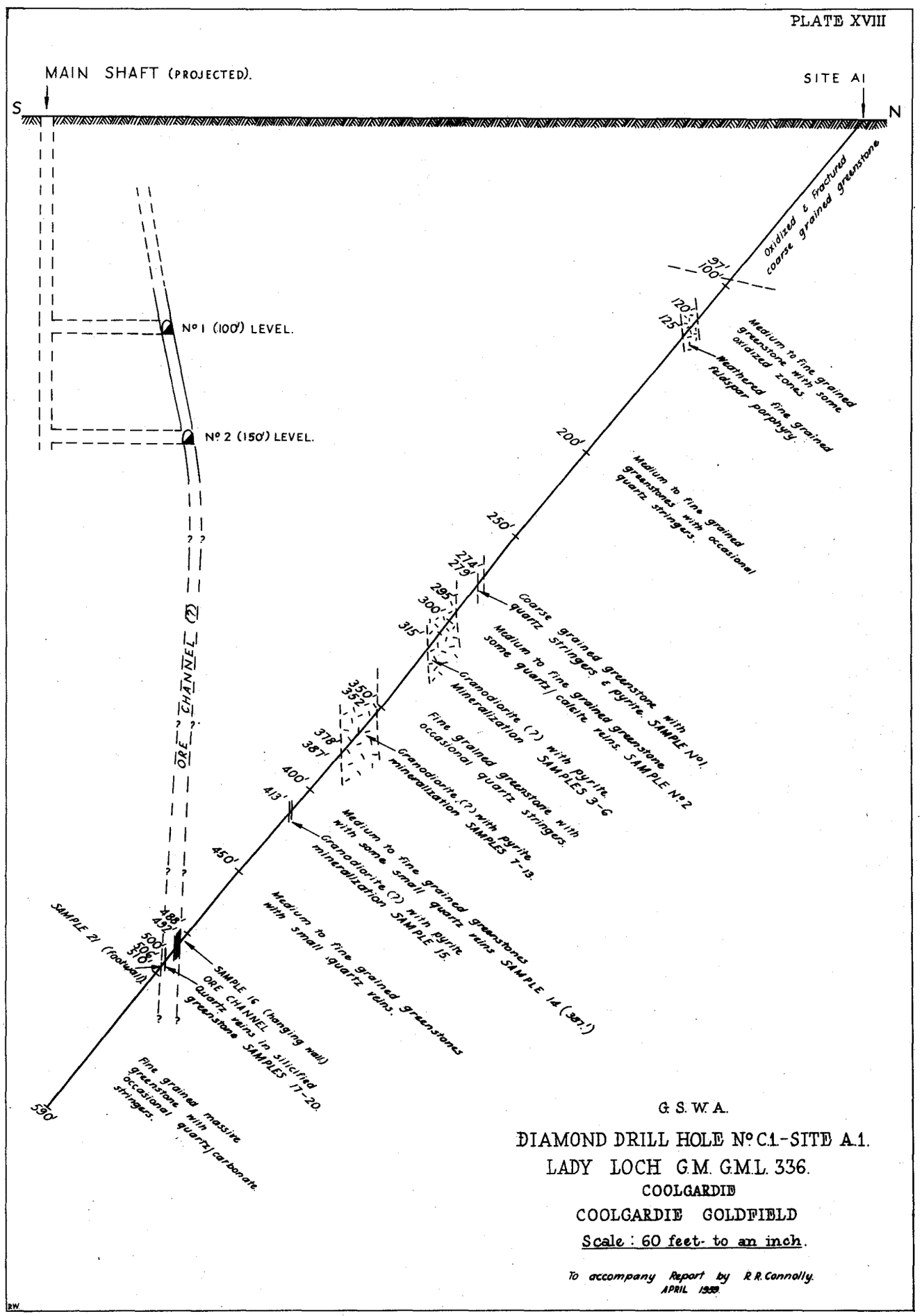
Conclusions.

The first of a proposed two hole programme designed to test the downward continuation of the Lady Loch reef, cut the reef at 491' 9" in the drill hole. Although the quartz reef was still strong it carried no gold. In view of the persistence of the reef to the vertical depth of 350 feet, the drilling of the second hole 150 feet to the east along the strike is warranted to test the possibility of an easterly plunging ore-body.

R. R. CONNOLLY,
Geologist.

19/12/1958.

PLATE XVIII



G.S.W.A.

DIAMOND DRILL HOLE No C.1-SITE A.1.

LADY LOCH G.M. G.M.L. 336.

COOLGARDIE

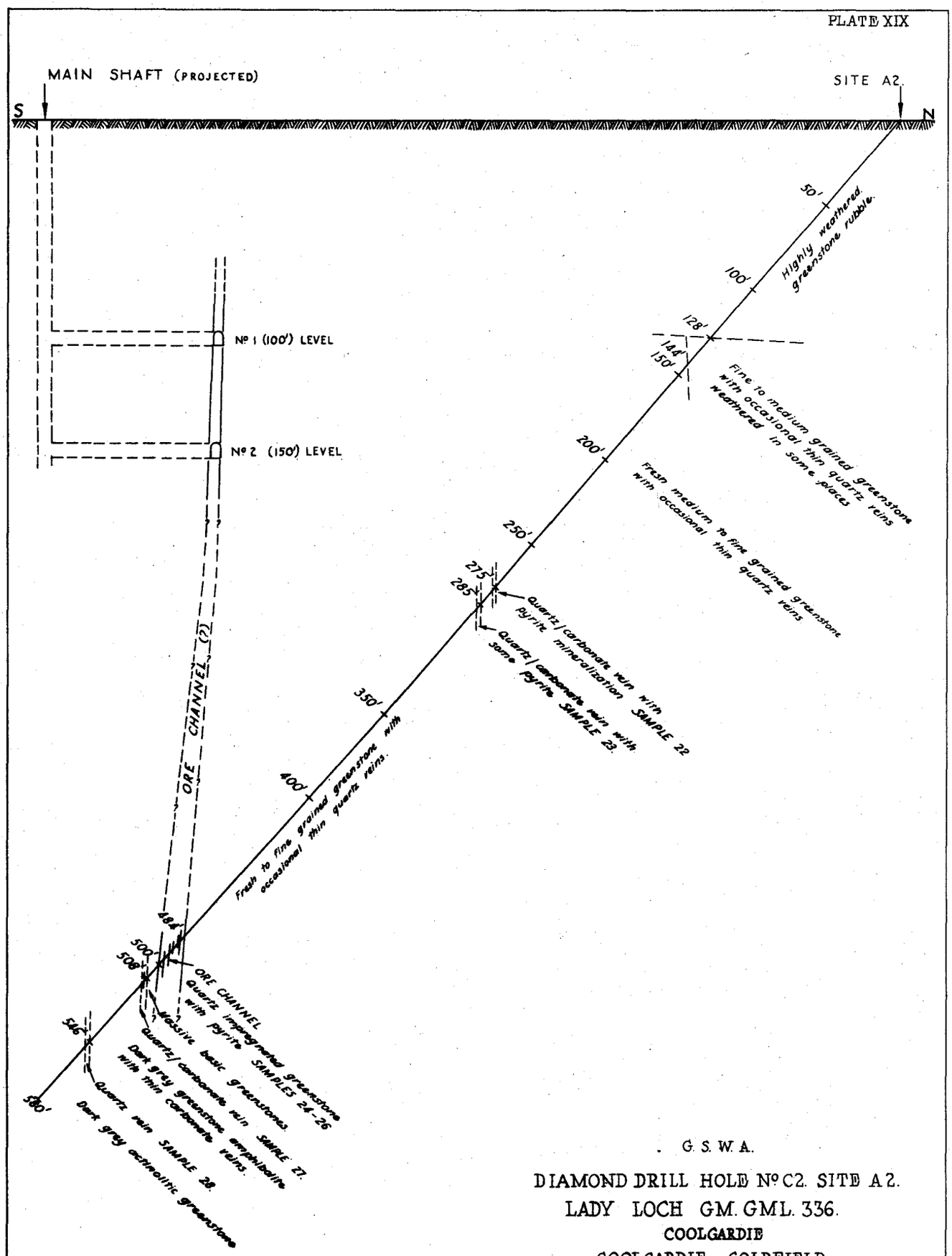
COOLGARDIE GOLDFIELD

Scale : 60 feet- to an inch.

To accompany Report by R.R. Connolly.
APRIL 1939.

RW

PLATE XIX



G. S. W. A.

DIAMOND DRILL HOLE Nº C2. SITE A2.

LADY LOCH GM. GML. 336.

COOLGARDIE

COOLGARDIE GOLDFIELD

Scale : 60 feet to an inch

To accompany Report by R.R. Connolly.
APRIL 1959.

LADY LOCH G.M.L. 336.

Crown Diamond Drilling.

D.D.H. No. C1, Site A1.

Commenced: 8th October, 1958. Completed: 16th December, 1958.

Sample List.

G.S.W.A. Sample No.	Drill Hole Depth From	Drill Hole Depth To	Core Length	Assay	Remarks
	ft. ins.	ft. ins.	ins.	dwts/ long ton	
GS/C/ 1	275 3	278 3	36	Trace	Quartz/pyrite/greenstone.
GS/C/ 2	289 6	292 6	36	Trace	9 in. quartz/calcite/pyrite.
GS/C/ 3	294 6	298 6	48	0·34	Well mineralized granodiorite (?).
GS/C/ 4	298 6	302 6	48	Trace	
GS/C/ 5	302 6	306 6	48	Trace	
GS/C/ 6	306 6	310 6	48	Trace	
GS/C/ 7	352 4	356 3	47	Trace	Well mineralized granodiorite (?).
GS/C/ 8	356 3	360 3	48	Trace	
GS/C/ 9	360 3	364 3	48	Trace	
GS/C/10	364 3	368 3	48	Trace	
GS/C/11	368 3	372 3	48	Trace	
GS/C/12	372 3	376 3	48	Trace	
GS/C/13	376 3	380 3	48	Trace	
GS/C/14	386 3	389 3	36	Trace	Greenstone with quartz veins.
GS/C/15	412 0	415 0	36	Trace	12 in.granodiorite/pyrite.
GS/C/16	488 9	491 9	36	Trace	Hanging wall.
GS/C/17	491 9	494 9	36	Trace	ORE BODY. Tota 54 in. quartz, balance silicified greenstone with pyr'te mineralization.
GS/C/18	494 9	497 9	36	Trace	
GS/C/19	497 9	502 0	51	0·11	
GS/C/20	502 0	506 0	48	0·34	
GS/C/21	506 0	510 0	48	Less than 0·1	Footwall.

Survey Results.

Depth	Angle of Depression	Azimuth	Remarks
ft.			
100	50°	S.6°W.	Cased to 80 feet—influenced survey instrument
200	50°	S.15°W.	
300	52°	S.20°W.	
400	49°	S.9°W.	Doubtful reading
500	51°	S.16°W.	

"LADY LOCH" G.M.

Crown Diamond Drilling.

D.D.H. No. C1, Site No. A1.

Position of Hole Collar: 380 feet N 9° 30′ E from main shaft.

Azimuth: 194°. Machine Used: Mindrill A2000.

Angle of Depression: 50°. Core Size: AXT.

Commenced: 8th October, 1958. Completed: 22nd December, 1958.

Driller: F. Jennings.

Final Drill Hole Depth: 590 feet.

Logged by: R. R. Connolly and G. H. Low.

Summarised Log.

From	To	Description
ft. ins.	ft. ins.	
0 0	97 0	Oxidised and fractured coarse grained greenstone.
97 0	120 0	Medium to fine grained greenstone with some oxidized zones.
120 0	125 0	Weathered fine grained feldspar porphyry
125 0	274 3	Medium to fine grained greenstone with occasional quartz stringers.

Summarised Log—*continued*

From	To	Description
274 3	279 0	Coarse grained greenstone with occasional quartz stringers and some pyrite mineralization.
279 0	295 0	Medium to fine grained greenstone with some quartz/calcite veins.
295 0	315 6	Granodiorite (?) with pyrite mineralization.
315 6	352 4	Fine grained greenstone with occasional quartz stringers.
352 4	378 4	Granodiorite (?) with pyrite mineralization.
378 4	492 0	Medium to fine grained greenstone with occasional quartz stringers.
492 0	506 6	QUARTZ REEF. Includes some silicified greenstone.
506 6	590 0	Medium to fine grained greenstone with occasional quartz carbonate veins.
		END OF HOLE.

REPORT ON DIAMOND DRILLING OF ABANDONED GOLD SHOWS D.D.H. No. C2, Site A2, G.M.L. 336 "Lady Loch" G.M. Coolgardie.

By R. R. Connolly,

Geological Survey of W.A.

General Information.

Details of location and access, production and dimensions of the ore-body have already been given in a previous report on the drilling of Hole No. C1 on this lease and will not be repeated here.

Purpose of the Drill Hole.

The second hole on this lease was designed to test the possibility of an easterly plunging ore-body, at a vertical depth of 300 feet and 150 feet along the strike to the east from the first hole.

Site A2 was located 398 feet N 31° 30′ E from the main shaft, to be drilled on an azimuth of 194° at a depressed angle of 50°. As originally planned, the drill hole length was 540 feet including 100 feet footwall penetration. After the drilling of hole C1 however, a marked steepening or even reversal of dip was indicated, resulting in a revised reef intersection of 480 feet drill hole length, and 580 feet total drill hole length.

Mineralization and Assay.

A total of seven samples were submitted for assay to the School of Mines, Kalgoorlie, with results as shown in the appended table. The quartz reef, representing the downward continuation of the ore-body as worked in the mine, was intersected at 484 feet at which point the reef had an apparent thickness of 16 feet or a true width of 10 feet. The reef here was not as strong or well defined as encountered in the first drill hole, and consisted in hole C2 of quartz carbonate veins (maximum true width 13 inches) interspersed with greenstone, the whole being weakly mineralized with pyrite.

Assays of the core taken from the reef intersection showed less than 0.01 dwts. per long ton of gold.

Other small quartz carbonate veins were intersected in the hole and core from these sections was assayed. None resulted in more than a trace of gold.

Surveying.

The hole was surveyed at intervals of 100 feet and results of the survey are shown in the appended table.

Core Recovery.

An analysis of the core recovery is as follows:—

Depth		Core Recovered	Per Cent Recovered
From	To		
ft.	ft.	ins.	
0	151	342	18·9
151	580	5,009	97·3
0	580	5,351	76·5

Conclusions.

A programme designed to test by diamond drilling the possible extension in depth of the "Lady Loch" goldmine has been completed. Two holes 150 feet apart in the direction of the strike of the ore-body were drilled beneath the old workings, and although each hole successfully intersected the ore channel, assays proved the channel lacking in gold mineralization at this depth. No further drilling could be recommended.

R. R. CONNOLLY,
7/4/1959. Geologist.

LADY LOCH G.M.L. 336.

Crown Diamond Drilling.

D.D.H. No. C2, Site A2.

Commenced: 23rd December, 1958. Completed: 2nd February, 1959.

Sample List.

G.S.W.A. Sample No.	Drill Hole Depth		Core Length	Assay	Remarks
	From	To			
	ft. ins.		ins.	dwts./long ton	
GS/C/22	275	278	36	Less than 0.1	Quartz carbonate veins with pyrite mineralization in basic fine to medium-grained greenstone.
GS/C/23	285	288	36	do.	
GS/C/24	484	487	36	do.	
GS/C/25	487	490	36	do.	
GS/C/26	496	500	48	do.	
GS/C/27	508	511	36	do.	
GS/C/28	546	549	36	do.	

Survey Results.

Depth	Angle of Depression	Azimuth	Remarks
ft.			
100	49°	N.40°W.	In casing.
200	49°	S.17°W.	
300	49°	S.16°W.	
400	48°	S.15°W.	
500	48°	S.16°W.	

LADY LOCH G.M.

Crown Diamond Drilling.

D.D.H. No. C2, Site No. A2.

Position of Hole Collar: 398 feet N 31° 30′ E from main shaft.

Azimuth: 194°. Machine Used: Mindrill A2000.

Angle of Depression: 50°. Core Size: AXT.

Commenced: 23rd December, 1958. Completed: 2nd February, 1959.

Driller: F. Jennings.

Total Depth: 580 feet.

Logged by: G. H. Low.

Summarised Log.

From	To	Description
ft. ins.	ft. ins.	
0 0	128 6	Highly weathered greenstone rubble.
128 6	144 0	Fine to medium grained actinolitic greenstone weathered in some places.
144 0	484 0	Fresh, medium to fine grained greenstone with occasional thin quartz veins.
484 0	500 0	ORE CHANNEL. Quartz impregnated medium grained dark grey greenstone with some pyrite mineralization visible veins oriented at 35° to core axis.
500 0	508 0	Massive, dark grey basic greenstone with some quartz/carbonate veins.
508 0	511 0	Irregular quartz/carbonate vein with sparse pyrite mineralization.
511 0	546 0	Dark grey greenstone amphibolite with thin carbonate veins oriented at 40° to core axis.
546 0	549 0	Irregular quartz/carbonate vein with some pyrite.
549 0	580 0	Dark grey actinolitic greenstone. END OF HOLE.

REPORT ON EXPLORATORY DRILLING OF THE TALLERING RANGE IRON DEPOSITS.

By R. R. Connolly.

CONTENTS

Introduction.

Although the iron ore deposits of the Tallering Range had been known to exist for many years, they assumed in 1957, a new importance when the State Government of the day announced its intention of seeking a permit from the Commonwealth Government to export one million tons of ore from these deposits to an overseas buyer. At this time very little was known about the deposits beyond the measurement of surface outcrops and analyses of specimen material only.

Gibb Maitland[1] in 1923 made a brief inspection of the Tallering Range and took specimens which showed on analysis an iron content of 70 per cent. In his report he remarked that several millions of tons of high grade iron ore would be available from the three deposits in the range.

W. Johnson[2] examined the outcrop ore in the course of a general geological investigation of the surrounding areas, measured the outcrop dimensions and took samples from each of the three deposits in the range. He calculated the total tonnage of iron ore above the level of the surrounding plain in the three deposits to be 3.517 million tons.

In 1957, following the publicity given to the Government's proposed export moves, the writer, accompanied by Mr. L. Fimmell, laboratory technician, re-examined the northernmost (Tallering Peak) deposit in conjunction with the inspection of an applied for mineral claim, the boundaries of

[1] 1924.—A. GIBB MAITLAND: Annual Progress Report of the Geological Survey of Western Australia for the year 1923.

[2] 1950.—W. JOHNSON: Geological Survey of Western Australia, Bulletin No. 106; A Geological Reconnaissance Survey of Parts of the Yalgoo, Murchison, Peak Hill and Gascoyne Goldfields.

which enclosed the outcrop iron ore. A profile and several cross sections were measured using an Abney level and linen tape, and an attempt was made to assess the tonnage of ore available by open cut mining down to an assumed base level.[3]

In June, 1958 Mr. G. H. Low and the writer were instructed to select sites for four diamond drillholes, two at the "Tallering Peak Lens" and one each at the "Middle Lens" and the "Tallering Trig. Lens", each hole being designed to test the downward continuation of the ore bodies at 400 feet down dip from the outcrop. Theodolite, plane table and telescopic alidade work was done to contour the three deposits and select the drill sites, the results of which survey appear on the accompanying Geological Map.

Mr. A. Horsham was the successful tenderer for a contract called by the State Mining Engineer for approximately 2,000 feet of drilling at AXT size from the selected sites, hiring for the purpose the Department's Mindrill A3000 drill and ancillary equipment. Actual drilling was commenced on 28th July, 1958 and completed on 10th September, 1959.

In the course of the drilling, due to pressure of other commitments, examination of the core was entrusted to four officers of the Geological Survey, viz., Messrs. Low, Noldart, Wyatt and the writer. Responsibility for the selection of the drill sites lies with Mr. Low, who was in charge of the survey of the deposits in 1958 under the direction of the Government Geologist, Mr. H. A. Ellis.

Location and Access.

Tallering Range is located some 30 miles N14°E from Mullewa, and is accessible by road following the northern telegraph line from Mullewa for 35 miles and a further distance westerly of 4.9 miles by fence track (see locality plan on accompanying map). Mullewa is 50 miles by rail and road from the port of Geraldton.

Prior to the commencement of drilling, a serviceable road was constructed from the main road (telegraph line) round the northern extremity of the range and along its western flank with spur roads to each drill site. Although it is not likely to be maintained, this road should provide easy access to the range for many years to come.

Water supplies in the area are limited to a few sheep station wells. One, immediately to the north of Tallering Peak, was reconditioned by the drilling contractor and used with the permission of the "Wandina" station management for domestic and drilling water purposes. It would not however, meet much more than these limited requirements. The Greenough River, which passes some five miles to the south of the range, is dry for the greater part of the year and water for the requirements of a mining settlement would need to be the subject of further investigation.

Timber suitable for mining operations does not exist in the immediate vicinity of the range where stunted mulga scrub predominates.

The Drilling Programme.

As mentioned earlier, the programme was designed to test the three ore bodies at a depth of 400 feet down dip from the outcrop.

Two holes from sites A and B respectively were drilled into the Tallering Peak Lens, both holes being at an azimuth of 160° mag. and depressed angle of 60° and some 250 feet apart.

One hole from site C was drilled into the middle lens at an azimuth of 138° mag. and a depressed angle of 60°.

One hole from site D was proposed to be drilled at an azimuth of 144° mag. and a depressed angle of 50°, but it was later found that vehicular access to the site was unobtainable. Site D was therefore relocated 210 feet down the surface slope and the hole drilled at the same azimuth direction, but at a depressed angle of 45°.

[3]1959, R. R. Connolly: Geological Survey of Western Australia, Bulletin No. 114; Miscellaneous Reports for 1957.

The holes were drilled in the order as listed above and were numbered 1 to 4. Hole No. 2 from site B was abandoned at 223 feet due to extremely bad drilling conditions and redrilled from a position two feet south of the original site. All four planned intersections were ultimately made, which is to the credit of the drilling contractor Mr. A. Horsham, whose tenacity in the face of exasperating conditions was responsible for the successful completion of a difficult drilling project. He was assisted throughout by a very willing helper in Mr. G. Horsham.

Initially, the contract provided for payment at the rate of £2 per foot for the first 200 feet and £2 5s. per foot thereafter. However, after the completion of the second hole approval was obtained for the payment of £3 per foot from start to finish of the remaining holes.

The total footage drilled was 3,154 feet, 223 feet being abandoned in the unsuccessful first attempt at hole No. 2 from site B.

Drilling Results.

The aim of the drilling programme, the purely exploratory nature of which is stressed, was to establish the behaviour of the three outcrop ore bodies at depth as a preliminary to a further programme of exploration which would be necessary to outline the exact dimensions and grades of the ore bodies. This second exploration stage would properly be conducted by any organization interested in the ultimate exploitation of the ore and would necessarily consist of adits and drives in ore.

Results of the drilling programme may be summarised as follows:—

(1) Establishment of the attitude of the outcrop ore beds which were proved for each of the three ore lenses to be structurally continuous from the surface outcrop to approximately 400 feet down dip.

(2) The approximate definition of the lower limit of the zone of oxidation and hence the lower limit of possible ore for each of the three lenses.

(3) The discovery of a quantity of mixed limonite and hematite ore occurring as recemented scree on the north-west slopes of the range adjacent to the outcrop ore.

(4) An appreciation of the grade of the ore bodies at the depth where cut by the drillholes was obtained.

The details of the drilling results are shown on the accompanying sections and the drillhole logs, assay results and mineral determinations later in the report.

In considering the economic results of the drilling, the three lenses will be treated separately.

Tallering Peak Lens (Johnson's Lens T1).—The section through DDH1 shows that predominantly hematitic ore was encountered at 123 feet 6 inches in the drillhole and continued at a grade of 52.3 per cent acid soluble iron to 175 feet. It is likely that this ore persisted to 213 feet, but insufficient core was recovered for analysis.

The dip of the ore beds at the outcrop was taken on an average at 60°, and on this basis the hanging wall of the ore body was not expected until a drillhole depth of 260 feet.

As a result, the early intersection of bedded hematite ore was initially taken to represent a separate hanging wall ore body, the outcrop of which was covered by scree material. The drillhole was continued to cut the second jaspilite bed between 337 feet 6 inches and 483 feet, the core between 337 feet 6 inches and 389 feet assaying 38.2 per cent acid soluble iron. This was assumed to be the unoxidized down dip extension of the outcrop ore.

At the completion of the whole programme however, when all sections were drawn it was considered unlikely that the postulated separate hanging wall ore body would have no surface topographic expression and equally unlikely that the second highly siliceous jaspilite bed could represent the depth extension of the high grade ore at the outcrop. The drillhole intersections were therefore correlated with the surface outcrops in the manner shown on the accompanying sections.

This interpretation of the factual data is supported by the following observations:—

(a) Surface exposures show evidence of intensive dragfolding with a 60° southerly plunge. The effect of this dragfolding would be to decrease the overall dip of the ore body below that measured on a bedding face at the surface.

(b) Irregular bedding angles in the core indicate the disturbance of the bedding most likely due to folding.

(c) On a regional basis, Johnson (Bulletin 106) describes the sediments as being highly folded, and it is usual, particularly in jaspilites to have the major fold pattern reflected by abundant dragfolding.

(d) The iron content of the bodies as intersected in the drillhole could reasonably be accepted as representing the down dip extension of the grades of the surface exposures.

(e) The topography is such that it can be expected to have developed as a result of differential erosion of the underlying rocks in the attitude as shown.

Although the deposit has been satisfactorily described as a folded body, the exact outline of the folds has not been obtained. It is difficult therefore, to assess the true thickness of the body which will be certainly less than the apparent thickness shown on the section, and is probably a little greater than the width shown in outcrop. In fact the dotted lines in the section are little more than indicative of the correlation of the drillhole rock types with the surface exposures and do not represent the limits of beds or iron ore.

DDH2 from site B proved the southerly plunge of ore body T1 and gave similar intersections in the hole to DDH1. An apparent thickening of the beds indicates a different angle of incidence of the drillhole with the beds. Holes 1 and 2 were 250 feet apart, parallel to the line of strike which distance of separation is approximately half the length of the ore body as outcropping.

The approximate lower level of oxidation is shown on the section for each hole and at the section for No. 2 hole the oxidation level is lower than that at No. 1. This is probably accounted for by the southerly plunge of the structure allowing deeper penetration of air down the folded beds. This oxidation level would almost without doubt control the down plunge limit of hematite ore, the change below this being to magnetite-silica banded iron formation.

The grades of iron ore encountered in both drillholes are approximately 10 per cent. lower than at the surface. This weakening of grade may be gradual from the surface to the points of intersection at depth, or a comparatively sharp drop may occur within a few feet of the surface. With the present information it is not possible to predict the nature of this change.

The footwall jaspilite bed outcropping to the south-east of the ore lens and encountered in DDH1 between 337 feet 6 inches and 483 feet, and in DDH2 between 428 feet and 637 feet, has neither the grade at the surface nor at depth to warrant further attention as a source of iron. Likewise small pyrite concentrations lack commercial possibilities.

Middle Lens (Johnson's Lens T2).—The correlation of the drillhole intersections with the outcrops as shown in the section is based on the same reasoning as applied to the Tallering Peak Lens correlation. The attitude of this lens agrees closely with that of a tabular body with a consistent dip of 65° as shown at the surface. However, the hanging wall of the ore body where cut by the drillhole is almost parallel with the hole indicating folding in this vicinity. The true width of the body is therefore again very much less than the apparent width of the ore intersection in the drillhole. Similar to Lens T1, a weakening in grade from 59.96 per cent. Fe at the surface to 43.4 per cent. acid soluble iron 400 feet down dip was shown.

The second jaspilite bed, cut between 525 feet and 771 feet 6 inches in the drillhole, was intersected below the oxidized zone and the iron content was beneath consideration commercially. A little pyrite was present, but not in economic concentrations.

Tallering Trig. Lens (Johnson's Lens T3).—This is the only lens which maintains a good grade at depth. Two surface samples (Johnson, Bulletin 106) showed 68.66 per cent. and 64.9 per cent. metallic iron, and at 650 feet down dip the weighted average grade of ore between 289 feet and 417 feet in the drill hole is 67.5 per cent. acid soluble iron. This grade is over an apparent width of 128 feet, but irregular bedding angles in the core show folding and the true width may be much less than 128 feet. Hematitic ore was encountered from 281 feet to 436 feet in the drillhole, and the average grade over this core length was 64.8 per cent. acid soluble iron. The second jaspilite bed, consisting where cut in the drillhole between 569 feet and 757 feet of banded magnetite-silica, showed an average grade of 22.4 per cent. acid soluble iron.

Recemented Scree Ore.—In each of the four drillholes a recemented limonitic and hematitic jaspilite rubble was encountered from the surface to a depth in the drillhole of approximately 50 feet. This ore varied in acid soluble iron content from 44.4 per cent. in DDH1 to 54.3 per cent. in DDH2. Its existence had not been known prior to the drilling, as at the surface only loose rubble poorly recemented with a weak lateritic type development is presented. Nothing is known therefore of the areal extent of this ore, but it can safely be assumed that it is confined to the north-west slopes of the range adjacent only to the main ore lenses. The exact extent however, has not been determined. Both dimensions and grade of this ore could be irregular, but if properly outlined by regularly spaced sample pits it could form a useful addition to the ore quantities in the Range.

Geological Considerations.

Johnson (Bulletin 106) has mapped the area in the vicinity of Tallering Range as consisting of a sedimentary series within the Murchison System of Archeozoic Age. He describes the sedimentary series as steeply inclined, highly metamorphosed sediments with quartz and pegmatite intrusives in places, and describes the Tallering Range in particular as consisting of highly folded sandstones, conglomerates, quartzites and associated basic volcanics and intrusives, metamorphosed to varying degrees. A tentative correlation, based on lithologic similarities has been suggested of this series with the Whitestone Series of the Yilgarn Goldfield as described by H. A. Ellis (Bulletin 97.)

The mode of formation of the three ore lenses has not be elucidated. As a result of the drilling programme, however, several facts emerge regarding the origin of the ore lenses. They are briefly as follows:—

(a) The ore showed bedding structure at the surface and at depth in the drill core.

(b) The ore was confined within a jaspilite bed.

(c) There was no evidence to suggest an intrusive origin for the ore bodies.

(d) The slightly cellular nature of the ore where intersected in the zone of oxidation suggests the removal of some of the original constituents, such as silica and perhaps sulphur, present initially as pyrite.

It is fairly certain therefore, that the iron was derived from the original sediment at or near its present position, but the reason for the concentration of iron in its present form as three distinct ore lenses is obscure. There may have been some redistribution of iron from within the beds to more suitable structural zones, such as slump brecciated or dragfolded zones, but if such is the case, the movement has been a slow one as would occur say if circulating groundwaters were the mobilising agent. On the other hand, the iron concentrations may have been an original depositional anomaly. There has certainly been an enrichment towards the surface in the oxidised zone and below this the ore body would pass to a banded silica-magnetite jaspilite of medium to low grade iron content. With the lateral extent of the ore bodies known only by outcrop, the spacial limits of the ore are incompletely known, and it is not possible to more than suggest a structural or depositional control.

Core Logs, Core Recovery Sampling, Assay Data and Mineral Determinations.

Core logs for each of the four drillholes are presented later in the report under Diamond Drill Hole details. The logs show the description of the material penetrated for each pull and the core recovered. A core recovery table showing the percentage recovery in iron-bearing beds and country rock follows each core log.

Also under Drillhole details are shown the sample lists with assay results, group analyses and mineral determinations.

Samples of the iron-bearing rocks were prepared from the core by taking every alternate inch of core broken at right angles to the core axis between the footages shown in the sample lists. Half of the remaining core has been retained for future reference at the Geological Survey. All assays and mineral determinations were done by Government Chemical Laboratories.

Partial analyses of group samples representing the whole intersection of each iron rich body were made for total and acid soluble iron Fe, silica SiO_2, phosphorus P, titanium Ti, magnesia MgO, lime CaO, manganese Mn and sulphur S. The group samples were prepared by taking equal weights of the individual samples where core sample lengths were equal throughout, or weights by proportion to sample lengths where lengths were unequal. All results are on a moisture free basis.

The mineral determinations were made by megascopic examination of the samples by officers of the minerals section, Government Chemical Laboratories. They show the relative abundance of hematite, magnetite, limonite, pyrite, quartz (silica) and other accessory minerals.

Quantity Estimates.

It is not the intention of the author to attempt the calculation of ore quantities based on an exploratory drilling programme, the purpose of which did not include the outlining of ore limits. For those interested in making such an estimate it is pointed out that the following assumptions must be made with respect to the outcrop ore lenses in order to arrive at a quantity:—

(a) That the outcrop dimensions persist to the total depth of the bodies.

(b) That the lower limit of the ore is the lower limit of the zone of oxidation as shown on the accompanying sections.

(c) That the weakening of grade from the surface to the depth of penetration by the drillhole is a gradual one.

(d) That the plunge of the ore bodies is approximately 60° to the south-west.

(e) That the folding evident in the ore bodies is of a minor nature.

The plan surface area of outcrop for the Tallering Peak (T1) lens is 45,000 square feet, for the middle (T2) lens 9,300 square feet and for the Tallering Trig. (T3) lens is 5,800 square feet as measured from the accompanying plan. A conversion factor of 10 cubic feet of ore per long ton would be appropriate for the ore.

As regards the surface ore occurring as recemented scree, it is obviously impossible to estimate the quantity existing with the limited information available.

Conclusions.

In an exploratory diamond drilling programme designed to test the extensions down dip of the three ore lenses in the Tallering Range, each lens was successfully penetrated 400 feet or more down dip from the outcrop. Only in the Tallering Trig. (T3) lens was the surface grade maintained at depth.

No quantity estimates are presented as it is considered that insufficient data exists for the purpose. It can be stated however, that a considerable amount of further exploration by way of adits, drives, etc., in ore would be required to ascertain the existence of a million tons of 60 per cent. Fe iron ore.

DIAMOND DRILLHOLE DETAILS.

Diamond Drillhole No. 1, Site A.

Detailed Log.

Locality: Tallering Peak, approximately 1.2 miles N. 38° E. of Tallering Trig.

Angle of Depression: 60°. Machine Used: Mindrill "A3000."

Bearing of Hole: 160° Mag. Core Size: A X T.

Total Depth: 562 feet. Contractor: A. Horsham.

Date Commenced: 28/7/58. Date Completed: 13/10/58.

Logged by: G. H. Low.

Pulls From	Pulls To	Width	Core Recovered	Particulars of Core	
ft. ins.	ft. ins.	ft. ins.	ft. ins.		
0 0	4 0	4 0	2 0	Limonite and hematite rubble.	
4 0	9 0	5 0	3 4	As above.	
9 0	19 0	10 0	2 9	As above.	Iron Ore
19 0	23 0	4 0	4 2	As above.	
23 0	27 6	4 6	4 1	As above.	
27 6	44 0	16 6	6 3	4 ft. 9 in. As above. 1 ft. 6 in. Light stone to light red argillaceous meta-sediment.	
44 0	46 0	2 0	0 9	Red, earthy, friable limonite.	
46 0	65 0	19 0	0 0		
65 0	75 0	10 0	0 10	Sedimentary rubble, stained red and green by iron oxides.	
75 0	94 0	19 0	3 5	Weathered, kaolinised fine grained greenstone.	
94 0	105 0	11 0	8 8	As above.	
105 0	114 0	9 0	2 11	As above.	
114 0	123 6	9 6	3 5	As above.	
123 6	124 6	1 0	0 11	Hematite and limonite.	Iron Ore
124 6	125 6	1 0	1 0	As above.	
125 6	135 0	10 0	9 6	Red brown limonite and hematite. Some silica banding at 45° to core axis.	
135 0	136 0	1 0	1 0	As above.	
136 0	143 6	7 0	2 8	As above.	
143 6	150 6	7 0	6 4	As above.	
150 6	153 6	3 0	2 6	As above.	
153 6	159 0	5 6	4 6	Massive hematite. Some magnetite.	
159 0	162 0	3 0	2 0	Hematite and limonite, some magnetite.	Iron Ore
162 0	163 6	1 6	1 0	As above.	
163 6	167 0	3 6	3 3	Hematite and limonite, with silica banding at 45° to core axis.	
167 0	168 0	1 0	1 0	As above.	
168 0	170 0	2 0	0 6	As above.	
170 0	173 0	3 0	2 0	As above.	
173 0	174 6	1 6	1 6	As above, but with increased silica.	
174 6	175 0	0 6	0 4	As above.	

Detailed Log—*continued.*

Pulls From	Pulls To	Width	Core Recovered	Particulars of Core	
ft. ins.	ft. ins.	ft. ins.	ft. ins.		
175 0	193 6	18 6	2 1	Siliceous jaspilite. Thin hematite bands. Bedding at 20° to core axis.	
193 6	203 6	10 0	0 3	Limonite and hematite rubble.	
203 6	208 6	5 0	0 4	Hematite and limonite rubble.	
208 6	210 6	2 0	0 3	Magnetite and silica.	
210 6	213 6	3 0	2 7	Hematite and limonite, some silica.	
213 6	222 6	9 0	7 0	Grey to red brown argillaceous fine grained sandy meta-sediment. Micaceous in places.	
222 6	227 0	0 6	0 5	As above.	
227 0	233 0	6 0	4 3	1 ft. 5 in. weathered greenstone. 2 ft. 10 in. fresh fine grained greenstone.	
233 0	233 6	0 6	0 6	Fresh fine grained greenstone.	
233 6	240 0	6 6	6 6	As above.	
240 0	244 0	4 0	4 0	As above.	
244 0	260 6	16 0	16 0	As above.	
260 6	270 0	10 0	10 0	6 in. quartz vein. 9 ft. 6 in. fresh fine grained greenstone.	
270 0	276 6	6 6	6 6	As above, with thin quartz stringers.	
276 6	286 6	10 0	10 0	As above, with 1 ft. quartz stringer at 280 ft.	
286 6	294 0	7 6	7 6	Fresh fine grained greenstone with some thin quartz stringers.	
294 0	301 0	7 0	7 0	As above.	
301 0	310 6	9 6	9 6	As above.	
310 6	317 0	7 6	6 6	As above.	
317 0	327 0	10 0	9 6	As above.	
327 0	330 0	3 0	1 6	As above.	
330 0	333 6	3 6	3 0	As above.	
333 6	342 0	8 6	7 0	4 ft. As above. 3 ft. banded talc and magnetite with silica. Some very fine pyrite scattered throughout. Bedding at 45° to core axis.	Iron Ore
342 0	352 6	10 6	10 6	As above.	Iron Ore
352 6	362 6	10 0	9 10	As above.	Iron Ore
362 6	372 6	10 0	8 3	As above, with scattered coarsely crystalline pyrite concentrations.	Iron Ore
372 6	382 6	10 0	10 0	As above.	Iron Ore
382 6	393 0	10 6	9 6	As above.	Iron Ore
393 0	398 0	5 0	4 9	Banded magnetite and silica, with fine pyrite concentrations.	Iron Ore
398 0	406 6	8 6	8 3	As above.	Iron Ore
406 6	414 6	8 0	7 10	As above, with chlorite from 408 ft.	Iron Ore
414 6	423 6	9 0	9 0	Siliceous jaspilite, with magnetite and pyrite, some chlorite.	Iron Ore
423 6	428 0	4 6	4 5	As above.	Iron Ore
428 0	431 0	3 0	3 0	Grey siliceous jaspilite with pyrite, some magnetite.	Iron Ore
431 0	439 0	8 0	7 6	As above.	Iron Ore
439 0	446 0	7 0	7 0	1 ft. 6 in. As above. 3 ft. 6 in. chloritic greenstone schist with pyrite concentrations, some magnetite.	Iron Ore
446 0	455 6	9 6	9 6	3 ft. As above. 6 ft. 6 in. As above, with increased pyrite.	Pyritic Ore
455 6	460 0	4 6	4 3	Siliceous jaspilite with pyrite concentrations, some magnetite. Chloritic banding at 45° to core axis.	Iron Ore
460 0	466 0	6 0	6 0	As above.	Iron Ore
466 0	468 0	2 0	1 10	As above.	Iron Ore
468 0	478 0	10 0	10 0	As above.	Iron Ore
478 0	483 0	5 0	5 0	As above.	Iron Ore
483 0	491 6	8 6	8 6	As above, with reduced pyrite.	
491 6	501 6	10 0	9 0	As above.	
501 6	512 0	10 6	10 6	As above.	
512 0	522 0	10 0	10 0	As above.	
522 0	532 0	10 0	10 0	As above.	
532 0	542 0	10 0	10 0	Jaspilite with green chloritic bands.	
542 0	552 0	10 0	10 0	Fine grained schistose greenstone, some pyrite and magnetite.	
552 0	562 0	10 0	10 0	As above. END OF HOLE.	

D.D.H. No. 1—Site A
Core Recovery Analysis.

From	To	Core Recovered		Remarks
ft. ins.	ft. ins.	ins.	%	
0 0	42 0	253	50·2	Iron ore
42 0	123 6	258	26·6	
123 6	175 0	480	77·6	Iron ore
175 0	339 0	1,502	76·4	
339 0	389 0	576	94·1	Iron ore
389 0	428 0	411	81·4	Pyrite ore
428 0	449 0	234	92·8	
449 0	483 0	403	98·7	Pyrite ore
483 0	562 0	936	98·6	
0 0	562 0	6,744	73·4	Overall

Sample List
D.D.H. No. 1—Site A

Sample No.	From	To	Sample Length	Assayed for	Results Fe (Acid soluble) on dry basis per cent.	
	ft. ins.	ft. ins.	ft. ins.			
T.R. 1	0 0	9 0	9 0	Fe	51·8	
T.R. 2	9 0	19 0	10 0	Fe	34·4	
T.R. 3	19 0	28 0	9 0	Fe	41·8	
T.R. 4	28 0	35 0	7 0	Fe	47·0	
T.R. 5	35 0	42 0	7 0	Fe	47·6	
T.R. 6	123 6	125 6	2 0	Fe	54·2	
T.R. 7	125 6	135 0	9 6	Fe	53·0	
T.R. 8	135 0	143 6	8 6	Fe	41·5	
T.R. 9	143 6	150 6	7 6	Fe	47·2	
T.R. 10	150 6	153 6	3 6	Fe	54·2	
T.R. 11	153 6	162 0	8 6	Fe	65·3	
T.R. 12	162 0	170 0	8 0	Fe	53·9	
T.R. 13	170 0	175 0	5 0	Fe	48·4	
T.R. 14	339 0	349 0	10 0	Fe	35·8	
T.R. 15	349 0	359 0	10 0	Fe	36·9	
T.R. 16	359 0	369 0	10 0	Fe	40·2	
T.R. 17	369 0	379 0	10 0	Fe	42·3	
T.R. 18	379 0	389 0	10 0	Fe	37·1	
					Sulphur S %	Gold
T.R. 19	389 0	398 0	9 0	S, Au.	0·03	*Nil*
T.R. 20	398 0	408 0	10 0	S, Au.	0·10	*Nil*
T.R. 21	408 0	418 0	10 0	S, Au.	0·12	*Nil*
T.R. 22	418 0	428 0	10 0	S, Au.	0·36	*Nil*
T.R. 23	449 0	459 0	10 0	S, Au.	7·78	*Nil*
T.R. 24	459 0	469 0	10 0	S, Au.	8·32	*Nil*
T.R. 25	469 0	478 0	9 0	S, Au.	6·98	*Nil*
T.R. 26	478 0	483 0	5 0	S, Au.	6·96	*Nil*

Mineral Determinations
D.D.H. No. 1—Site A

Sample No.	Relative Abundance of Minerals						
	Talc	Magnetite	Quartz	Chlorite	Pyrite	Hematite	Limonite
T.R. 1							
T.R. 2							
T.R. 3							
T.R. 4	Limonite, hematite and quartz.						
T.R. 5	Limonite predominant over hematite.						
T.R. 6	Traces magnetite T.R. 5-8 inclusive.						
T.R. 7							
T.R. 8							
T.R. 9							
T.R. 10	Hematite, predominant over limonite with quartz.						
T.R. 11	Hematite, trace only of limonite.						
T.R. 12	Mainly hematite, some limonite and quartz.						
T.R. 13							
T.R. 14	A	A	C	L	L	L	....
T.R. 15	A	A	C	T	T	C	T
T.R. 16	A	A	C	....	T	L	....
T.R. 17	A	A	C	T	T	L	T
T.R. 18	A	A	C	....	....	L	....
T.R. 19	A	A	C	T	T	....	....
T.R. 20	....	A	A	T	L	....	....
T.R. 21	....	C	A	A	T	L	....
T.R. 22	....	C	A	T	T	....	....
T.R. 23	....	....	A	L	C	....	....
T.R. 24	....	T	A	A	C	....	....
T.R. 25	....	L	A	A	C	....	....
T.R. 26	....	L	A	L	C	....	....

A = abundant. C = common. L = little. T = trace.

Group Analyses
D.D.H. No. 1—Site A

Chemical Laboratory No. 1958	16652	16653	16654
G.S.W.A. Numbers	TR1–TR5	TR6–TR13	TR14–TR18
Between drillhole depths	0 ft.–42ft.	123 ft. 6ins.–175ft.	339ft.–389ft.
	Per cent. on dry basis		
Iron Fe (total)	44·8	52·7	40·3
Iron Fe (Acid Soluble)	44·4	52·3	38·2
Silica SiO_2	24·8	21·3	31·3
Phosphorus P	0·04	0·17	0·05
Titanium Ti	0·24	*Nil*	*Nil*
Magnesia MgO	Trace	Trace	10·8
Lime CaO	*Nil*	*Nil*	*Nil*
Manganese Mn	Trace	0·02	0·04
Sulphur S	0·01	*Nil*	0·02

Trace represents less than 0·01 per cent.

Diamond Drillhole No. 2—Site B

Detailed Log

Locality: Tallering Peak, approximately 1.2 miles N. 38° E. of Tallering Trig.

Angle of Depression at Surface: 60°.

Bearing of Hole at Surface: 160° Mag.

Machine Used: Mindrill "A3000."

Core Size: AXT.

Total Depth: 637 feet. Contractor: A. Horsham.

Commenced: 7/11/58. Completed: 30/1/59.

(Note: A hole with the same depression and azimuth was commenced at this site on 20th October, and was abandoned at 223 feet on 7th November, due to extremely bad conditions. The collar of the completed hole is 2 feet south of this.)

Logged by : G. H. Low.

Pulls From	Pulls To	Width	Core Recovered	Particulars of Core	
ft. ins.	ft. ins.	ft. ins.	ft. ins.		
0 0	4 0	4 0	0 4	Surface cemented red, brown or black limonitic iron ore	Iron Ore
4 0	6 0	2 0	0 5	As above.	
6 0	9 0	3 0	0 5	As above.	
9 0	15 0	6 0	0 11	As above.	
15 0	17 0	2 0	0 8	As above.	
17 0	22 0	5 0	1 0	As above.	
22 0	23 0	1 0	0 4	As above.	
23 0	30 0	7 0	1 6	As above.	
30 0	43 6	13 6	0 5	As above.	
43 6	54 0	10 6	0 2	As above.	
54 0	114 0	50 0	0 5	Highly weathered greenstone.	
114 0	154 0	40 0	7 0	As above.	
154 0	210 0	56 0	2 0	As above.	
210 0	215 0	5 0	4 0	As above.	
215 0	217 0	2 0	1 6	Hematite and limonite bearing jaspilite. Slightly magnetic.	Iron Ore
217 0	219 0	2 0	2 0	As above.	
219 0	226 6	3 6	3 6	As above.	
226 6	231 6	5 0	5 0	As above.	
231 6	234 0	2 6	2 6	As above.	
234 0	237 0	3 0	2 9	As above.	
237 0	239 0	2 0	2 0	As above.	
239 0	241 0	2 0	2 0	As above.	
241 0	242 0	1 0	1 0	As above.	
242 0	246 0	4 0	3 0	As above.	
246 0	249 0	3 0	2 9	As above.	
249 0	252 0	3 0	3 0	As above, cellular in places.	
252 0	255 0	3 0	2 9	As above.	
255 0	264 0	9 0	9 0	As above.	
264 0	266 6	2 6	2 0	As above.	
266 6	268 0	1 6	1 2	As above.	
268 0	276 0	8 0	5 0	As above.	
276 0	280 6	4 6	3 0	As above.	
280 6	284 0	3 6	2 6	As above.	
284 0	289 0	5 0	5 0	Hematite jaspilite with increased percentage of magnetite.	
289 0	294 0	5 0	4 6	As above.	
294 0	297 0	3 0	3 0	As above.	
297 0	297 6	0 6	0 6	As above.	
297 6	300 0	2 6	1 5	As above, cellular in places.	
300 0	302 0	2 0	2 0	Hematite jaspilite with increased percentage of magnetite, cellular in places.	
302 0	305 0	3 0	2 6	As above.	
305 0	306 6	0 6	0 6	As above.	
306 6	310 6	4 0	2 0	As above.	
310 6	315 0	4 6	3 6	As above.	
315 0	323 0	8 0	6 3	As above.	
323 0	325 0	2 0	2 0	Hematite, magnetite jaspilite.	
325 0	331 0	6 0	6 0	As above.	
331 0	341 0	10 0	9 0	As above.	
341 0	351 6	10 6	3 0	As above.	
			6 0	Dark grey talcose, schistose greenstone, broken.	
351 6	356 0	4 6	0 6	As above.	
356 0	361 6	5 6	1 2	As above.	
361 6	363 0	1 6	1 6	As above, with scattered pyritic patches.	
363 0	365 0	2 0	2 0	As above.	
365 0	369 6	4 6	1 0	As above.	
369 6	375 0	5 6	5 0	As above.	
375 0	379 0	4 0	4 0	Massive quartz dolerite greenstone.	
379 0	387 6	8 6	7 6	As above.	
387 6	394 0	7 0	5 0	As above.	
394 0	400 0	6 0	6 0	As above.	
400 0	402 0	2 0	2 0	As above.	
402 0	412 0	10 0	9 0	As above.	
412 0	415 6	3 6	3 0	As above, slightly sheared.	
415 6	416 6	1 0	1 0	Massive quartz dolerite greenstone.	
416 6	419 6	3 0	3 0	As above.	
419 6	424 6	5 0	5 0	Massive quartz dolerite greenstone.	
424 6	434 6	10 0	10 0	As above.	

Detailed Log—*continued.*

Pulls From	Pulls To	Width	Core Recovered	Particulars of Core	
ft. ins.	ft. ins.	ft. ins.	ft. ins.		
434 6	437 6	10 0	10 0	Massive quartz dolerite greenstone	
437 6	442 6	5 0	5 0	As above.	
442 6	447 0	4 6	4 6	As above.	
447 0	457 0	10 0	10 0	As above.	
457 0	465 0	8 0	8 0	As above.	
465 0	467 6	2 6	2 0	As above (sheared).	
467 6	469 6	2 0	2 0	Massive quartz dolerite greenstone.	
469 6	475 0	5 6	5 0	As above.	
475 0	477 0	2 0	2 0	As above.	
477 0	480 0	3 0	3 0	As above.	
480 0	483 0	3 0	3 0	As above.	
483 0	486 0	3 0	3 0	As above.	
486 0	496 0	10 0	2 0	As above.	
			8 0	Magnetite in jaspilite, with some talc.	Iron Ore
496 0	506 6	10 6	10 6	As above.	
506 6	517 0	10 6	10 0	As above.	
517 0	527 0	10 0	9 0	As above.	
527 0	534 0	7 0	7 0	As above, bedding at 35° to core axis.	
534 0	544 0	10 0	9 6	Magnetite in jaspilite, with some talc.	
544 0	554 0	10 0	10 0	As above, more siliceous and less magnetite .	
544 0	564 0	10 0	10 0	As above.	
564 0	574 0	10 0	10 0	As above.	
574 0	584 0	10 0	10 0	As above.	
584 0	591 0	7 6	7 0	Siliceous jaspilite with magnetite and some pyrite.	
591 0	596 6	5 6	5 0	As above.	
596 6	606 0	9 6	9 6	Siliceous jaspilite with some disseminated pyrite bands.	
606 0	611 6	5 6	5 6	As above.	
611 6	621 6	10 0	10 0	As above, bedding at 50° to core axis.	
621 6	627 6	6 0	6 0	As above.	
627 6	637 0	9 6	9 0	As above.	
				END OF HOLE.	

D.D.H. No. 2—Site B

Core Recovery Analysis

From	To	Core Recovered		Remarks
ft. ins.	ft. ins.	ins.	%	
0 0	54 0	74	11·5	Iron Ore.
54 0	215 0	161	8·4	
215 0	351 6	1,363	83·4	Iron Ore.
351 6	488 0	1,740	92·5	
488 0	584 0	1,056	97·7	Iron Ore.
584 0	637 0	624	98·1	
0 0	637 0	5,018	65·6	Overall.

Sample List

D.D.H. No. 2—Site B

Sample No.	From	To	Sample Length	Assayed for	Results Fe (Acid Soluble) on dry basis per cent.
	ft. in.	ft. in.	ft. in.		
T.R. 27	0 0	15 0	15 0	Fe	46·7
T.R. 28	15 0	54 0	39 0	Fe	61·4
T.R. 29	215 0	225 0	10 0	Fe	35·9
T.R. 30	225 0	235 0	10 0	Fe	41·6
T.R. 31	235 0	245 0	10 0	Fe	39·2
T.R. 32	245 0	255 0	10 0	Fe	50·9
T.R. 33	255 0	265 0	10 0	Fe	56·8
T.R. 34	265 0	272 0	7 0	Fe	44·4
T.R. 35	272 0	282 0	10 0	Fe	67·2
T.R. 36	282 0	292 0	10 0	Fe	42·6
T.R. 37	292 0	302 0	10 0	Fe	44·5
T.R. 38	302 0	312 0	10 0	Fe	61·3
T.R. 39	312 0	322 0	10 0	Fe	54·9
T.R. 40	322 0	332 0	10 0	Fe	56·8
T.R. 41	332 0	344 0	12 0	Fe	44·1
T.R. 42	488 0	498 0	10 0	Fe	38·6
T.R. 42A	498 0	508 0	10 0	Fe	36·6
T.R. 42B	508 0	517 0	9 0	Fe	37·7
T.R. 43	517 0	527 0	10 0	Fe	52·8
T.R. 44	527 0	537 0	10 0	Fe	34·2
T.R. 45	537 0	547 0	10 0	Fe	35·8
T.R. 46	547 0	557 0	10 0	Fe	27·6
T.R. 47	557 0	567 0	10 0	Fe	22·0
T.R. 48	567 0	577 0	10 0	Fe	27·3
T.R. 49	577 0	584 0	7 0	Fe	17·8

Mineral Determinations
D.D.H. No. 2—Site B

Sample No.	Relative Abundance of Minerals							
	Magnetite	Hematite	Limonite	Pyrite	Quartz	Talc	Chlorite	Magnesite
T.R. 27	T	C	A	....	L	....	....	....
T.R. 28	L	A	A	....	L	....	....	....
T.R. 29	L	A	L	....	A	....	....	....
T.R. 30	C	A	L	....	A	....	....	....
T.R. 31	L	A	L	....	A	....	....	....
T.R. 32	T	A	C	....	C	....	....	....
T.R. 33	L	A	T	....	C	....	....	....
T.R. 34	L	A	T	....	C	....	....	....
T.R. 35	L	A	L	....	L	....	....	....
T.R. 36	L	A	C	....	C	....	....	....
T.R. 37	L	A	L	....	A	....	....	....
T.R. 38	L	A	L	....	L	....	....	....
T.R. 39	L	A	L	T	L	....	....	....
T.R. 40	A	C	C	....	C	....	....	....
T.R. 41	A	L	L	T	A	....	....	....
T.R. 42	A	T	....	....	A	....	....	....
T.R. 42A	A	....	....	....	A	A	....	....
T.R. 42B	A	....	....	....	....	A	....	....
T.R. 43	A	....	....	....	C	....	....	....
T.R. 44	A	....	....	....	A	....	....	....
T.R. 45	A	....	....	....	A	....	....	....
T.R. 46	A	....	....	....	A	....	....	....
T.R. 47	A	....	....	T	A	....	C	....
T.R. 48	A	....	....	....	A	....	....	T
T.R. 49	C	....	....	L	A	....	....	....

A = Abundant. C = Common. L = Little. T = Trace.

Group Analyses
D.D.H. No. 2—Site A

Chemical Laboratory No. (1959)	2057	2058	2059
G.S.W.A. Numbers	T.R. 27–28	T.R. 29–41	T.R. 42–49
Between drillhole depths	0–54 ft.	215–344 ft.	488–584 ft.
	Per cent on dry basis		
Iron Fe (total)	54·5	49·4	33·1
Iron Fe (acid soluble)	54·3	49·3	33·0
Silica SiO_2	12·3	27·7	49·3
Phosphorus P	0·02	0·07	0·06
Titanium Ti	0·21	0·03	0·06
Magnesia MgO	0·02	0·24	2·85
Lime CaO	*Nil*	*Nil*	*Nil*
Manganese Mn	0·01	Trace	0·01
Sulphur S	*Nil*	Trace	0·07
Specific Gravity	4·17	4·02	3·35

Trace represents less than 0·01 per cent.

Diamond Drill Hole No. 3—Site C

Detailed Log

Locality: Tallering Range, approximately 0.4 miles N. 23° E. of Tallering Trig.
Angle of Depression at Surface: 60°
Bearing of Hole at Surface: 138° Mag.
Machine Used: Mindrill "A3000."
Core Size: AXT.
Total Depth: 872 feet. Contractor: A. Horsham.
Commenced: 2/3/59. Completed: 5/6/59.
Logged by: G. H. Low—0 feet to 186 feet, A. J. Noldart—186 feet to end of hole.

Core Log

Pulls From	Pulls To	Width	Core Recovered	Particulars of Core	
ft. in.	ft. in.	ft. in.	ft. in.		
0 0	1 0	1 0	0 4	Lateritic ore.	Iron Ore
1 0	3 0	2 0	1 0	As above.	
3 0	7 0	4 0	2 0	As above.	
7 0	9 0	2 0	1 10	As above.	
9 0	11 0	2 0	1 2	As above.	
11 0	16 0	5 0	4 8	As above.	
16 0	21 6	5 6	2 9	As above.	
21 6	27 6	6 0	2 0	As above.	
END OF ORE BODY					
27 6	51 0	23 6	0 8	Rubble laterite.	
51 0	71 0	20 0	2 6	White to red weathered fine grained sediments.	
71 0	76 6	5 6	0 4	As above.	
76 6	80 0	3 6	1 5	Sericite quartz schist very fine grained white and highly weathered.	

Core Log—*continued.*

Pulls From	Pulls To	Width	Core Recovered	Particulars of Core	
ft. in.	ft. in.	ft. in.	ft. in.		
80 0	92 0	12 0	5 9	56 in. as above. 8 in. red fine grained sediments. 5 in. white as above.	
92 0	102 0	10 0	5 7	Red and white sericite schist.	
102 0	112 0	10 0	10 0	Meta-sedimentary as above.	
112 0	122 0	10 0	2 0	As above.	
122 0	142 0	20 0	1 10	As above.	
142 0	148 0	6 0	1 1	As above, 3 in. quartz vein at 142 ft.	
148 0	157 0	9 0	4 7	Reddish meta-sedimentary schist.	
157 0	166 0	9 0	2 5	Brown, micaceous meta-sediments Bedding 43° to core axis.	
166 0	171 0	5 0	3 0	As above.	
171 0	177 0	6 0	2 0	As above.	
177 0	181 0	4 0	0 10	White milky quartz.	
181 0	183 0	2 0	0 5	As above.	
183 0	186 0	3 0	3 0	Red-brown micaceous meta-sediment.	
186 0	189 0	3 0	2 6	As above.	
189 0	199 0	10 0	9 6	As above.	
199 0	209 0	10 0	9 9	As above.	
209 0	220 6	11 6	4 6	As above, very broken and oxidised.	
220 6	222 6	2 0	1 8	Greenish schistose meta-sediments.	
222 6	230 0	7 6	6 6	As above, becoming reddish.	
230 0	232 0	2 0	0 9	6 in. quartz reef. 3 in. reddish brown meta-sediments.	
232 0	234 6	2 6	1 0	As above.	
234 6	238 0	4 0	3 6	As above.	
238 0	242 6	6 6	4 4	As above.	
242 6	245 6	3 0	2 0	As above, very broken.	
245 6	249 6	4 0	4 0	As above, partly broken.	
249 6	253 0	3 6	3 6	As above.	
253 0	262 6	9 6	9 6	Reddish brown meta-sediments—contact between banded iron formation and meta-sediments above occurs almost parallel to core axis.	
262 6	273 0	10 6	10 0	84 in. As above, hematitic banded iron formation gradually widening.	
START OF ORE BODY					
				36 in. hematitic banded iron formation.	Iron Ore Body
273 0	282 6	9 6	9 6	18 in. As above. 24 in. banded iron formation and sediments as above. 72 in. mainly banded iron formation as above.	
282 6	288 6	6 0	3 6	As above.	
288 6	294 0	5 6	5 0	As above.	
294 0	297 0	3 0	3 0	As above.	
297 0	298 0	1 0	1 0	As above.	
298 0	308 0	10 0	10 0	24 in. As above. 96 in. mixed meta-sediments and hematitic banded iron formation.	
308 0	313 0	5 0	5 0	As above.	
313 0	323 0	10 0	10 0	24 in. As above. 96 in. hematitic banded iron formation.	
323 0	325 0	2 0	1 7	As above.	
325 0	325 6	0 6	0 4	As above, very broken.	
325 6	326 6	1 0	0 9	As above.	
326 6	329 0	2 6	2 0	As above.	
329 0	331 0	2 0	2 0	As above.	
331 0	333 0	2 0	0 9	As above.	
333 0	333 6	0 6	0 3	Hematitic banded iron formation.	Iron Ore Body
333 6	339 0	5 6	5 6	Green talc schist with hematite.	
339 0	343 0	4 0	4 0	30 in. As above. 18 in. hematitic iron ore.	
343 0	352 6	9 6	9 6	As above.	
352 6	354 0	1 6	1 6	As above.	
354 0	356 0	2 0	1 8	As above.	
356 0	361 0	5 0	4 0	20 in. As above, becoming talcose. 28 in. green talc schist.	
361 0	363 6	2 6	2 6	Talc schist and hematite.	
363 6	367 6	4 0	4 0	Mainly hematite iron ore with talcose bands.	
367 6	373 6	6 0	5 6	60 in. As above. 6 in. As above, banded iron formation strongly pyritic.	
373 6	374 6	1 0	0 6	As above.	
374 6	375 0	0 6	0 6	As above.	
375 0	377 6	2 6	2 6	As above.	
377 6	381 6	4 0	4 0	As above.	
381 6	385 6	4 0	3 6	As above.	
385 6	387 0	1 6	1 0	As above.	
387 0	397 0	10 0	8 6	60 in. green meta-sediments with pyritic and/or hematitic bands.	
END OF ORE BODY					
				42 in. dark green talcose meta-sediments.	
397 0	398 6	1 6	1 6	Dark green talcose meta-sediments.	
398 6	401 0	2 6	1 6	As above, very broken.	
401 0	404 6	3 6	2 6	As above.	
404 6	406 0	1 6	1 3	As above.	
406 0	406 6	0 6	0 6	As above, with traces pyrite.	
406 6	410 0	3 6	3 3	Dark green talcose meta-sediments.	
410 0	416 0	6 0	5 6	As above.	
416 0	421 0	5 0	1 3	As above, broken.	
421 0	426 0	5 0	1 9	12 in. As above. 9 in. tuffaceous meta-sediments.	
426 0	427 0	1 0	0 6	As above, broken.	
427 0	431 6	4 6	2 6	As above, broken.	
431 6	441 6	10 0	10 0	As above.	
441 6	451 6	10 0	10 0	As above.	
451 6	461 6	10 0	10 0	As above.	
461 6	471 6	10 0	10 0	As above.	
471 6	472 0	0 6	0 3	As above.	

Core Log—*continued.*

Pulls From	Pulls To	Width	Core Recovered	Particulars of Core	
ft. ins.	ft. ins.	ft. ins.	ft. ins.		
472 0	482 0	10 0	10 0	As above, with amphibole blebs.	
482 0	486 0	4 0	4 0	12 in. As above. 9 in. fine grained andesitic intrusive. 1 in. quartz reef. 26 in. meta-sediments as above.	
486 0	496 0	10 0	10 0	As above.	
496 0	506 0	10 0	10 0	72 in. As above. 48 in. marked gneissose effect to amphibole blebs 60° to core axis.	
506 0	514 0	8 0	8 0	As above. becoming sericitic.	
514 0	524 0	10 0	10 0	56 in. sericitic schist. 54 in. silicified schist.	
524 0	526 0	2 0	2 0	12 in. porphyritic andesite intrusive.	
		START OF ORE BODY			
				12 in. highly siliceous magnetite - hematite banded iron formation with occasional disseminated pyrite.	Iron Ore Body
526 0	529 0	3 0	3 0	As above.	
529 0	535 0	6 0	6 0	As above.	
535 0	545 0	10 0	10 0	As above.	
545 0	555 0	10 0	10 0	As above.	
555 0	564 0	9 0	9 0	As above.	
564 0	574 0	10 0	10 0	As above.	
574 0	584 0	10 0	10 0	As above.	
584 0	594 0	10 0	10 0	As above.	
594 0	595 0	1 0	1 0	As above.	
595 0	604 0	9 0	8 6	As above. 6 in. schist at 596 ft.	
604 0	605 0	1 0	0 9	As above.	
605 0	614 0	9 0	8 6	As above.	
614 0	620 0	6 0	5 6	As above.	
620 0	630 0	10 0	10 0	As above.	
630 0	633 0	3 0	3 0	As above.	
633 0	641 6	7 6	7 6	As above.	
641 6	661 6	20 0	20 0	As above.	
661 6	685 0	13 6	13 6	As above.	
685 0	697 0	12 0	12 0	As above.	
697 0	699 6	2 6	2 6	As above.	
699 6	700 6	1 0	1 0	As above.	
700 6	705 0	4 6	4 6	As above.	
705 0	706 6	1 6	1 6	As above.	
706 6	716 6	10 0	10 0	As above.	
716 6	725 0	9 6	8 6	As above.	
725 0	729 6	4 6	4 6	As above.	
729 6	735 6	6 0	6 0	As above.	
735 6	741 6	6 0	6 0	Highly siliceous magnetite-hematite banded iron formation with occasional disseminated pyrite.	
741 6	749 0	7 6	7 6	As above.	
749 0	754 0	5 0	5 0	As above.	
754 0	764 0	10 0	10 0	As above.	
764 0	768 6	4 6	4 6	As above.	
768 6	778 6	10 0	10 0	36 in. As above.	
		END OF ORE BODY			
				84 in. Chlorite schist.	
778 6	781 0	2 6	2 6	As above.	
781 0	791 0	10 0	10 0	As above, with pyrite blebs.	
791 0	797 0	6 0	6 0	Partly carbonitised meta-sediments	
797 0	799 6	2 6	2 6	As above.	
799 6	804 6	5 0	5 0	As above, partly broken.	
804 6	811 0	6 6	6 0	As above, broken and epidotised.	
811 0	821 0	10 0	10 0	Epidote-sericite-talc schist.	
821 0	825 0	4 0	1 6	As above.	
825 0	827 0	2 0	1 0	As above.	
827 0	832 0	5 0	4 6	As above.	
832 0	836 0	4 0	4 0	Epidotised chlorite schist.	
836 0	846 0	10 0	10 0	30 in. epidotised chlorite schist. 6 in. igneous intrusive. 84 in. tuffaceous meta-sediments.	
846 0	856 0	10 0	10 0	As above.	
856 0	862 0	6 0	6 0	As above.	
862 0	872 0	10 0	10 0	As above.	
		END OF HOLE.			

Core Recovery Analysis.

From	To	Core Recovered		Remarks
ft. ins.	ft. ins.	ft. ins.	%	
0 0	27 6	15 9	57·3	Iron Ore.
27 6	273 0	117 5	47·8	Country Rock.
273 0	392 0	113 4	95·3	Iron Ore.
392 0	525 0	115 3	49·5	Country Rock.
525 0	771 6	233 9	94·8	Iron Ore.
771 6	872 0	96 0	95·5	Country Rock.
0 0	872 0	691 6	79·3	Overall.

Sample List.
D.D.H. No. 3—Site C.

Sample No.	From	To	Sample Length	Assayed for	Results Fe (Acid Soluble) on dry basis
	ft. ins.	ft. ins.	ft. ins.		%
TR50	0 0	10 0	10 0	Fe	49·2
TR51	10 0	20 0	10 0	Fe	48·8
TR52	20 0	51 0	31 0	Fe	45·7
TR53	261 0	271 0	10 0	Fe	39·3
TR54	271 0	281 0	10 0	Fe	49·1
TR55	281 0	291 0	10 0	Fe	48·3
TR56	291 0	301 0	10 0	Fe	54·5
TR57	301 0	311 0	10 0	Fe	38·8
TR58	311 0	321 0	10 0	Fe	38·2
TR59	321 0	331 0	10 0	Fe	58·6
TR60	331 0	341 0	10 0	Fe	29·3
TR61	341 0	351 0	10 0	Fe	57·5
TR62	351 0	361 0	10 0	Fe	47·8
TR63	361 0	371 0	10 0	Fe	43·3
TR64	371 0	381 0	10 0	Fe	25·0
TR65	381 0	392 0	11 0	Fe	31·5
TR66	526 0	536 0	10 0	Fe	24·9
TR67	536 0	546 0	10 0	Fe	25·0
TR68	546 0	556 0	10 0	Fe	25·5
TR69	556 0	566 0	10 0	Fe	26·2
TR70	566 0	576 0	10 0	Fe	23·1
TR71	576 0	586 0	10 0	Fe	23·6
TR72	586 0	596 0	10 0	Fe	25·5
TR73	596 0	606 0	10 0	Fe	30·4
TR74	606 0	616 0	10 0	Fe	28·5
TR75	616 0	626 0	10 0	Fe	20·9
TR76	626 0	636 0	10 0	Fe	25·9
TR77	636 0	646 0	10 0	Fe	31·3
TR78	646 0	656 0	10 0	Fe	26·7
TR79	656 0	666 0	10 0	Fe	29·8
TR80	666 0	676 0	10 0	Fe	30·9
TR81	676 0	686 0	10 0	Fe	33·1
TR82	686 0	697 0	11 0	Fe	23·0
TR83	697 0	707 0	10 0	Fe	6·60
TR84	707 0	717 0	10 0	Fe	14·8
TR85	717 0	727 0	10 0	Fe	21·8
TR86	727 0	737 0	10 0	Fe	6·16
TR87	737 0	747 0	10 0	Fe	24·9
TR88	747 0	757 0	10 0	Fe	9·76
TR89	757 0	767 0	10 0	Fe	19·6
TR90	767 0	771 6	4 6	Fe	9·91

Mineral Determinations.
D.D.H. No. 3—Site C.

Sample No.	Relative Abundance of Minerals				
	Hematite	Magnetite	Limonite	Pyrite	Others
TR50	A	L	C	....	L
TR51	A	L	A	....	L
TR52	A	T	A	....	A
TR53	C–A	L	L	....	C
TR54	A	....	L	....	L
TR55	A	T	T–L	....	L
TR56	A	....	C	....	A
TR57	C–A	....	C	....	A
TR58	C	....	C	....	A
TR59	A	....	L	....	A
TR60	L–C	....	C	....	A
TR61	A	....	T–L	....	C
TR62	A	....	C	....	C–A
TR63	A	....	L	....	C–A
TR64	L	T	L	A	A
TR65	C	T	C	A	C
TR66	T	C	....	T	A
TR67	....	A	....	T–L	A
TR68	....	C	....	T	A
TR69	....	C–A	....	T	A
TR70	....	C	....	T–L	A
TR71	....	A	....	T–L	A
TR72	T	A	....	T	C–A
TR73	....	C–A	....	T	A
TR74	L	C	....	C	A
TR75	....	L	....	L	A
TR76	....	C	....	L	A
TR77	T	C–A	....	T	A
TR78	T	C	....	T	A
TR79	T	C–A	....	T	A
TR80	T	C–A	....	T	A
TR81	....	A	....	T	C–A
TR82	....	C	....	T	A
TR83	....	L	....	T	A
TR84	....	L–C	....	T	A
TR85	....	C–A	....	T	A
TR86	....	C	....	T	A
TR87	....	C	....	T	A
TR88	....	L–C	....	T	A
TR89	....	C	....	T	A
TR90	....	L	....	T	A

A = Abundant
C = Common
L = Little
T = Trace
" others " are predominantly chlorite and quartz.

Group Analyses.
D.D.H. No. 3—Site A.

Chemical Laboratory No. (1959)	8261	8262	8263
G.S.W.A. Numbers....	TR50–TR52	TR53–TR65	TR66–TR90
Between Drillhole depths	0ft.–51ft.	261ft.–392ft.	526 ft.–771ft. 6ins.
	Percentage on dry basis		
Iron Fe (total)	47·9	46·5	23·7
Iron Fe (acid soluble)	47·7	43·4	22·7
Silica SiO_2	22·2	11·5	62·6
Phosphorus P	0·03	0·02	0·03
Titanium Ti	0·20	0·15	0·03
Magnesia MgO	*Nil*	6·46	1·07
Lime CaO	0·09	0·08	*Nil*
Manganese Mn	0·01	0·05	0·04
Sulphur S	0·06	2·58	0·59

Diamond Drill Hole No. 4, Site D.
Detailed Log.

Locality: Tallering Range, approximately 605 feet N. 33° W. (mag.) of Tallering Trig.

Angle of Depression at Surface: 45°.

Bearing of Hole at Surface: 145° (mag.)

Machine Used: Mindrill "A3000."

Core Size: A X T.

Total Depth: 860 feet. Contractor: A Horsham.

Commenced: 1/7/59. Completed: 10/9/59.

Logged by: A. J. Noldart—0 feet to 591 feet, R. R. Connolly—591 feet to end of hole.

Core Log.

Pulls From	Pulls To	Width	Core Recovered	Particulars of Core
ft. ins.	ft. ins.	ft. ins.	ft. ins.	
0 0	10 0	10 0	2 6	Pisolitic, limonitic laterite and recemented jaspilite fragments —low grade iron ore.
10 0	22 0	12 0	4 0	As above.
22 0	39 0	17 0	3 4	As above.
39 0	48 0	9 0	6 3	As above.
48 0	61 0	13 0	1 9	As above.
61 0	73 0	12 0	1 2	As above. END OF ORE BODY.
73 0	83 0	10 0	1 6	9 in. red clayey meta-sediments. 9 in. white kaolinitic rock.
83 0	110 0	27 0	1 0	Highly oxidised reddish meta-sediments highly sheared and fractured throughout.
110 0	120 0	10 0	2 3	As above.
120 0	143 0	23 0	3 0	As above.
143 0	145 0	2 0	1 3	As above.
145 0	155 0	10 0	3 4	As above.
155 0	173 0	23 0	2 3	As above.
173 0	183 0	10 0	5 6	As above.
183 0	188 0	5 0	4 6	As above.
188 0	198 0	10 0	2 6	As above.
198 0	209 0	11 0	3 3	As above.
209 0	214 0	5 0	3 4	As above.
214 0	222 0	8 0	4 0	As above.
222 0	230 0	8 0	4 9	As above.
230 0	234 0	4 0	3 9	As above.
234 0	238 0	4 0	3 0	As above.
238 0	242 0	4 0	3 6	As above.
242 0	252 0	10 0	10 0	As above.
252 0	262 0	10 0	10 0	18 in. As above. 102 in. As above but becoming greenish and less oxidised.
262 0	272 0	10 0	10 0	108 in. Talc-chlorite-sericite-schist. 12 in. reddish, oxidised meta-sediments.
272 0	281 0	9 0	5 0	As above. START OF ORE BODY.
281 0	285 0	4 0	3 2	Hematitic iron ore with strong weathering to limonite—remnant banded iron formation structure throughout.
285 0	295 0	10 0	9 0	6 in. reddish meta-sediments. 39 in. whitish-green kaolinitic rock. 3 in. reddish meta-sediments. 60 in. oxides of iron as above.
295 0	299 0	4 0	4 0	As above.
299 0	309 0	10 0	10 0	As above.
309 0	319 0	10 0	10 0	As above.
319 0	329 0	10 0	10 0	As above.
329 0	337 6	8 6	8 6	As above.
337 6	347 0	9 6	9 6	As above.
347 0	353 0	6 0	6 0	Oxides of iron as above—cave in and water loss.
353 0	360 0	7 0	6 0	Oxides of iron as above—mud on joint faces, etc.
360 0	360 6	0 6	0 6	Oxides of iron as above.
360 6	370 6	10 0	10 0	As above.
370 6	375 0	4 6	4 6	As above.
375 0	375 6	0 6	0 4	As above.
375 6	383 6	8 0	8 0	As above.
383 6	387 6	4 0	3 9	As above.
387 6	388 6	1 0	0 9	As above.
388 6	398 6	10 0	10 0	As above.

Core Log—*continued.*

Pulls From	Pulls To	Width	Core Recovered	Particulars of Core
ft. ins.	ft. ins.	ft. ins.	ft. ins.	
398 6	402 0	3 6	3 6	Oxides of iron as above.
402 0	409 0	7 0	6 0	As above.
409 0	412 0	3 0	2 9	As above.
412 0	414 6	2 6	2 3	As above.
414 6	415 0	0 6	0 6	As above.
415 0	419 0	4 0	4 0	24 in. As above. 24 in. oxidised red and talcose meta-sediments.
419 0	428 6	9 6	9 6	78 in. As above. 36 in. hematitic iron ore as above contaminated with talcose country rock.
428 6	430 0	1 6	1 0	As above.
430 0	439 0	9 0	9 0	72 in. As above. END OF ORE BODY. 36 in. partly weathered meta-sediments—talcose.
439 0	449 6	10 6	10 0	As above.
449 6	452 6	3 0	3 0	As above.
452 6	461 0	8 6	8 6	As above, iron staining on joint faces—rock more tuffaceous.
461 0	463 6	2 6	2 6	As above.
463 6	473 6	10 0	10 0	Partly weathered meta-sediments talcose-coarse-grained tuffaceous appearance.
473 6	483 6	10 0	10 0	As above, amphibolite porphyroblasts.
483 6	486 0	2 6	2 6	As above.
486 0	491 0	5 0	5 0	As above.
491 0	494 0	3 0	3 0	As above.
494 0	503 6	9 6	9 6	Medium-grained talcose meta-sediments.
503 6	511 0	7 6	7 6	As above.
511 0	521 0	10 0	10 0	As above.
521. 0	525 0	4 0	4 0	As above.
525 0	535 0	10 0	10 0	As above.
535 0	541 0	6 0	6 0	As above.
541 0	551 0	10 0	10 0	As above, occurrences of syngenetic pyrite.
511 0	561 0	10 0	10 0	As above, becoming siliceous and spotty—traces of pyrite. This rock may be a meta-agglomerate.
561 0	571 0	10 0	10 0	96 in. As above. START OF ORE BODY. 24 in. banded silica-magnetite iron "ore" with pyrite blebs.
571 0	581 0	10 0	10 0	15 in. As above. 105 in. hematite banded iron formation with some magnetite present—coarse silica bandings.
581 0	591 0	10 0	10 0	As above., some syngenetic pyrite present.
591 0	601 0	10 0	10 0	Megnetite banded iron formation with pyrite blebs and slump breccia in places. Occasional transverse silica veins.
601 0	610 0	9 0	9 0	As above.
610 0	620 0	10 0	10 0	As above, with 12 in. talc chlorite schist at 613 ft.
620 0	629 6	9 6	9 6	Contorted and brecciated magnetite banded iron formation with scattered pyrite and some transverse silica veins.
629 6	639 6	10 0	10 0	As above.
639 6	645 6	6 0	6 0	As above.
645 6	652 6	7 0	7 0	As above.
652 6	660 6	8 0	8 0	As above.
660 6	667 6	7 0	7 0	As above.
667 6	677 6	10 0	10 0	As above.
677 6	678 6	1 0	1 0	As above.
678 6	688 6	10 0	10 0	As above.
688 6	697 6	9 0	9 0	As above.
697 6	707 6	10 0	10 0	As above.
707 6	717 6	10 0	10 0	As above with two pyrite bands each 1 inch thick.
717 6	725 6	8 0	8 0	Contorted and brecciated magnetite banded iron formation with scattered pyrite and some transverse silica veins.
725 6	732 0	6 6	6 6	As above.
732 0	739 0	7 0	7 0	As above.
739 0	749 0	10 0	10 0	As above.
749 0	757 6	8 6	8 6	100 in. As above. END OF ORE BODY. 2 in. chloritic schist.
757 6	766 0	8 6	6 6	Green choritic schist with sparse pyrite blebs.
766 0	744 0	8 0	8 0	Green schistose siliceous meta-sediments with abundant pyrite.
774 0	783 0	9 0	6 0	As above.
783 0	792 0	9 0	5 0	As above.
792 0	797 0	5 0	5 0	Green schistose siliceous meta-sediments with abundant pyrite.
797 0	799 0	2 0	2 0	As above.
799 0	805 0	6 0	6 0	Green schistose siliceous meta-sediments with abundant pyrite—grading in places to a white talc.
805 0	815 0	10 0	10 0	Grey to green medium-grained meta-sediments with abundant chlorite in places.
815 0	825 0	10 0	10 0	Grey slightly schistose meta-sediments with occasional pyrite bands.
825 0	830 0	5 0	5 0	As above.
830 0	840 0	10 0	10 0	As above.
840 0	850 0	10 0	10 0	As above.
850 0	860 0	10 0	10 0	As above. END OF HOLE.

Core Recovery Analysis.
D.D.H. No. 4, Site D.

From	To	Core Recovered		Remarks
ft. ins.	ft. ins.	ft. ins.	%	
0 0	73 0	19 0	26·0	Iron Ore.
73 0	281 0	73 8	35·4	Country rock.
281 0	436 0	149 6	97·9	Iron ore
436 0	569 0	131 6	99·9	Country rock
569 0	757 4	188 4	100·0	Banded iron ore.
757 4	860 0	93 8	91·2	Country rock.
0 0	860 0	655 8	76·3	Overall.

Sample List.
D.D.H. No. 4, Site D.

Sample No.	From	To	Sample Length	Assayed For	Results Fe (Acid Soluble) on dry basis
	ft. ins.	ft. ins.	ft. ins.		%
TR 91	0 0	22 0	22 0	Fe	44·2
TR 92	22 0	46 0	24 0	Fe	48·2
TR 93	46 0	48 0	2 0	Fe	27·0
TR 94	48 0	73 0	25 0	Fe	43·4
TR 95	281 0	285 0	4 0	Fe	63·7
TR 96	289 0	299 0	10 0	Fe	66·0
TR 97	299 0	309 0	10 0	Fe	66·3
TR 98	309 0	319 0	10 0	Fe	67·3
TR 99	319 0	329 0	10 0	Fe	67·5
TR100	329 0	339 0	10 0	Fe	67·8
TR101	339 0	349 0	10 0	Fe	67·8
TR102	349 0	359 0	10 0	Fe	67·3
TR103	359 0	369 0	10 0	Fe	67·9
TR104	369 0	379 0	10 0	Fe	68·2
TR105	379 0	389 0	10 0	Fe	68·6
TR106	389 0	399 0	10 0	Fe	68·6
TR107	399 0	409 0	10 0	Fe	66·8
TR108	409 0	417 0	8 0	Fe	66·7
TR109	417 0	427 0	10 0	Fe	46·6
TR110	427 0	437 0	10 0	Fe	60·0
TR111	569 0	571 0	2 0	Fe	45·7
TR112	571 0	581 0	10 0	Fe	36·4
TR113	581 0	591 0	10 0	Fe	30·9
TR114	591 0	601 0	10 0	Fe	22·2
TR115	601 0	610 0	9 0	Fe	24·0
TR116	610 0	620 0	10 0	Fe	25·5
TR117	620 0	629 6	9 6	Fe	21·1
TR118	629 6	639 6	10 0	Fe	24·6
TR119	639 6	645 6	6 0	Fe	22·0
TR120	645 6	652 6	7 0	Fe	24·0
TR121	652 6	660 6	8 0	Fe	22·9
TR122	660 6	667 6	7 0	Fe	22·2
TR123	667 6	677 6	10 0	Fe	22·3
TR124	677 6	688 6	11 0	Fe	24·3
TR125	688 6	697 6	9 0	Fe	21·9
TR126	697 6	707 6	10 0	Fe	19·8
TR127	707 6	717 6	10 0	Fe	17·7
TR128	717 6	725 6	8 0	Fe	18·0
TR129	725 6	732 0	6 6	Fe	14·1
TR130	732 0	739 0	7 0	Fe	12·7
TR131	739 0	749 0	10 0	Fe	15·0
TR132	749 0	757 6	8 6	Fe	20·3

Mineral Determinations
D.D.H. No. 4—Site D

Sample No.	Relative Abundance of Minerals					
	Hematite	Limonite	Magnetite	Pyrite	Quartz	Chlorite
TR 91	C	A	....	....	C	....
TR 92	C	A	....	....	C	....
TR 93	A	C	....	....	A	....
TR 94	C	A	....	....	C	....
TR 95	A	A	....	....	C	....
TR 96	A	C	....	....	L	....
TR 97	A	C	....	....	L	....
TR 98	A	C	....	....	L	....
TR 99	A	C	....	....	L	....
TR100	A	C	....	....	L	....
TR101	A	C	....	....	L	....
TR102	A	C	....	....	L	....
TR103	A	C	....	....	L	....
TR104	A	C	....	....	L	....
TR105	A	C	....	....	L	....
TR106	A	C	....	....	L	....
TR107	A	C	L	....	L	L
TR108	A	C	L	....	L	L
TR109	C	L	A	....	L	A
TR110	C	L	A	....	L	A
TR111	A	....	C	T	C–A	C
TR112	C–A	....	C	T	A	C
TR113	C	....	C	T	A	C A
TR114	L	....	C–A	T	A	C
TR115	L–T	....	C–A	T	A	C–A
TR116	T	....	C–A	R	A	A
TR117	T–L	....	C–A	T	A	T–L
TR118	....	....	C–A	T–L	A	L–C
TR119	C	....	C	T–L	A	L
TR120	L–C	....	C	T–L	A	L
TR121	L	....	C–A	T	A	L
TR122	L	....	C–A	T	A	T–L
TR123	L	....	C–A	T	A	T–L
TR124	T–L	....	C	T	A	T
TR125	L	....	C	T	A	T
TR126	L	....	C	R	A	R
TR127	L	....	C	T–L	A	R
TR128	T–L	....	C	T	A	R
TR129	T–L	....	C	T	A	T
TR130	L	....	C	T	A	T
TR131	L–C	....	C	L–C	A	T
TR132	L	....	C	T	A	T–L

A = Abundant. C = Common L = Little T = Trace. R = Rare.

Group Analyses
D.D.H. No.4—Site D

Chemical Laboratory No. (1959)	12970	12971	12972
G.S.W.A. Numbers	TR91–TR94	TR95–TR110	TR111–TR132
Between Drillhole lengths	0ft.–73ft.	281ft.–437ft.	569ft.-757ft. 6in.
	Per cent. on dry basis.		
Iron Fe (total)	45·0	67·5	23·5
Iron Fe (acid soluble)	44·1	64·8	22·4
Silica SiO_2	27·6	2·73	64·3
Phosphorus P	0·02	0·01	0·05
Titanium Ti	0·11	0·04	0·02
Magnesia MgO	0·08	0·61	0·85
Lime CaO	*Nil*	*Nil*	0·06
Manganese Mn	0·03	0·01	0·02
Sulphur S.	0·02	0·01	0·72

REPORT ON DIAMOND DRILLING OF ABANDONED GOLD SHOWS D.D.H. No. C3, SITE B1, "FOREST KING" G.M., LATE G.M.L. 284, COOLGARDIE.

By R. R. Connolly,

Geological Survey of W.A.

Location and Access.

The "Forest King" G.M. adjoins to the south-east the "Lady Loch" G.M., access to which has already been described in a previous report (page 75). The track from Coolgardie to the "Lady Loch" continues through that lease and passes immediately to the north of the main shaft on the "Forest King." The three compartment main shaft on the "Forest King" is still identifiable although in poor condition. There are no surface structures remaining on the lease.

Production.

The production from the "Forest King" lease cannot be separated from other leases with which it was amalgamated to form Lady Loch Gold Mines Ltd., but as the "Forest King" was the main producer for the company, the following figures as supplied by the Mines Statistician may be applied to this lease with fair accuracy:—

Late G.M.L's. 336, 284, 1583, 745, 2094, 2105, 2073.

Lady Loch G.M's. Ltd.—

to 1902: 24,711 tons ore yielded 20,061.38 fine ozs. gold.

1903/06: 3,923 tons ore yielded 2,904.99 fine ozs. gold.

The 1903/06 figures are probably the results of tributors, as at this period the company was attempting to raise additional capital to finance an exploratory drilling programme. This implies that so far as the company was concerned, the ore was mined out and a new body would have to be found if the company was to continue.

The additional capital was not raised and the company relinquished the leases in 1907.

The Ore Body.

Information on the attitude and dimensions of the ore body was found on a company supplied level plan and longitudinal projection showing some stope outlines, held at the Geological Survey office (folder 164 drawer C19). This was augmented by a description of the mine by Blatchford in 1898 (G.S.W.A. Bulletin No. 3, p. 63).

The ore body was a quartz reef in basic lavas, the reef generally striking N. 10° E. and dipping at 60° to the east. The longitudinal projection indicates a steep northerly plunge (approximately 75°) on the northern edge of the reef and a shallower plunge to the southern edge, giving a roughly triangular, tabular ore body, the base of the triangle being the surface outcrop of the reef and the apex at a point on the No. 7 level.

The maximum length (at the No. 1 level) is 450 feet; the depth to which the reef was worked is 520 feet vertical or 600 feet on the 60° underlay; the thickness of the reef as observed above the No. 3 level varies from 1 foot to 6 feet.

Purpose of the Drillhole.

Following representations by the Coolgardie Prospectors' Association, the Hon. Minister for Mines approved of an exploratory drilling programme to test the downward continuation of the "Forest King" G.M. A Temporary Crown Reserve (1636H) was declared surrounding the mine and two drill sites were marked on the ground in August, 1958. The drilling was NOT recommended by the Government Geologist.

In the absence of detailed subsurface geological information on the mine, planning of exploratory drillholes was done with the idea of intersecting the plane of the ore body at two points each at least 200 feet down dip from the bottom of the old workings, this on the chance of improvement of the grade of the ore channel if continuing to this depth, or of repetition of the reef.

Accordingly, hole No. C3 was drilled from site B1 which was located 765 feet on a bearing S. 76° E. from the main shaft, the azimuth of the drillhole being 293° and the angle of depression 60°. It was calculated that the reef if present, would be intersected at approximately 900 feet drillhole length and that the hole would be continued for 100 feet into the footwall.

Mineralization and Assay.

A total of ten samples were submitted for assay, six samples to the Kalgoorlie Metallurgical Laboratory and the remaining four to the Government Chemical Laboratories. The results of these assays are shown in the appended table.

Thin quartz-carbonate veins with some pyrite mineralization occurred intermittently between 845 and 963 feet in the drillhole and one or more of these veins may represent the downward continuation of the Forest King quartz reef. None contained gold and four other samples from positions outside of the target area of the hole were also barren.

Surveying.

The drillhole was surveyed at intervals of 200 feet by an officer of the State Mining Engineer's Branch and the results of the survey are shown in the appended table. A pronounced southerly drift in azimuth early in the hole resulted in a penetration some 150 feet to the south of the planned target area. This however, was still within the rather arbitrary lateral limits assumed for the ore body.

Core Recovery.

An analysis of the core recovery is as follows:—

Depth		Core Recovered	Per cent. Recovered
From	To		
ft.	ft.	in.	
0	200	1,178	49·1
200	1,155	11,141	97·2
0	1,155	12,319	88·9

Conclusions.

The first of two diamond drillholes designed to test the possible depth extension of the Forest King G.M. cut a succession of small quartz-carbonate veins at the anticipated target depth. It is considered that these veins represent the downward continuation of the Forest King reef, but at the points of intersection the veins were barren of gold.

A second hole is in progress which is aimed to cut the reef some 290 feet to the north and test the possibility of a more shallow northerly plunge to the Forest King ore body.

R. R. CONNOLLY,
Geologist.

22/1/60.

FOREST KING G.M. T.R. 1636H.

Crown Diamond Drilling.

D.D.H. No. C3, Site B1.

Commenced: 10th February, 1959. Completed: 12th August, 1959.

Sample List.

G.S.W.A. Sample No.	Drill Hole Depth From		Drill Hole Depth To		Core	Assay	Remarks
	ft.	in.	ft.	in.	in.	dwts./long ton	
GS/C/29	457	0	459	0	24	Less than 0·1	Quartz - carbo - nate - pyrite
31	568	0	570	0	24	,,	Quartz - pyrite - greenstone
30	588	0	590	0	24	,,	Quartz - carbo - nate-pyrite
32	845	9	846	6	9	,,	,,
33	918	8	920	3	15	,,	,,
34	920	3	920	9	6	,,	,,
35	935	6	938	6	36	*Nil*	,,
36	945	4	948	4	36	,,	,,
37	960	3	963	3	36	,,	,,
38	1,125	0	1,128	0	36	,,	,,

Survey Results.

Depth	Angle of Depression	Azimuth	Remarks
ft.			
100	58°	N. 77° W.	Cased to 55 ft.
300	58°	N. 82° W.	
500	56°	N. 88° W.	
700	55°	N. 87° W.	
900	53°	N. 90° W.	
1,100	51°	N. 79° W.	

FOREST KING G.M.

Crown Diamond Drilling.

D.D.H. No. C3, Site No. B1.

Position of Hole Collar: 765 feet S 76°E from main shaft.

Azimuth at Surface: 293°. Machine used: Mindrill A2000.

Angle of Depression: 60°. Core Size: AXT.

Commenced: 10th February, 1959. Completed: 12th August, 1959.

Driller: F. Jennings. Final Drillhole Depth: 1,155 feet.

Logged by: G. H. Low.

Summarized Log.

From		To		Description
ft.	in.	ft.	in.	
0	0	94	0	Weathered fine grained greenstone.
94	0	160	8	Fairly massive fine grained greenstone.
160	8	180	7	Schistose fine grained greenstone with schistosity at 45° to core axis.
180	7	188	0	Fairly massive fine grained greenstone.
188	0	213	6	Schistose fine grained greenstone.
213	6	258	0	Massive fine grained greenstone with occasional thin quartz/carbonate veins at 50° to core axis.
258	0	350	0	Schistose fine grained greenstone with occasional quartz veins.
350	0	420	0	Massive fine grained greenstone.
420	0	438	0	Fine grained greenstone, slightly schistose with some quartz/carbonate veins.
438	0	457	0	Massive fine grained greenstone.
457	0	459	0	Irregular quartz/carbonate in fine grained greenstone.
459	0	511	0	Fine grained greenstone with irregular quartz/carbonate veins.

PLATE XX

Thick mulga scrub

Mulga scrub

mulga scrub

irregular iron enrichment on surface

soil and surface rubble

irregular development of laterite in places

soil and surface rubble on metamorphosed argillaceous sediments

thick mulga scrub

Jaspilite rubble

ironstone and silica rubble on slopes

TALLERING PEAK

TALLERING PEAK LENS (T1)

irregular iron enrichment on surface

ironstone and silica rubble on slopes

light mulga scrub.

soil cover over argillaceous metamorphosed sediments

SITE A D.D.H. 1 R.L. 1202'

SITE B D.D.H 2 R.L. 1171'

Depn. 60°

Depn. 60°

Line of Section N°1

Line of Section N°2

MAG.

S

J

Fe

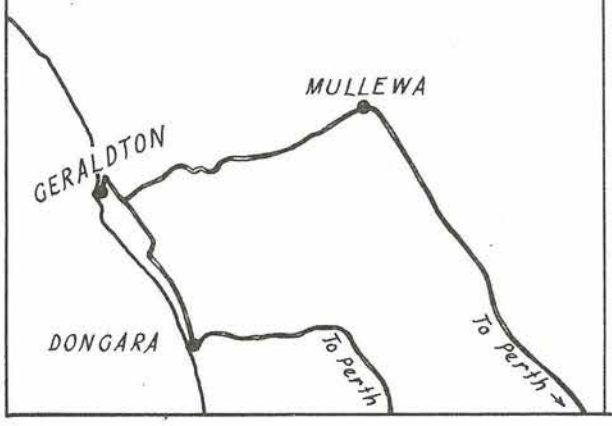
OP

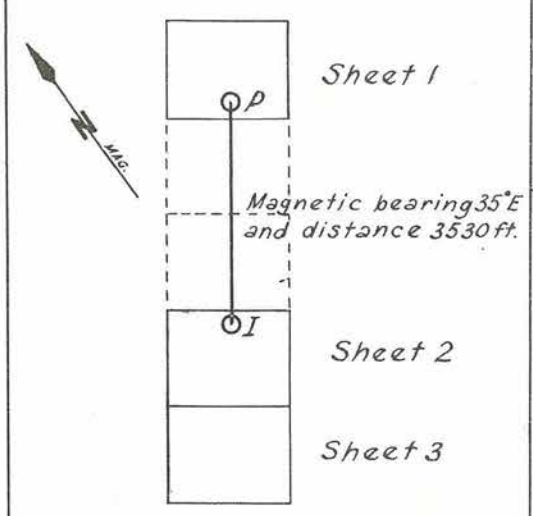
1150 1160 1170 1180 1190 1200 1210 1220 1230 1240 1250 1260 1270 1280 1290 1300 1310 1320 1330 1340 1350

55° 43° 45° 50° 30° 60° 50° 65° 58° 62° 70° 65°

LOCALITY MAP

— Scale: 40 mls = 1 inch —





KEY DIAGRAM

LEGEND

Iron ore consisting predominantly of fine grained massive Hematite with some silica bands and laths. Some limonite

Jaspilite coarse banded and mostly overlain by jaspilite rubble re-cemented and iron rich in places.

Soil covered areas. Alluvial and residual soils overlying meta-morphosed argillaceous sediments includes some lateritic areas.

G.S.W.A.

GEOLOGICAL MAP

TALLERING RANGE IRON DEPOSITS

Approx. 80m. N.E. of Geraldton

— Scale: 1" = 100 feet —

Datum for Levels: Tallering Trig Station — 1486 feet

Geology by G.H. Low. Plane table, alidade and theodolite survey by R.R. Connolly and G.H. Low. June 1958.

SHEET 1

J.H.C.

PLATE XXI

Soil and Lateritic rubble

Soil and Lateritic iron on surface

Laterite cover

Pisolitic and massive laterite

Jaspilite rubble and soil on slope

Line of Section N°3.

SITE C
D.D.H. 3
R.L. 1159'
Depn. 60°

Irregular iron enrichment on surface

Bands of silica

MIDDLE LENS (T2)

Jaspilite

Sheared and fractured sediments

MAG.

1110' 1120' 1130' 1140' 1150' 1160' 1170' 1180' 1190' 1200' 1210' 1220' 1230' 1240' 1250' 1260' 1270' 1280' 1290' 1300' 1310' 1320' 1330' 1340'

LEGEND

- Iron ore consisting predominantly of fine grained massive Hematite with some silica bands and laths. Some limonite.
- Jaspilite coarse banded and mostly overlain by jaspilite rubble re-cemented and iron rich in places.
- Soil covered areas. Alluvial and residual soils overlying meta-morphosed argillaceous sediments includes some lateritic areas.

J.H.C.

G.S.W.A.

GEOLOGICAL MAP
TALLERING RANGE IRON DEPOSITS

Approx. 80m. N.E. of Geraldton

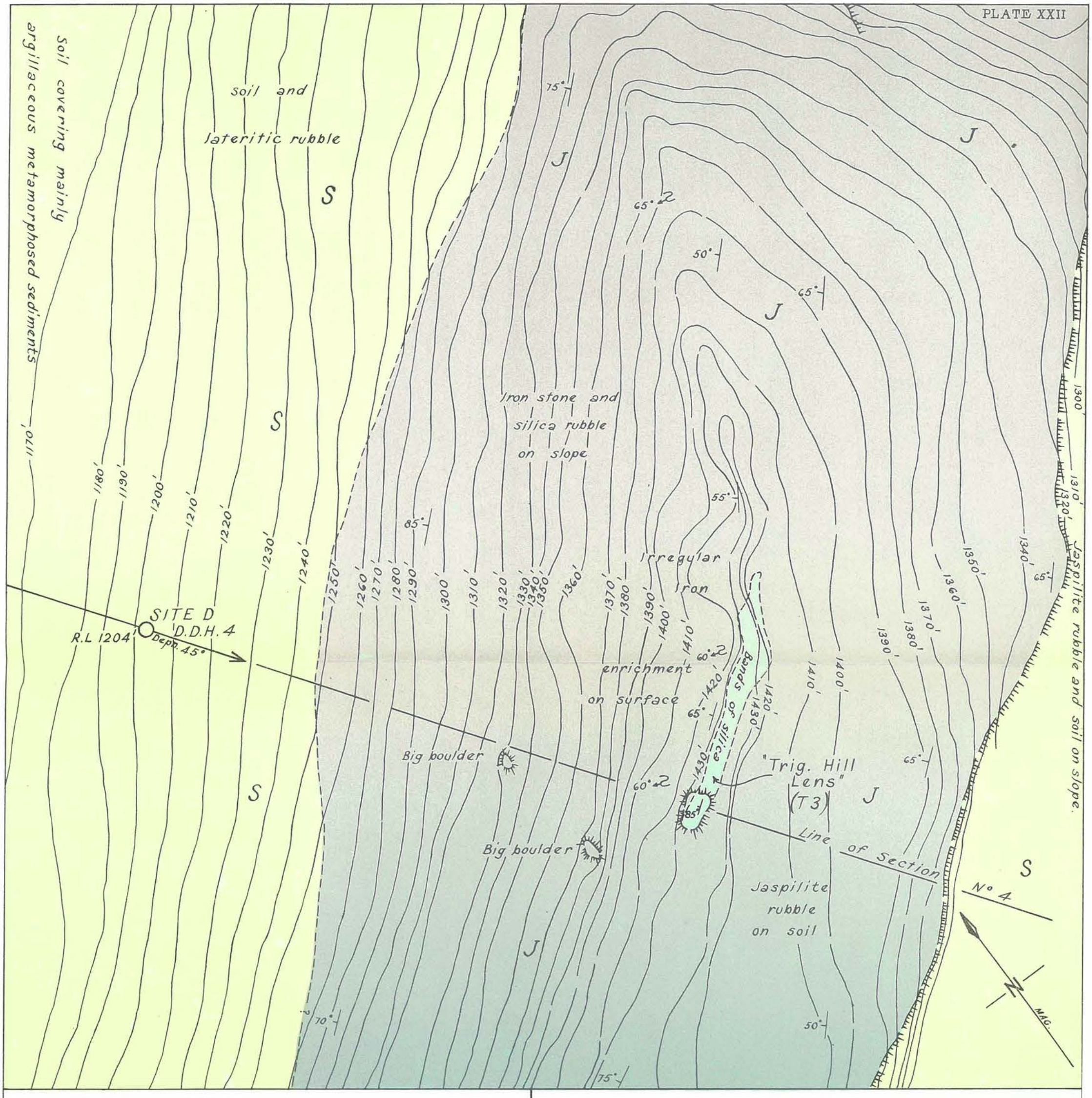
Scale: 1" = 100 feet

Datum for Levels: Tallering Trig Station – 1486 feet

Geology by G.H. Low. Plane table, alidade and theodolite survey by R.R. Connolly and G.H. Low. June 1958

SHEET 2

PLATE XXII



LEGEND

- Iron ore consisting predominantly of fine grained massive Hematite with some silica bands and laths. Some limonite.
- Jaspilite coarse banded and mostly overlain by jaspilite rubble re-cemented and iron rich in places.
- Soil covered areas. Alluvial and residual soils overlying meta-morphosed argillaceous sediments includes some laferitic areas.

J.H.C.

G.S.W.A.

GEOLOGICAL MAP
TALLERING RANGE IRON DEPOSITS

Approx. 80 m. N.E. of Geraldton

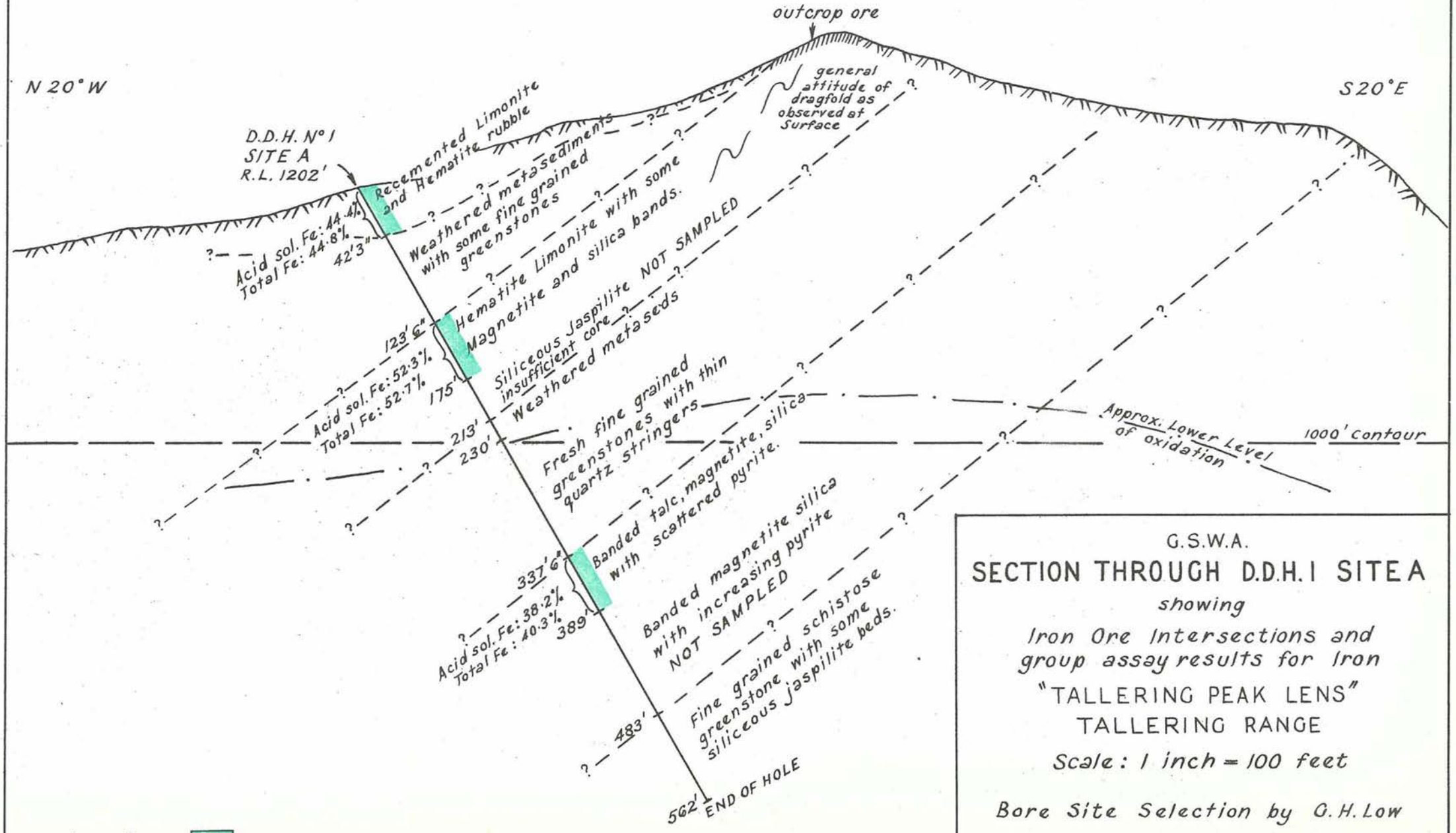
Scale: 1" = 100 feet

Datum for Levels: Tallering Trig Station - 1486 feet

Geology by G.H. Low. Plane table, alidade and theodolite survey by R.R. Connolly and G.H. Low. June 1958.

SHEET 3

PLATE XXIII



G.S.W.A.

SECTION THROUGH D.D.H. 1 SITE A

showing

Iron Ore Intersections and group assay results for Iron

"TALLERING PEAK LENS"

TALLERING RANGE

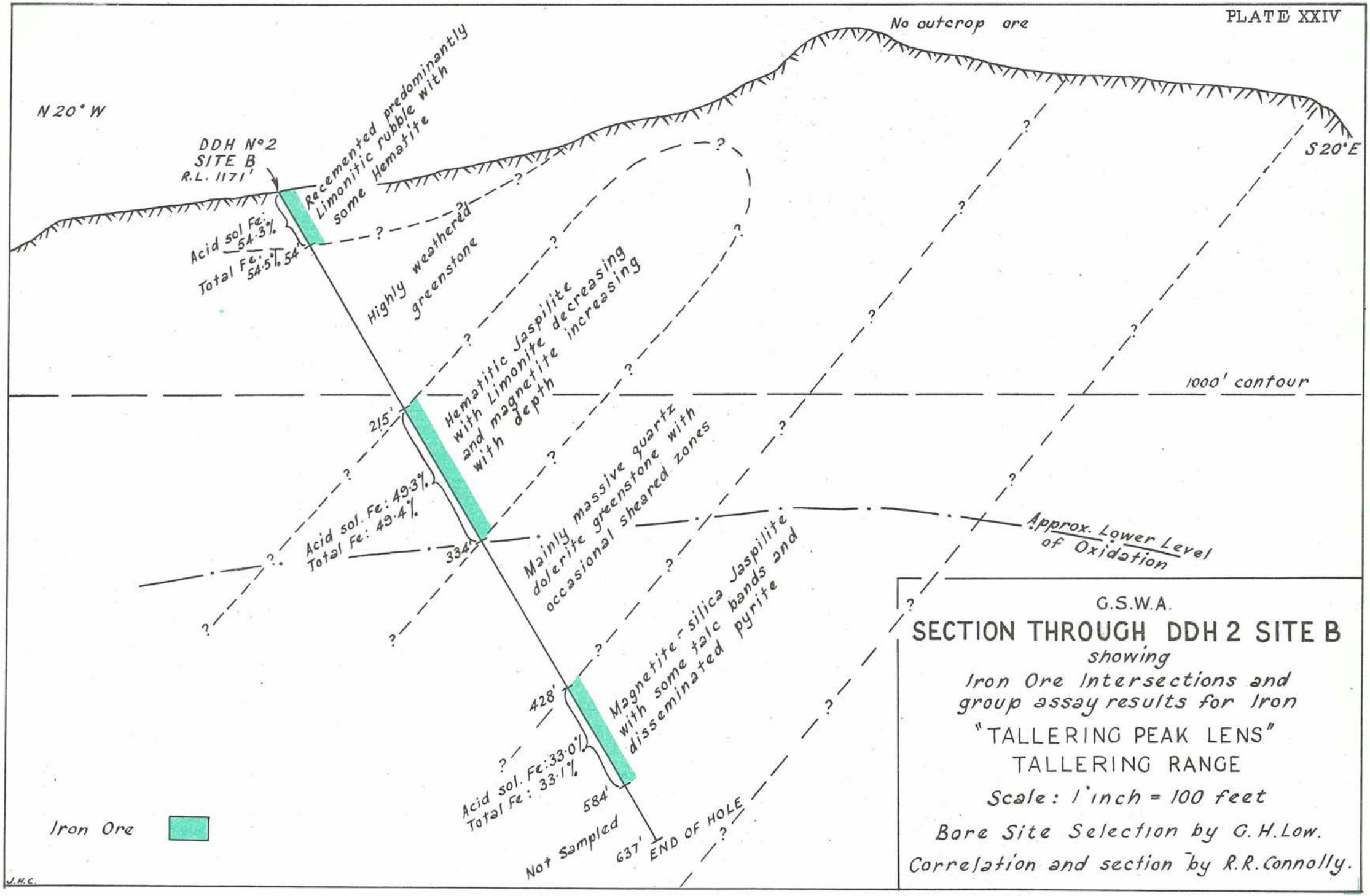
Scale: 1 inch = 100 feet

Bore Site Selection by G. H. Low

Correlation and section by R. R. Connolly.

J.H.C

PLATE XXIV



G.S.W.A.

SECTION THROUGH DDH 2 SITE B

showing

Iron Ore Intersections and
group assay results for Iron

"TALLERING PEAK LENS"

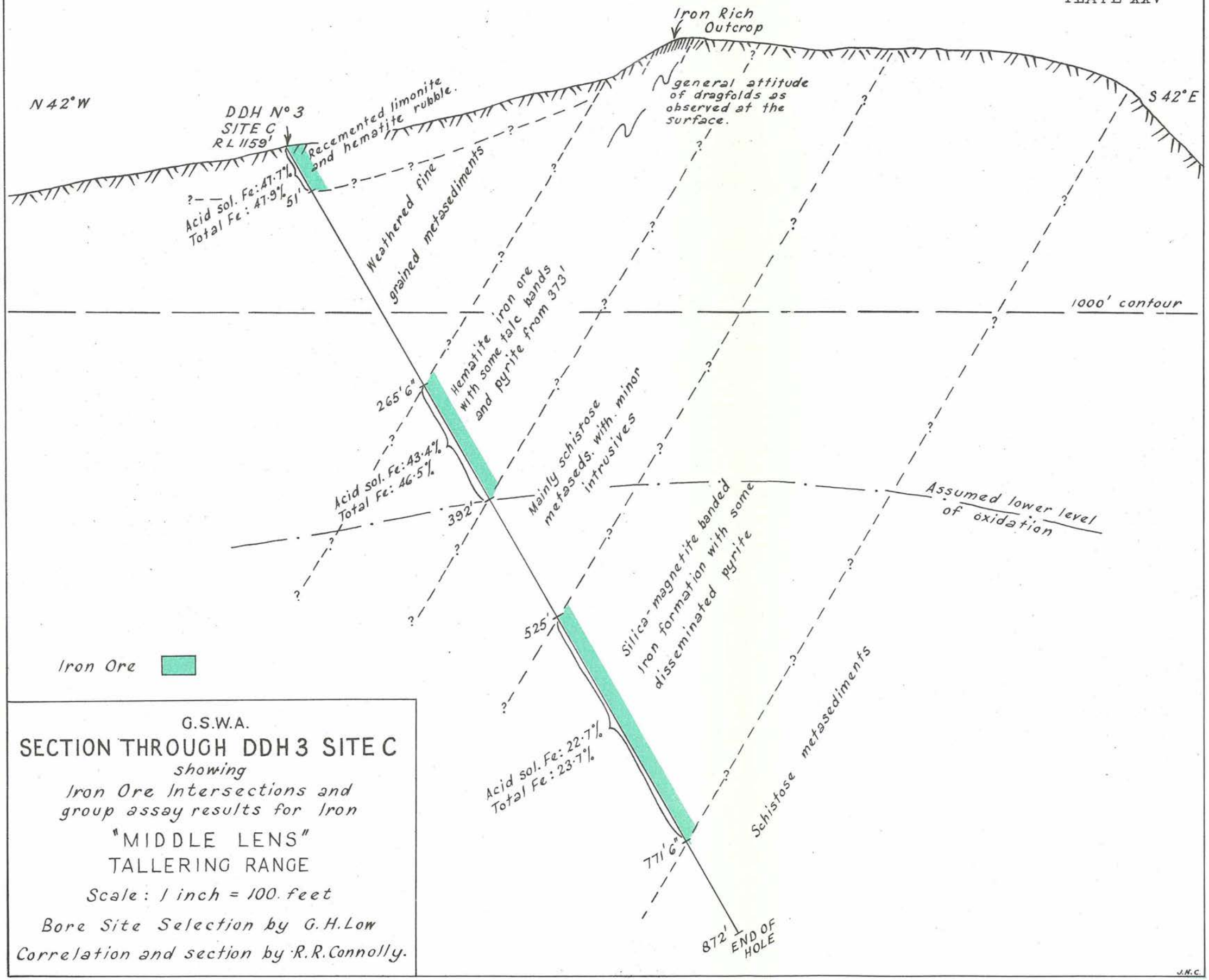
TALLERING RANGE

Scale: 1 inch = 100 feet

Bore Site Selection by G. H. Low.

Correlation and section by R. R. Connolly.

PLATE XXV



G.S.W.A.

SECTION THROUGH DDH 3 SITE C

showing

Iron Ore Intersections and group assay results for Iron

"MIDDLE LENS"

TALLERING RANGE

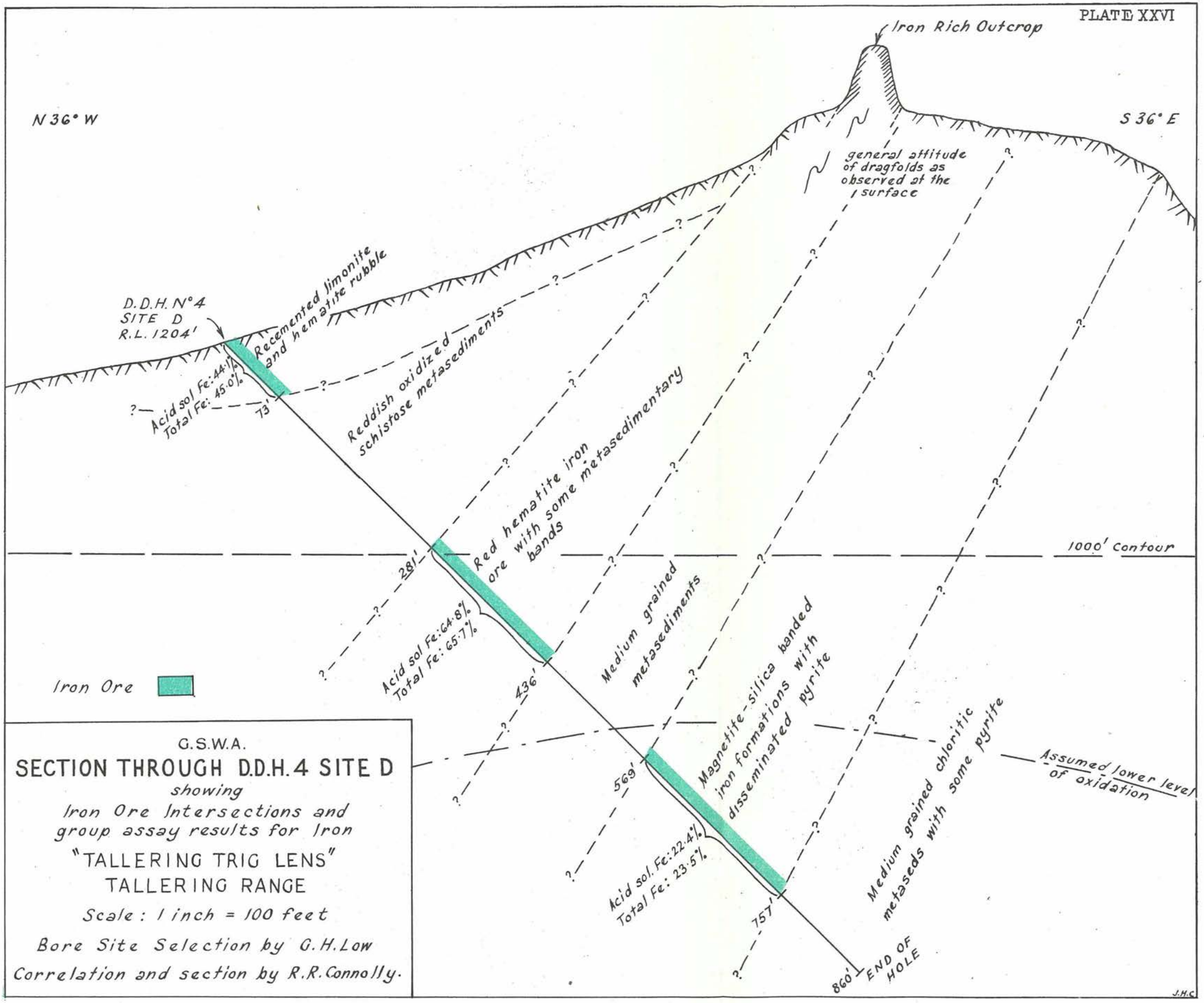
Scale: 1 inch = 100. feet

Bore Site Selection by G. H. Low

Correlation and section by R. R. Connolly.

J.H.C.

PLATE XXVI



G.S.W.A.

SECTION THROUGH D.D.H. 4 SITE D

showing

Iron Ore Intersections and group assay results for Iron

"TALLERING TRIG LENS"

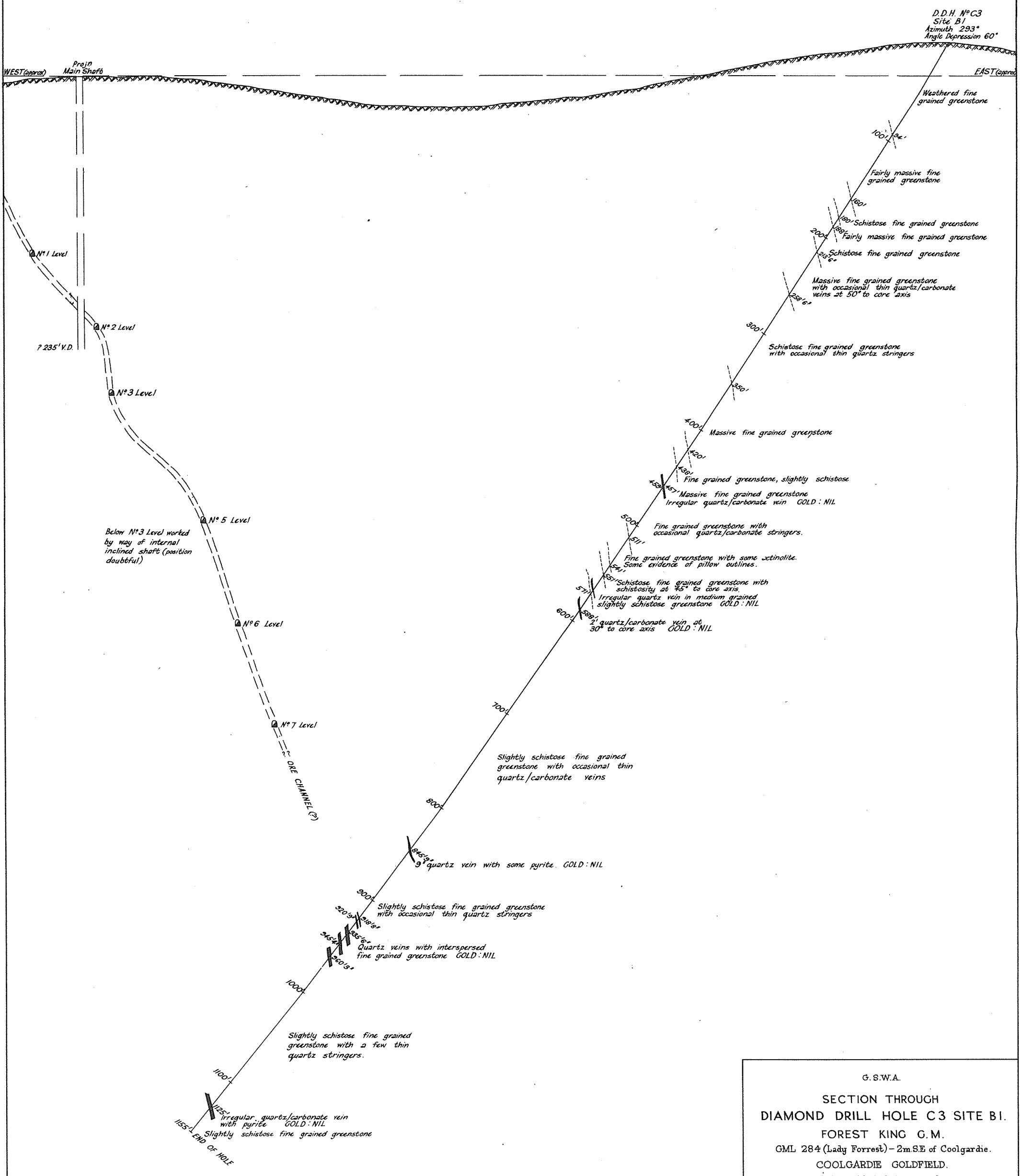
TALLERING RANGE

Scale : 1 inch = 100 feet

Bore Site Selection by G. H. Low

Correlation and section by R. R. Connolly.

PLATE XXVII



G.S.W.A.

SECTION THROUGH DIAMOND DRILL HOLE C3 SITE B1.

FOREST KING G.M.

GML 284 (Lady Forrest) – 2m.S.E of Coolgardie.

COOLGARDIE GOLDFIELD.

Scale – 80 feet to an inch.

By R.R.Connolly, Jan. 1960.

Summarised Log—*continued.*

From	To	Description
511 0	541 0	Fine grained greenstone carrying some actinolite. Some evidence of pillow outlines.
541 0	551 0	Schistose fine grained greenstone, schistosity at 45° to core axis.
551 0	571 0	Medium grained slightly schistose greenstone. Irregular quartz/carbonate vein with pyrite at 568 ft.
571 0	845 9	Slightly schistose fine grained greenstone with occasional thin quartz/carbonate veins. Two feet quartz/carbonate at 588 ft. oriented at 30° to core axis.
845 9	846 6	9 in. quartz with some pyrite mineralization.
846 6	918 8	Slightly schistose fine grained greenstone with some thin quartz/carbonate veins.
918 8	920 9	Mainly quartz/carbonate with pyrite mineralization.
920 9	935 6	Slightly schistose fine grained greenstone with irregular quartz/carbonate veins.
935 6	963 3	Mainly quartz/carbonate with pyrite interspersed with slightly schistose, fine grained greenstone.
963 3	1,125 0	Slightly schistose fine grained greenstone with occasional thin quartz/carbonate stringers.
1,125 0	1,128 0	Irregular quartz/carbonate vein with some pyrite mineralization.
1,128 0	1,155 0	Slightly schistose fine grained greenstone.
		END OF HOLE.

INDEX TO GEOLOGICAL SURVEY ANNUAL PROGRESS REPORT FOR 1959

INDEX TO GEOLOGICAL SURVEY ANNUAL REPORT FOR 1959—*continued*

DIVISION V

School of Mines, Western Australia

Annual Report — 1959

The Under Secretary for Mines:

I have the honour to submit for the information of the Honourable the Minister for Mines my report for the year 1959. The report covers the work done in Kalgoorlie, in Norseman, and in Bullfinch.

KALGOORLIE.

Enrolments.

The total number of students enrolled during 1959 was 365—a decrease of 15 by comparison with 1958. Table I gives the individual and class enrolments for 1959 and for the two previous years; Table II, the enrolments in individual subjects for 1959; and Table III, the enrolments in the various courses. The small increase in the number of students enrolled for Associateship Courses noted in last year's report again appeared this year and could now be significant. There was also an increase in number of students enrolled for Certificate Courses. Generally, there has been in recent years an increase in the standard of the students enrolled. This was first noticeable in 1958 and was again apparent in 1959. Classes such as Trade Mathematics I, Workshop Practice I, have been gradually becoming less useful, and no class in Trade Mathematics I will be held during 1960.

TABLE I.
Enrolments, Kalgoorlie.
1957, 1958, 1959.

Year	First Term		Second Term		Third Term	
	Individual	Class	Individual	Class	Individual	Class
1957	363	940	315	767	264	653
1958	370	871	314	757	278	673
1959	350	924	314	800	266	686

TABLE II.
Class Enrolments, Kalgoorlie, 1959.

Subject	First Term	Second Term	Third Term
Preparatory Chemistry	18	18	16
Chemistry IA	45	41	38
Chemistry IB	15	15	13
Chemistry II	4	4	4
Analytical Chemistry I	4	3	3
Analytical Chemistry II	3	3	3
Chemical Metallurgy I	2	2	2
Chemical Metallurgy II	6	6	6
Mineral Dressing I	14	12	11
Mineral Dressing II	3	3	2
Mineral Dressing III	6	6	6
Physical Metallurgy I	9	9	4
Assaying	11	11	11
Trade Metallurgy	8	6	5
Preparatory Mathematics	55	51	42
Mathematics I	45	36	29
Mathematics II	45	38	28
Mathematics III	....	....	1
Applied Mathematics I	35	31	26
Applied Mathematics II	9	8	8
Preparatory Physics	31	23	17
Physics I	66	58	53
Physics II	....	....	....
Physics III	....	....	....
Trade Mathematics I	19	11	5
Preparatory Engineering Drawing	29	24	15
Engineering Drawing I	42	35	28
Engineering Drawing and Design IIA	29	22	17
Engineering Drawing and Design IIB	6	3	2
Engineering Drawing and Design IIC	5	2	2
Engineering Drawing and Design IID	6	2	1
Surveying Drawing II	7	6	4
Mechanical Engineering I	11	10	9
Mechanical Engineering II	7	7	7
Practical Electricity	....	....	....
Electrical Engineering I	26	22	21
Electrical Engineering II	10	10	10
Internal Combustion Engines	12	10	8
Workshop Practice I	21	13	10
Workshop Practice II	4	4	3
Workshop Practice IIIA	1	1	1
Workshop Practice IIIB	2	2	1
Engineering Workshop Practice....	9	9	9
Welding I	18	15	11
Welding II	5	5	4
Steam Engine Driving	3	2	2
Structural Engineering I	17	14	12
Structural Engineering II	5	5	5
Machine Design	8	6	5
Materials of Construction	11	11	10
Hydraulics	6	4	4
Preparatory Geology	36	32	27
Geology IA	13	12	12
Geology IB	15	14	13
Geology IIA	12	12	11
Geology IIB	5	5	5
Geology IIC	3	3	3
Geology IIIA	2	2	2
Geology IIIB	....	....	....
Geology IIIC	1	1	1
Mining I	22	20	18
Mining II	8	6	6
Mining III	3	3	8
Mining IIIB	....	....	....
Mine Ventilation	4	4	4
Surveying I	22	19	17
Surveying II	7	7	6
Preparatory English	9	6	6
English I	....	....	....
English IA	18	15	14
Totals	924	800	686
Totals, 1958	871	757	673

TABLE III.

Number of Students Enrolled for Various Courses at Kalgoorlie.

Course	Number Enrolled			
	1956	1957	1958	1959
Associateship Courses—				
Mining	30	27	29	35
Metallurgy	23	26	21	21
Engineering	40	37	43	43
Mining Geology	9	10	13	13
Total	102	100	106	112
Certificate Courses—				
Assayer's	2	2	2	5
Surveyor's	15	10	18	23
Mine Manager's	2	1	....	....
Engineering Draughtsman's	11	8	8	9
Electrical Engineering	5	2	4	7
Mechanical Engineering	1	3	....	....
Total	36	26	32	44
Technicians' Courses—				
Engine Operation and Maintenance	2	3	3	1
Workshop Foreman's	9	8	8	6
Welding	13	16	14	7
Total	24	27	25	14
No Set Course—				
Preparatory Subjects	54	50	52	61
External	....	....	....	3
Junior and Leaving	....	....	....	2
University	....	....	....	10
Others	149	184	165	119
Total	208	234	217	195
Total for Year	365	387	380	365

Revenue.

The following moneys were received during the year:—

	1958. £ s. d.	1959. £ s. d.
Class Fees, Registration Fees, Lecture Notes	623 16 6	1,253 4 0 62 0 0 63 12 6
Laboratory Deposits	39 0 0	154 0 0
Supplementary Examinations	44 0 0	20 0 0
Metallurgical Laboratory Trust	468 10 6	859 16 8
Apparatus and Equipment Trust Fund	1,000 0 0	1,000 0 0
Commonwealth Grants Trust	3,736 8 6	1,151 10 0
Mine Managers and Underground Supervisors	56 10 6	60 0 0
Sundries	83 17 11	54 15 8
Total	£6,052 3 11	£4,714 18 10

The increase in the amount received from students is due to a general increase in fees from the start of the year. This increase brought the school fees into line with those charged by the Technical Education Division of the Education Department. The increase in the amount paid into the Metallurgical Laboratory Trust Fund is due to the increase in the number of assays done in the Laboratory following the closing down of the only firm of Public Assayers in Kalgoorlie towards the end of 1958. Information about the numbers of students paying fees is given in Table IV. The table shows that about half the students pay either class fees or registration fee. The remainder receive free tuition, but do pay lecture note fees and Students' Association membership fees.

TABLE IV.

Numbers of Students Paying Fees at Kalgoorlie.

Group No.	Description	Full Time	Part Time	Ext.	Total
1	Students under 18, Lecture Notes plus Students' Association	19	129	....	148
2	Students 18–21, Registration plus Lecture Notes plus Students' Association	6	56	....	62
3	Students over 21, Class plus Lecture Notes plus Students' Association	1	105	2	108
4	Returned Servicemen, exempt class fees	....	34	1	35
5	Staff, exempt class fees	3	6	....	9
6	Scholarship holders, exempt class fees	3	....	....	3
	Total	32	330	3	365

Staff.

The following staff changes occurred during the year:—

Name	Position	Date	Notes
Burnham, A. M. (Mrs.)	Cleaner	23/2/59	Appointed
Cairnduff, D. J.	Junior Clerk	29/5/59	Appointed
Critchlow, R.	Junior Clerk	12/6/59	Transferred to Mining Registrar's Office
Dunstan, H. R.	Assayer	21/8/59	Appointed Acting Research Metallurgist. Confirmed 1/12/59
Higgs, K. E.	Laboratory Assistant	24/4/59	Resigned
Jones, H. E. (Miss)	Clerk-Typist	24/12/59	Resigned
Middleton-White, K. C.	Lecturer	27/2/59	Resigned
Mullins, H. D.	Laboratory Assistant	21/9/59	Appointed
Muskett, G. H.	Research Metallurgist	1/4/59	Appointed
Neve, H. D.	Laboratory Assistant	21/9/59	Transferred to position of Assayer
Richards, O. M. (Mrs.)	Cleaner	6/2/59	Resigned
Thomas, R. P.	Research Metallurgist	10/2/59	Transferred to teaching staff of School
Willis, R. J.	Cadet	16/2/59	Appointed
Wills, M. F.	Laboratory Assistant	7/9/59	Appointed

Courses of Study.

Generally the Courses and Subjects remained as in 1958. Revision of the Mechanical Engineering Certificate Course was completed during 1958 and the revised Course became available during 1959.

Annual and Supplementary Examinations.

The examination results are summarised in Tables V and VI—Table V is based on class enrolments and Table VI on individual enrolments. The figures for 1959 do not differ significantly from those for previous years. Table V shows that there was a small increase in the number of subject entries for the examinations and a small decrease in proportion of those who passed. Table VI shows that the percentage of individual students sitting was slightly lower than in the two previous years.

The results for individual subjects are given in Appendix I.

TABLE V.

Results of Annual and of Supplementary Examinations Based on Class Enrolments, 1955-1959, Kalgoorlie.

——	1955	1956	1957	1958	1959
Class enrolments = A	802	878	951	928	916
Number of entries for Annual Examinations = B	495	557	577	577	605
B/A per cent.	62	63	61	62	68
Number of passes at Annual Examinations, as a per cent. of A	51	53	48	52	52
Number of passes at Annual Examinations, as a per cent. of B	82	83	79	84	79
Number of passes at Annual and Supplementary Examinations, as a per cent. of A	52	55	52	53	54
Number of passes at Annual and Supplementary Examinations, as a per cent. of B	85	86	83	85	80

TABLE VI.

Students Sitting for Annual Examinations 1957, 1958, 1959, Kalgoorlie.

Course	1957		1958		1959	
	Number Enrolled	Per cent. Sitting	Number Enrolled	Per cent. Sitting	Number Enrolled	Per cent. Sitting
Associateship	100	89	106	91	112	86
Certificate	26	85	32	81	44	73
Technicians'	27	67	25	88	14	79
No Set Course	234	59	217	47	195	44
Total	387	69	380	64	365	61

Scholarships and Prizes.

S.T. Hunter continued to hold a Mines Department Entrance Scholarship. He completed another good year's work and also the final year of his Scholarship. Mr. Hunter made good use of his Scholarship and should complete the Associateship Course in Engineering in 1961. No applications for Scholarships were received during the year.

Twelve students held Chamber of Mines Scholarships during the year. All these students worked well and three completed the course for which they were enrolled. To the end of 1959 seven students had completed Associateship Courses under the Chamber of Mines Scholarship Scheme.

The usual Scholarships and Prizes were awarded at the end of the year, and a list of awards is given in Appendix 2.

Diplomas and Certificates.

During the year 22 students completed Associateship Courses; 15 students, Certificate Courses. and 10, Technicians' Courses. The number completing Associateship Courses is greater than any other year—the next highest was in 1949, when 20 students completed Associateship Courses. The numbers of students completing courses during the past five years is shown in Table VII.

For the first time in many years a graduation ceremony was held. Diplomas were presented to students by the President of the Chamber of Mines, Mr. R. J. Agnew, at a brief ceremony held at the Students' Association Ball. The ceremony was necessarily brief, but was quite impressive, and directed attention to those students who had completed courses as a result of some years of work and also to the purpose for which the School exists.

From 1940 onwards there has been a marked increase in the numbers of students completing Associateship Courses. Figures since 1902 are as follows:—

1902-1909	3
1910-1919	14
1920-1929	18
1930-1939	16
1940-1949	71
1950-1959	131

TABLE VII.

Diplomas and Certificates Awarded, 1955-1959.

——	1955	1956	1957	1958	1959
Associateship Courses—					
Mining	1	6	3	7	6
Metallurgy	2	4	5	2	11
Engineering	2	8	3	3	4
Mining Geology	....	1	....	1	1
	5	19	11	13	22
Certificate Courses—					
Assayer's	3	2	4	3	3
Mine Manager's	4	3	1	....	3
Mine Surveyor's	8	4	2	9	5
Engineering Draughtsman's	1	....	2	....	1
Electrical Engineering	....	....	....	1	1
Mechanical Engineering	1	....	....	1	2
	17	9	9	14	15
Technicians' Courses—					
Engine Operation and Maintenance	3	....	2	2	4
Workshop Foreman's	....	2	1	1	1
Welding	....	3	2	3	5
	3	5	4	6	10

Present indications are that for the next five years (1960-1964) there will be a small increase in the numbers completing Associateship Courses.

Library.

The bulk of the school book stock has been catalogued as reported last year. The uncatalogued material is mainly pamphlets and unbound serials. As the library becomes organised into a working unit, the maintenance of library service leaves little time for other than current work, and the cataloguing of old material must be done mainly in school vacation.

Numbered items catalogued at December 31, 1959 totalled 5,906. New books and bound periodicals added to the shelves totalled 367—an increase of 100 on 1958 figures.

A card loan system is now working satisfactorily in four departments of the school. This system considerably simplifies the recording of loans and recall of overdue items. Although the amount of material lost through inadequate loan records has not been large, this is a loss which could be eliminated except for deliberate theft.

The subject cataloguing of book stock is proceeding and in addition subject entries are being made for selected periodical articles. It is pleasing to note that in the last year or so there has been a slight increase in the number of enquiries received from persons engaged in the mining industry—both for specific information and for material. These have mostly been met from school stock, but where necessary we have borrowed from other libraries. The number of such enquiries has, it is true, been small, and the school could not at present handle any large number, but the interest is indicative of some awareness amongst mining companies of the library facilities available at the school. This is to our mutual advantage. We have had at least two lots of back files of periodicals given to us, the donors finding it simpler to consult references in the school library—and we have thereby completed some gaps in our own sets.

Accommodation remains the biggest problem—and one which gets bigger every year. A central reference and administration building is essential if the school is to offer to students and to the mining industry anything approaching what is in particular would appreciate some point for normally considered "library service." Students enquiry and a library staff member to help them find material in the evenings, when most students attend classes and when lecturers are too busy to attend to their wants, besides the disadvantage of classes being held in the rooms where the books are shelved.

Services to the Public.

In addition to its teaching activities the School continued to provide a number of other services. During the year, 398 samples and specimens were received for assay and/or mineral determination from prospectors and others. This is an increase of 137 by comparison with 1958. The increase is almost entirely in samples submitted for gold assay.

Buildings.

The mineral dressing laboratory for student use referred to in last year's report was brought in use early in 1959 and satisfied a long existing need. The exhaust fans required for the Metallurgical Laboratory were not installed until late in 1959. All work was completed before the end of the year, and conditions in the Laboratory were much improved. General repairs and renovations to the buildings were not done during 1959 as had been planned, and it now appears that these will not be commenced until late 1960.

Requirements of the School.

These remain generally as listed in the 1958 Report. The accommodation for the Registrar and for the office staff is not adequate and some thought is being given to possible alterations to increase this.

TABLE VIII.

Work done on Samples Received from Prospectors and Others—Kalgoorlie.

——	1956	1957	1958	1959
Assay—gold	147	106	105	220
Assay—gold and other constituents	23	6	....	4
Assay—metals other than gold	20	42	18	16
Assay plus mineral determination	11	11	3	5
Mineral examination	150	223	130	140
Rejected or transferred to Metallurgical Laboratory pay	42	10	5	13
Total	393	398	261	398

TABLE IX.

Kalgoorlie Metallurgical Laboratory—Summary of Work.

——	1956	1957	1958	1959
Investigations outstanding (1st January)	5	8	7	3
Investigations asked for (710-712 inclusive)	14	13	7	3
Total	19	21	14	6
Investigations completed	10	11	11	3
Investigations outstanding (31st December)	8	7	3	3
Investigations cancelled	1	3	....	....
Total	19	21	14	6
Certificates issued (assays, analyses, etc.)	71	70	106	481

Advisory Committee.

During the year the Committee met on nine occasions, and the attendance was as follows:—Mr. Harwood, 4; Mr. Blown, 5 (possible 6); Mr. Collard, 2; Mr. Field, 7; Mr. Golding, 6 (possible 6); Mr. Hobson, 9; Mr. Mundle, 6; Mr. Tonks, 3 (possible 3). Mr. Golding was appointed by the Associates' Association to replace Mr. Warman, who resigned from the Committee in 1958 because of his departure from Kalgoorlie. Mr. D. J. Tonks replaced Mr. Blown as representative of the Institution of Engineers during Mr. Blown's absence from Kalgoorlie.

An additional £2,000 was paid into the Apparatus and Equipment Trust Fund during the year—£1,000 from the Chamber and £1,000 from the Department—and equipment to the value of £1,000 was ordered.

Kalgoorlie Metallurgical Laboratory.

Three Reports of Investigations and 481 Certificates were issued during the year. In addition 245 "free" Assay Certificates were issued to prospectors and others. All Reports of Investigations referred to gold ores. Three investigations were in progress at the end of the year—two for the Government Geologist and one for industry. The work done is summarised in Table IX.

Throughout the year the Senior Research Metallurgist was a member of the Chamber of Mines Committee of Metallurgists. This Committee was appointed to discuss metallurgical problems and co-ordinate test work. A certain amount of test work has been done in the Laboratory as part of a programme being undertaken for the Committee. Other work has been done in the mine laboratories.

More information about the work done during the year is given in Appendix 3.

Students' Association.

The Students' Association was quite active during the year. In addition to the usual activities—Ball, Dinner and Scholarships—the Committee published a magazine and generally took a much more active interest in student affairs. A Hockey Club was formed within the Association and a team competed in the local competition.

NORSEMAN.

Enrolments.

The number of students enrolled during the year was 55—1 less than in the previous year. Table X sets out the individual and class enrolments for the year and for the two previous years; Table XI, the enrolments for individual subjects; and Table XII, the numbers of students enrolled for the various courses.

Revenue.

The revenue received at Norseman was £137 18s.

Staff.

The following appointment was made:—

Hunter, D. R. C.—Cadet; Appointed; 9/2/59.

During the year nine part-time instructors were employed and the Mining Registrar continued as part-time Registrar of the School.

Subjects Taught.

Eighteen subject were taught at Norseman, and use was again made of the workshops of the Central Norseman Gold Corporation for practical instruction in workshop practice, practical electricity, and welding.

Examinations.

The results of the Annual Examinations are summarised in Tables XIII and XIV—Table XIII is based on class enrolments and Table XIV on individual enrolments. Table XV makes a comparison of Norseman and Kalgoorlie results and is based on class enrolments. Tables XIV and XV show that the results at Norseman are slightly better than those at Kalgoorlie. This is normal for Norseman.

The results for individual subjects are given in Appendix I.

TABLE X.

Enrolments, Norseman, 1957,1958,1959.

Year	First Term		Second Term		Third Term	
	Individual	Class	Individual	Class	Individual	Class
1957	58	160	55	144	51	134
1958	65	168	58	143	50	115
1959	54	136	50	125	42	103

TABLE XI.

Class Enrolments, Norseman, 1959.

Subjects	First Term	Second Term	Third Term
Preparatory Chemistry	10	10	8
Trade Metallurgy	9	8	8
Preparatory Mathematics	17	17	11
Mathematics I	8	7	6
Applied Mathematics I	5	5	4
Preparatory Physics	12	11	8
Trade Mathematics I	6	4	4
Preparatory Engineering Drawing	8	6	5
Drawing I	17	16	14
Engineering Drawing IIA	3	3	2
Surveying Drawing II	1	1	2
Practical Electricity	9	7	6
Workshop Practice II	4	4	4
Welding I	8	8	8
Welding II	5	5	5
Steam Engine Driving	4	4	3
Preparatory Geology	5	4	1
Mining I	5	5	4
Total	136	125	103
Totals, 1958	168	143	115

TABLE XII.

Number of Students Enrolled for Various Courses at Norseman.

Course	Number Enrolled			
	1956	1957	1958	1959
Associateship Courses—				
Mining	6	3	6	....
Metallurgy	....	....	....	....
Engineering	....	....	2	3
Mining Geology	....	....	1	....
Total	6	3	9	3
Certificate Courses—				
Assayer's	1	....	....	....
Surveyor's	5	8	7	8
Mine Manager's	1	1	....	....
Engineering Draughtsman's	....	1	....	1
Electrical Engineering	....	....	1	....
Mechanical Engineering	....	....	....	....
Total	7	10	8	9
Technicians' Courses—				
Engine Operation and Maintenance	27	22	18	14
Workshop Foreman's	2	2	4	3
Welding	1	4	6	4
Total	30	28	28	21
No Set Course—				
Preparatory Subjects	5	11	13	9
Others	12	8	9	13
Total	17	19	22	22
Total for Year	60	60	67	55

TABLE XIII.

Results of Annual and of Supplementary Examinations Based on Class Enrolments, 1955-1959, Norseman.

	1955	1956	1957	1958	1959
Class enrolments = A	167	163	178	180	140
Number of entries for Annual Examinations = B	90	111	116	95	93
B/A per cent.	54	68	65	52	66
Number of passes at Annual Examinations, as a per cent. of A	43	58	52	37	53
Number of passes at Annual Examinations, as a per cent. of B	79	86	79	70	80
Number of passes at Annual and Supplementary Examinations, as a per cent. of A	43	61	53	38	57
Number of passes at Annual and Supplementary Examinations, as a per cent. of B	80	89	81	73	86

TABLE XIV.

Students Sitting at Annual Examinations Norseman, 1956-1959.

Courses	1956		1957		1958		1959	
	No. enrolled	Per cent. sitting	No. enrolled	Per cent. sitting	No. enrolled	Per cent. sitting	No. enrolled	Per cent. sitting
Associateship	6	100	3	100	9	89	3	100
Certificate	7	86	10	90	8	86	9	89
Technicians'	30	83	28	86	22	79	21	76
No Set Course	17	81	19	84	22	31	22	41
Totals	60	83	60	87	67	66	55	65
Kalgoorlie for comparison	365	63	387	69	380	64	365	61

TABLE XV.

Examination Results, Norseman and Kalgoorlie.

Notes:

(i) Information based on class enrolments.

(ii) The letters "A" and "B" have the same meaning as in Table XIII.

	Norseman				Kalgoorlie			
	1956	1957	1958	1959	1956	1957	1958	1959
B/A per cent.	68	65	52	66	63	61	62	68
Total passed as a per cent. of A	61	53	38	57	55	52	53	54
Total passed as a per cent. of B	89	81	73	86	86	83	85	80

Scholarships and Prizes.

The Reg. Dowson Scholarships for 1959, were awarded to D. R. C. Hunter and to J. Bottegal. R. J. Lea, who was awarded a Reg. Dowson Scholarship at the end of 1958, completed a good year's work in 1959; he obtained three credit passes and one pass. C. F. May, who was also awarded a Scholarship at the end of 1958, passed in two subjects in 1959.

C. J. S. Cook, a Norseman student, was awarded a Robert Falconer prize at the end of the year. Students enrolled for Preparatory Subjects at Kalgoorlie, Norseman, or Bullfinch are eligible for this prize.

A list of awards is given in Appendix 2.

Buildings.

The buildings are in good condition and adequate for the requirements of the School.

Advisory Committee.

The Advisory Committee continued to meet with Mr. W. L. Dutton as Chairman and to take an interest in the affairs of the School. Through the Committee, the mines at Norseman paid half the cost of a drinking fountain for the School.

BULLFINCH.

Enrolments.

The number of students enrolled was 48—an increase of one by comparison with the previous year. Information about the numbers of students enrolled, the numbers in the various classes, and the numbers in the various courses is given in Tables XVI, XVII and XVIII.

Revenue.

The total revenue received was £144 2s. 6d.

TABLE XVI.

Enrolments, Bullfinch, 1957, 1958, 1959.

Year	First Term		Second Term		Third Term	
	Individual	Class	Individual	Class	Individual	Class
1957	56	113	41	78	41	77
1958	40	75	35	62	33	58
1959	45	81	40	68	36	66

TABLE XVII.

Class Enrolments, Bullfinch, 1959.

Subjects	First Term	Second Term	Third Term
Preparatory Chemistry	4	4	3
Mineral Dressing I	1	1	1
Preparatory Mathematics	12	8	7
Preparatory Physics	3	2	1
Physics I	6	5	5
Trade Mathematics I	4	....	....
Preparatory Engineering Drawing	13	13	13
Engineering Drawing I	7	7	7
Engineering Drawing and Design IIA	2	2	2
Practical Electricity	5	5	5
Welding I	13	13	13
Welding II	5	4	4
Preparatory Geology	3	3	2
Mining IIC	....	....	1
Surveying II	3	2	2
Total	81	68	66
Totals, 1958	75	62	58

TABLE XVIII.

Number of Students Enrolled for Various Courses at Bullfinch.

Course	Number Enrolled			
	1956	1957	1958	1959
Associateship Courses—				
Mining	....	....	....	....
Metallurgy	....	1	2	1
Engineering	....	....	....	....
Mining Geology	2	1	2	1
Total	2	2	4	2
Certificate Courses—				
Assayer's	....	....	....	....
Surveyor's	3	4	7	3
Mine Manager's	....	....	....	1
Engineering Draughtsman's	....	....	....	1
Electrical Engineering	1	2	....	1
Mechanical Engineering	....	....	....	....
Total	4	6	7	6
Technicians' Courses—				
Engine Operation and Maintenance	....	....	....	....
Workshop Foreman's	....	1	4	2
Welding	....	....	....	1
Total	....	1	4	3
No Set Course—				
Preparatory Subjects	10	7	4	8
Others	17	41	28	29
Total	27	48	32	37
Total for Year	33	57	47	48

Staff.

Mr. M. H. Lloyd commenced duty as Officer-in-Charge at Bullfinch on Monday, February 9, 1959. Mr. Browne continued as part-time Registrar and seven part-time instructors were employed during the year.

Subjects Taught.

Fifteen subjects were taught. One of these subjects—Preparatory Physics—was discontinued at the end of first term.

Examinations.

The results of the Annual Examinations are summarised in Tables XIX, XX, XXI. The tables show that the results at Bullfinch are quite comparable with those obtained at Kalgoorlie and at Norseman, and that they are much better than the results obtained in earlier years at Bullfinch.

The results for individual subjects are given in Appendix I.

Scholarships and Prizes.

P. Powell, a Bullfinch student, was awarded the Associates' Prize for 1959.

A list of awards is given in Appendix 2.

Buildings.

The buildings including the quarters are in satisfactory condition and adequate for the needs of the school.

Advisory Committee.

The Advisory Committee with Mr. K. E. Denham as Chairman, met once during the year.

TABLE XIX.

Results of Annual and of Supplementary Examinations Based on Class Enrolments, Bullfinch 1956-1959.

——	1956	1957	1958	1959
Class enrolments = A	77	114	87	85
Number of entries for Annual Examinations = B	45	64	55	55
B/A per cent.	58	56	63	65
Number of passes at Annual Examinations as a per cent. of A	39	33	54	46
Number of passes at Annual Examinations as a per cent. of B	67	59	85	71
Number of passes at Annual and Supplementary Examinations as a per cent. of A	39	35	54	46
Number of passes at Annual and Supplementary Examinations as a per cent. of B	67	62	85	71

TABLE XX.

Students Sitting for Annual Examinations, Bullfinch.

Courses	1956		1957		1958		1959	
	No. enrolled	Per cent. sitting	No. enrolled	Per cent. sitting	No. enrolled	Per cent. sitting	No. enrolled	Per cent. sitting
Associateship	2	50	2	100	4	75	2	50
Certificate	4	75	6	100	7	100	6	100
Technicians'	....	....	1	....	4	25	3	100
No Set Course....	27	59	48	48	32	47	37	68
Totals	33	67	57	54	47	55	48	73
Totals—								
Kalgoorlie	365	63	387	69	380	64	365	61
Norseman	60	83	60	87	67	66	55	65

TABLE XXI.

Examination Results—Bullfinch, Norseman and Kalgoorlie.

Notes:

(i) Based on class enrolments.

(ii) The letters "A" and "B" have the same meaning as in Table XIX.

——	1956	1957	1958	1959
B/A per cent.—				
Bullfinch	58	56	63	65
Norseman	68	65	52	66
Kalgoorlie	63	61	62	68
Total passes as a per cent. of A—				
Bullfinch	39	35	54	46
Norseman	61	53	38	53
Kalgoorlie	55	52	53	52
Total passes as a per cent. of B—				
Bullfinch	67	62	85	71
Norseman	89	81	73	80
Kalgoorlie	86	83	85	79

ACKNOWLEDGMENTS.

All members of the Staff have given the maximum assistance to students throughout the year, and, as required, have assisted members of the public and staffs of other organisations. Members of the part-time staff have also worked well and given generously of their time. The information given in the various tables in this report has been compiled by the Registrar and members of the office staff—particularly Miss H. Jacobs.

Thanks are due to members of the Advisory Committees, and to the mining companies in Norseman and Bullfinch for making their workshops available for classes.

Co-operation and assistance have been received from Head Office staff and generally from the staffs of all sections of the Mines Department.

R. A. HOBSON,
Director, School of Mines.

APPENDIX I.

School of Mines of Western Australia.

Annual Examinations.

1959.

PASS LIST.

Passes are in order of merit.

(E) denotes equal.

(*) denotes year fee scholarship.

Preparatory Chemistry.

Pass:
McGushin, G.
Colgrove, J. E.
Attrill, D. M. (E)
Keogh, J. T. (E)
Younger, B. A.

Supp. Exam. granted:
Perks, A. C. J.
Rumble, R. W.
Rumble, S. J.
Scott, T. G.

Chemistry IA.

Credit:
Coumbe, J. T.
Pearson, C. A. L.
Wills, M. F.

Pass:
Erceg, S. G.
Collins, J. L. (E)
Thornton, W. F. (E)
Blurton, L. N. (E)
Cruickshank, A. C. (E)
White, R.
Frank, P. H. (E)
Klose, W. F. (E)
Parry, K. F. (E)
Wilson, R. Y. (E)
Miller, E. G.
Tonkin, D.
Crocker, R. F. (E)
Cuneen, P. J. (E)
Marshall, D. A. (E)
Sheehy, F. M. (E)
Willis, R. J. (E)
Hooker, N. R.
Mullins, H. D.

Supp. Exam. granted:
Hobson, J. C.
O'Shaughnessy, M.
Taylor, E. B.

Chemistry IB.

Credit:
Mitchell, P. N. (E)
Schultz, K. (E)

Pass:
Sceresini, B. J. S.
Marsh, F. E.
Baker, S. R.
Pearson, C. A.
Goode, W. D.
Henderson, G.

Supp. Exam. granted:
Veale, I. L.

Chemistry II.

Pass:
Campbell, A. D.
Kops, J. N.
Smith, A. McD.

Supp. Exam. granted:
George, T. J. F.

Analytical Chemistry I.

Credit:
Bourne, R. W.

Pass:
Campbell, A. D.
Kops, J. N.

Analytical Chemistry II.

Pass:
Dowson, J. W.
Hooker, L. F.
Neve, H. D.

Chemical Metallurgy I.

Credit:
Bourne, R. W.
Mitchell, P. N.

Chemical Metallurgy II.

Credit:
Bracanin, B. F.
Hooker, L. F.
Neve, H. D.
Buckett, L. N.

Pass:
Zani, D. A.
Smith, A. Mc.

Mineral Dressing I.

Credit:
Hopkins, G. M. F. (E)
Travis, G. A. (E)

Pass:
Lubbock, F. M.
Hurley, B. J.
Frank, P. H. (E)
Wills, M. F. (E)
Meiklejohn, G.

Mineral Dressing II.

Credit:
Bourne, R. W.
Dowson, J. W.

Mineral Dressing III.

Credit:
Buckett, L. N.
Bracanin, B. F.
Dunstan, H. R.
Zani, D. A.

Pass:
Smith, A. McD.
Neve, H. D.

Physical Metallurgy I.

Credit:
Mitchell, P. N.

Pass:
George, T. J. F.
Neve, H. D.
Casserly, F. A.

Assaying.

Credit:
Sceresini, B. J. S.
Baker, S. R.
Simmons, M. R.

Pass:
Schultz, K.
Travis, G. A.
Ganthavee, S.
Chamberlain. H. I.
Goode, W. D.
Lewis, R. P. J.
Wills, M. F.

Trade Metallurgy.
Credit:
Wise, S. A.
Brock, G. H.
Pass:
Neve, F.

Trade Mathematics I.
Credit:
Rymer, H. A.
Lithgow, D.
Pass:
Irving, G. H.
Grey, R. J.

Preparatory Mathematics.
Credit:
Bostelman, L. E.
Wise, S. A.
Caple, D. F.
Pass:
Goldner, H.
Rumble, S. J.
Gould, G. A. (E)
Harvey, J. S. (E)
Lithgow, J. R.
Rumble, R. W.
McGushin, G.
Russell, C. W.
Joyce, G. D. C.
Fisher, R. W. (E)
Macfarlane, R. K. (E)
King, B. F.
Younger, B. A.
Supp. Exam. granted:
Haldenwanger, H. E.
O'Brien, R. W.
Ridley, R. H.
Tahan, G.
Thomas, G. N.

Mathematics I.
Credit:
Collins, J. L. (E)
Donovan, R. J. (E)
Brien, P. S.
Pass:
Manners, R. B.
Williams, B. M.
Willis, R. J.
Geogh, J. T.
Boschis, A.
Proctor, J. D.
Fraser, H. S.
Kilderry, T. J.
Perks, A. C. J.
Colgrove, J. E.
Supp. Exam. granted:
Chisholm, M. R.
Sommerville, I. J.

Mathematics II.
Credit:
Hurley, B. J.
Travis, G. A.
Pass:
McIntyre, A. T.
Buckett, L. N. (E)
Van der Hoek, B. J. D. (E)
Lubbock, F. N. (E)
Bennett, V. G. (E)
Pearson, C. A. L.
Miller, J.
Argus, J. C.
Sceresini, B. J. S.
Klose, W. F. (E)
Lawson, K. S. (E)
Leslie, W. E.
Morel, F. R.

Mathematics II.—Section "B" only.
Pass:
Thompson, B. M.

Mathematics III.
Pass:
Mullins, H. D.

Applied Mathematics I.
Credit:
Schultz, K.
Goode, W. D.
Lubbock, F. N.
Cruikshank, A. C.
Pass:
Hurley, B. J.
Patterson, B. S.
Lewis, R. P. J. (E)
Willis, R. J. (E)
Donovan, R. J.
Collins, J. L.
Frank, P. H.
Supp. Exam. granted:
Hobson, J. C.
James, W. F.
Mackay, I. D.

Applied Mathematics II.
Credit:
Buckett, G. A.
Hunter, S. T.
Hardy, R. J.
Murray, B. F.
Pass:
Muncaster, I. M.
Mullins, H. D.

Preparatory Physics.
Credit:
Kew, J. A.
Ridley. R. H.
Walsh, M. J.
Rumble, R. W.
Pass:
Bevans, E. T.
Harvey, J. S.
Gould, G. A.
Douglas, D. C.
Younger, B. A.
Peden, W. R.
Haldenwanger, H. E.
Hutchinson, D. W.
Delbridge, R. J.
Exemption granted from practical work for 1960:
Hayles, A.
Thomas, G. N.

Physics I.
Credit:
Cruickshank, A. C.
Donovan, R. J. (E)
McIntyre, A. T. (E)
Pass:
Frank, P. H.
Hamilton, I. R.
Brown, L. A. (E)
Willis, R. J. (E)
Fraser, P. G.
Davey, C. R.
Proctor, J. D.
Supp. Exam. granted:
Colgrove, J. E.
Mand, E. D.
Exemption granted from practical work for 1960:
Colgrove, J. E.
Flanagan, K. J.
Mand, E. D.
Mead, B. E. P.
Mills, W. J.
O'Shaughnessy, M.
Perks, A. C. J.

Preparatory Engineering Drawing.
Credit:
Haldenwanger, H. E.
Wilkinson, E. Z.
Fogarty, J. M.
Stretton, B.
Boschis, A.
Rumble, S. J.
Joyce, G. D. C.
Rumble, R. W.
Walsh, M. J.
O'Shaughnessy, M.
Pass:
Evans, V.
O'Brien, R. W.
McGushin, G.
Tahan, G.
Linton, J. V.
Rymer, H. A.
Taaffe, L. D.
Bowley, R. F.
Sullivan, T. J.
Delbridge, R. J.
Caple, D. F.

Engineering Drawing I.
Credit:
Haldenwanger, H. E.
Andrews, D. N. M.
Younger, B. A.
Fogarty, J. M.
Livingstone, N. R.
Willis, R. J.
Mand, E. D.
Hurley, B. J.
Brown, L. A.
Harvey, J. S.
Hutchinson, D. W.
Pass:
Joyce, J. P.
Collins, J. L.
Delbridge, A. G.
Cooper, G.
Bone, K.
Mead, B. E. P.
Lithgow, J. R.
Thompson, F.
Tie, C. S.
Joyce, M. J.

Engineering Drawing and Design IIA.
Credit:
Patterson, B. S.
Donovan, R. J.
Lubbock, F. N.
Leslie, W. E.
Mills, W. J.
Colgrove, J. E.
Marshall, D. A.
Muncaster, I. M.
Manners, R. B.
Pass:
Bostleman, L. E.
Cugley, K.
Miller, E. G.
Perks, A. C. J.
Tindall, E. R.
Kilderry, T. J.
Jongen, P.

Engineering Drawing and Design IIB.
Credit:
Bagworth, B. A.
Scott, S. J.

Engineering Drawing and Design IIC.
Credit:
Mitchell, P. N.
Lawson, K. S.
Sullivan, A. D.

Engineering Drawing and Design IID.
Credit:
Mitchell, P. N.
Willis, J. S.
Crocker, R. F.
Scott, S. J.

Surveying Drawing II.
Credit:
Hardy, R. J.
Morel, F. R.
Pass:
McGushin, P. J.
Flanagan, K. J.
Davey, C. R.
Dykstra, F. D.

Mechanical Engineering I.
Credit:
Hunter, S. T.
Forrest, R. N.
Manners, R. B.
Pass:
Ganthavee, S.
Bennett, V. G.
White, R.
Slocomb, J. H.
Jordan, A. F.
Henderson, G.

Mechanical Engineering II.
Credit:
Mitchell, P. N.
Duncan, H. F.
Pass:
Sullivan, A. D.
Willis, J. S.
Thompson, B. M.
Terrell, R. J. H.
Jasson, K. E.

Electrical Engineering I.
Credit:
Buckett, G. A.
Dunstan, H. R.
Hooker, L. F. (E)
Murray, B. F. (E)
Baker, S. R.
Zani, D. A.
Hurley, B. J.
George, T. J. F.
Campbell, A. D.
Kops, J. N.
Pass:
Muncaster, I. M.
Maguire, D. W.
Sceresini, B. J. S.
Patterson, B. S.
Lubbock, F. N.
Lawson, K. S. (E)
Mullins, H. D. (E)
Henderson, G.

Electrical Engineering II.
Credit:
Mitchell, P. N.
Bagworth, B. A.
Hunter, S. T.
Pass:
White, R.
Jasson, K. E.
Manners, R. B.
Duncan, H. F.
Ruvidini, A.

Internal Combustion Engines.
Pass:
Gors, I. R.
Genge, J. W.
Hahn, P. S.
Lamont, E. G.
Farrell, R. T.
Hall, B. (E)
Martin, R. (E)

Workshop Practice I.
Credit:
Willis, R. J.
Pass:
Hutchinson, D. W.
Evans, V.
Delbridge, A. G.

Workshop Practice II.
Pass:
Thompson, F.
Neve, F.
Tindall, E. R.

Workshop Practice IIIA.
Pass:
Hall, E.

Workshop Practice IIIB.
Pass:
Joyce, M. J. V.

Engineering Workshop Practice.
Credit:
Willis, J. S.
Crocker, R. F.
Forrest, R. N.
Pass:
Donovan, R. J.
Hunter, S. T.
James, W. F.
Exemption from practical work granted for 1960:
Patterson, B. S.
Mead, B. E. P.
Perks, A. C. J.

Welding I.
Credit:
Brock, G. H.
Mitchell, P. N.
Pass:
Hunter, S. T.
Duval, J. D.
Brealey, D.
Joyce, M. J. V.
Exemption granted from practical work for 1960:
Stretton, B.

Welding II.
Credit:
Martin, S. T.
Wise, S. A.
Pass:
Neve, F.
Exemption granted from practical work for 1960:
Baker, B. G.

Steam Engine Driving.
Credit:
Douglas, D. C.

Structural Engineering I.
Credit:
Forrest, R. N.
Bagworth, B. A.
Bennett, V. G.
Pass:
White, R.
van der Hoek, B. J. D.
Manners, R. B.
Hennessy, R. M.
Ruvidini, A.
McIntyre, A. T.

Structural Engineering II.
Credit:
Hardy, R. J. (E).
Mitchell, P. N. (E).
Pass:
Sullivan, A. D.
Jasson, K. E.
Terrell, R. J. H.

Machine Design.
Credit:
Buckett, G. A.
Hardy, R. J.
Muncaster, I. M.
Hunter, S. T.
Pass:
Murray, B. F.

Materials of Construction.
Credit:
Hardy, R. J.
Donovan, R. J.
White, R.
Marshall, D. A.
Pass:
Miller, J.
Maguire, D. W.
Mullins, H. D.
Patterson, B. S.
Douglas, D. C.
Hamilton, I. R.

Hydraulics.
Credit:
Hunter, S. T.
Pass:
White, R.
Slocomb, J. H.
Duncan, H. F.

Preparatory Geology.
Credit:
Lubbock, F. N.
Lewis, R. P. J.
Brien, P. S. (E)
Collins, J. L. (E)
Hurley, B. J. (E)
McNally, B. T. (E)
Pass:
Cooper, G. H.
Colgrove, J. E.
Thornton, W. F.
Linton, J. V.
Andrews, D. N. M. (E)
Tahan, G. (E)
Lauri, J. M. (E)
O'Shaughnessy, M. (E)
Magnus, E. R.
Fraser, H. S.
Younger, B. A.
Sommerville, I. J.
Boschis, A.

Geology IA.
Credit:
Schultz, K.
Travis, G. A.
Pass:
Gatti, F. V.
Evans, J. D. (E)
Goode, W. D. (E)
Veale, I. L.
Letts, I. R.
Banks, F. R.
McGushin, P. J.

Geology IB.
Credit:
Schultz, K.
Pass:
Evans, J. D.
Cruickshank, A. C.
Hennessy, R. M.
Sceresini, B. J. S. (E)
Veale, I. L. (E)
Jongen, P. J. F. G.
Davey, C. R. (E)
Wills, M. F. (E)
Letts, I. R.
Goode, W. D.
Flanagan, K. J.
Turner, B. C.

Geology IIA
Pass:
Hopkins, G. M. F.
McNally, R. T.
Jordan, A. F.
Frank, P. H.
Shugg, P. J.
Meiklejohn, G.
van der Hoek, B. J. D.

Geology IIB.
Credit:
Wheeler, H. W.
Pass:
McNally, R. T.
Jordan, A. F.
Simmons, M. R.

Geology IIC.
Pass:
Campbell, A. D.
Casserly, F.
Dowson, J. W.

Geology IIIA.
No Passes.

Geology IIC.
Pass:
Connelly, M. A.

Mining I.
Credit:
Cooper, G. M.
Pass:
Travis, G. A.
Hurley, B. J.
Cruickshank, A. C.
Collins, J. L.
Schultz, K.
Lubbock, F. N.
Goode, W. D.
Crew, W. J.
Teede, L. N.
McNally, B. T.
Colgrove, J. E.
Hennessy, R. M.
Proud, D. J. B.
Cooper, W. H.
Scott, T. G.
Loxton, I. W.

Mining II.
Pass:
Banks, F. R.
Shugg, P. J.
Fiegert, J.
McGushin, P. J.
Argus, J. C.
Bain, W. B.

Mining III.
Credit:
Hardy, R. J.
Pass:
Smith, C. L.
Ganthavee, S.

Mining IIIA.
Pass:
Jordan, A. F.
Henderson, G. A.

Mining IIIB.
Pass:
Cedro, J. A.
Simmons, M. R.
McDermott, J. C.
Poole, R. H.

Mine Ventilation.
Pass:
Hopkins, G. M. F.
Chamberlain, H. I.
Ganthavee, S.

Surveying I.
Credit:
Cruickshank, A. C.
Travis, G. A.
Cooper, G. H.
Pass:
Hurley, B. J.
Collins, J. L.
Lubbock, F. N.
Crew, W. J.
Mackay, I. D.
Frank, P. H.
Patterson, B. S.
Shugg, P. J.
Colgrove, J. E.
Cooper, W. H. (E)
McNally, B. T. (E)
Hopkins, G. M. F.

Surveying II.
Credit:
Letts, I. R.
Pass:
Banks, F. R.
McGushin, P. J.
Supp. Exam. granted:
Flanagan, K. J.

Preparatory English.
Pass:
McGushin, P. J.
Delbridge, R. J.
Hutchinson, D. W.
Goddard, R. L.
Supp. Exam. granted:
Younger, B. A.

English IA.
Credit:
Buckett, G. A.
Pass:
Bracanin, B. F.
Hunter, S. T.
Bennett, V. G.
Crocker, R. F.
Sceresini, B. J. S.
Duncan, H. F.
Mahalingham, S. S.
White, R.
Dykstra, F. D.
Jordan, A. F.
Supp. Exam. granted:
Mackay, I. D.

School of Mines—Norseman.

ANNUAL EXAMINATIONS.

PASS LIST.

Preparatory Chemistry.
Credit:
Hunter, D. R. C.
Lea, R. J.
Pass:
Burgess, R. J.
Schultz, J. G.
Cook, G. J. S.
Daly, P. R.
Kleppe, G. K. (E)
Moffatt, B. (E)

Trade Metallurgy.
Credit:
Young, P. A.
Pass:
Avery, A. E.
Horne, R. H.
Perkin, R. E.
Wilson, N. E.
Moir, L. W.
Supp. Exam. granted:
Sharpe, V. C.

Trade Mathematics I.
Credit:
Bottegal, J.
Pass:
Delamotte, R. C.
Supp. Exam. granted:
Salmon, L. J.

Preparatory Mathematics.
Pass:
Bastow, S. J. (E)
Johnson, R. (E)
Hill, A. J.
Bennett, W. J.
Cook, G. J. S.
Shave, D. A.
Supp. Exam. granted:
Benoit, A. L.

Mathematics I.
Pass:
Hunter, D. R. C.
Brouwer, J. H.
Daly, P. R.
Supp. Exam. granted:
Denison, J. L.

Applied Mathematics I.
Supp. Exam. granted:
Hunter, D. R. C.
Kerr, P. H.

Preparatory Physics.
Credit:
Hunter, D. R. C. (E)
Lea, R. J. (E)
Pass:
Avery, A. E. (E)
Cook, G. (E)
Moffatt, B.
Bennet, W. J.
Stewart, B. A.
Exemption granted from practical work for 1960:
Prime, G. G.

Preparatory Engineering Drawing.
Credit:
Shave, D. A.
Sainsbury, J. A.
Pass:
May, C. F.
Bottegal, J.
Coles, J. E.

Engineering Drawing I.
Credit:
Kleppe, G. K.
Squance, K. D. W.
Brouwer, J. H.
Pass:
Hill, A. J.
Hunter, D. R. C.
Daly, P. R.
Sainsbury, J. A.
Benoit, A. L.
Stewart, B. A.
Moir, L. W.

Engineering Drawing and Design IIA.
Credit:
Kerr, P. H.
Pass:
Young, P. A.

Surveying Drawing II.
Credit:
Lea, R. J.
Brouwer, J. H.

Practical Electricity.
Credit:
Hill, A. J.
Pass:
Sainsbury, J. A.
Young, P. A.
Wilson, N. E.
Johnson, R.
Bottegal, J.

Workshop Practice I.
No passes.

Workshop Practice II.
Pass:
May, C. F.
Benoit, A. L.
Bastow, S. J.

Welding I.
Pass:
Silvester, S. W.
Bastow, S. J.
Horne, R. H.
Exemption granted from practical work for 1960:
Sharpe, V. C.
Delamotte, R. C.
Coles, J. E.
Supp. Exam. granted:
Sharpe, V. C.

Welding II.
Pass:
Avery, A. E.
Jones, W. B.
Moir, L. W.
Perkin, R. E.

Steam Engine Driving.
Credit:
Stewart, D. A.
Pass:
Wilson, N. E.

Preparatory Geology.
Pass:
Burgess, R. J.

Mining I.
Pass:
Denison, J. L.
Moffatt, B.
Lea, R. J.
Burgess, R. J.

School of Mines—Bullfinch.

ANNUAL EXAMINATIONS.

PASS LIST.

Preparatory Chemistry.
Pass:
Blackley, T.
Campbell, F. C.
Harris, B. H.

Mineral Dressing I.
No passes.

Preparatory Mathematics.
Pass:
Ryan, T. E.

Preparatory Physics.
Credit:
Blackley, T.

Physics I.
Credit:
Powell, P.
Pass:
Harris, B. H.
Swain, G. B.
Stokes, M. C.
Campbell, F. C.

Preparatory Engineering Drawing.
Pass:
Cotton, J. R.
Campbell, F. C.
Cossens, K.
Montgomery, B. J.
Hooper, L. W.
Robson, M. J.
Martain, R. A.
Hoskin, G. W.
Ickeringill, C. D.

Engineering Drawing I.
Pass:
Hooper, F. W.
Lanfranchi, J. J.
Smith, T. K.
Powell, P.
Campbell, F. C.

Engineering Drawing and Design IIA.
Credit:
Leyland, E. C.

Practical Electricity.
Pass.
Leyland, E. C.
Powell, P.
Ryan, T. E.

Welding I.
Pass:
Hampel, N. W.
Nunn, A. S.
Martain, R. A.
Whiley, N. E.
Carroll, N. J.
Cossens, K.
Exemption granted from practical work for 1960:
Ickeringill, G. D.
Smith, T. K.
Feeney, J. E.
Wesley, W. E.
Rowan, G. R.
Nunn, J. E.
Supp. Exam. granted:
Ickeringill, G. D.

Welding II.
Pass:
Walton, W. A.
Exemption granted from practical work for 1960:
Basten, L. J.
Dixon, W. R.

Preparatory Geology.
Pass:
Blackley, T.

Mining IIC.
Credit:
Leyland, E. C.

Surveying II.
Pass:
Harris, B. H.
Blackley, T.

SUPPLEMENTARY EXAMINATIONS.

February 1959.

The following students passed in the subjects listed below:—

KALGOORLIE

Mathematics II, Section A.
Slocomb, J. H.
Preparatory Physics.
Morocz, G.
Physics I.
Kilderry, T. J.
Trade Mathematics I.
Reid, R. H. J.
Electrical Engineering I.
Wolff, D. L.
Mining I.
Weir, D. J.
Surveying I.
Flanagan, K. J.

NORSEMAN

Trade Mathematics II.
Perkin, R.
Internal Combustion Engines.
Moir, L. W.
Welding I.
Moir, L. W.
English IA.
Silvester, S. W.

BULLFINCH

Nil.

APPENDIX 2.

School of Mines of Western Australia.

SCHOLARSHIPS AND PRIZES, 1959.

CHAMBER OF MINES PRIZES.

Metallurgy: Wills, M. F.
Mining: Cooper, G. H.
Engineering: Forrest, R. N.
Mining Geology: Goode, W. D.

STUDENTS' ASSOCIATION.

Metallurgy: Bourne, R. W.
Mining: Baker, S. R.
Engineering: Hardy, R. J.
Mining Geology: Shugg, P. J.

Society of the W.A. School of Mines.
Associates Prize.
Powell, P. (Bullfinch).

INSTITUTE OF MINING SURVEYORS.
£10 Prize: Cruickshank, A. C.
£5 Prize: Letts, I. R.

REG. DOWSON.
Group "A": Hunter, D. R. C.
Group "B": Bottegal, J.

ROBERT FALCONER.
First Prize (£5): Cook, C. J. S. (Norseman).
Second Prize (£1 10s.): No award.

C. A. HENDRY.
McIntyre, A. T.

MINING STANDARD.
Mining I: Travis, G. A.
Mineral Dressing I: Hopkins, G. M. F.

WESLEY LADIES' GUILD.
Haldenwanger, H. E.

SOCIETY OF ENGINEERS.
Hunter, S. T.
Buckett, G. A.

APPENDIX 3.

KALGOORLIE METALLURGICAL LABORATORY.

By E. Tasker, A.W.A.S.M. (Met.), A.M. (Aust.), I.M.M., Senior Research Metallurgist.

INTRODUCTION.

Three reports of investigations and 481 certificates of testing or analyses were issued during the year. A brief description of the investigations is included in this report. A complete list of reports issued, senders, localities of samples, ore types and scope of the investigations is contained in the table with the report.

For further information regarding these reports apply to:—

Research Secretary,
Industrial and Physical Sciences,
Commonwealth Scientific and Industrial Research Organisation,
314 Albert Street,
East Melbourne, C2, Victoria.

from whom copies of reports can be obtained, usually six months after date of issue.

In addition to the reports issued, three other investigations were approved and test work was in progress.

Various inquiries dealing with the technical problems of people engaged in the mining industry were handled by the laboratory staff during the year.

The Chamber of Mines of W.A., invited the Senior Research Metallurgist to join their Committee of Metallurgists. The object of the committee is to discuss metallurgical problems and co-ordinate test work. This laboratory in conjunction with the mine laboratories has carried out test work as a result of these discussions.

COMPLETED INVESTIGATIONS.

Report No. 707.

Treatment tests were made on samples of various ore types from the Sons of Gwalia Gold Mine, Gwalia, W.A. The test-work indicated that the occurrence of the gold changed in ores from various portions of the mine, and that high residue values in the final tailings resulted when the amount of gold occurring as auriferous sulphide minerals increased.

Report No. 708.

Treatment tests were made on ore and stamp battery treatment products from the King Solomon Gold Mines, Edward's Find, W.A. The test-work showed that crushing through a stamp battery with plate amalgamation followed by percolation leach cyanidation was unsatisfactory as only 67 per cent. of the gold was recoverable. By grinding to all minus 72 mesh (B.S.S.), straking and amalgamation followed by agitation cyanidation would recover 91 per cent. of the gold.

Report No. 711.

Gold recovery tests were carried out on ore samples from the Goodenough Gold Mine, Menzies, W.A. Results of the test-work indicated that a large portion of the gold in the ores was occurring as tellurides and was the reason for the low gold recovery obtained by plate amalgamation at the Menzies State Battery.

INCOMPLETE INVESTIGATIONS.

Report No. 700.

Washing tests on low-grade gypsum deposits taken from various W.A. lakes were in progress. A considerable amount of test-work has been carried out and test-work was almost complete.

Report No. 710.

Beneficiation tests on low-grade manganese ores from the Rippon Hills and Balfour Downs deposits were in progress.

Report No. 712.

Gravity concentration tests and flotation tests were in progress on samples of zircon rich products from the Westralian Oil Company's ilmenite concentrating plant at Capel, W.A.

CERTIFICATES.

The number of certificates issued continued to increase and the laboratory staff was mainly occupied in carrying out test-work in connection with these certificates. The 481 certificates issued covered the usual wide range of measurements, but a major portion covered gold assays of ores and metallurgical products.

GENERAL.

The fitting out of the new chemical laboratory and the sampling room was completed late in 1959 and these facilities are proving very satisfactory.

KALGOORLIE METALLURGICAL LABORATORY

Summary of Year's Work, 1959

Report No.	Owner	State	Locality	Ore Type	Type of Investigation	Confidential until	Number of Metallurgical Tests	Number of Assays	
								Gold	Others
707	Sons of Gwalia G.M., Gwalia	W.A.	Gwalia	Gold	Treatment Method	19/9/59	35	90	45
708	King Solomon G.M., Edward's Find	W.A.	Edward's Find	Gold	Treatment Method	20/8/59	18	89	18
711	Goodenough Gold Mine Syndicate, Menzies	W.A.	Menzies	Gold	Treatment Tests	4/5/60	8	17	4
						Totals	61	196	67
	Certificates Nos. 352–487 and 489–832 (inclusive)							869	404
	Free Assays							232	27
	School of Mines							3	18
						Totals	61	1,300	516
	THE FOLLOWING INVESTIGATIONS WERE INCOMPLETE OR PENDING AT 31st DECEMBER, 1959								
700	Government Geologist, Perth	W.A.	Various W.A. Lakes	Gypsum	Beneficiation Tests		29		98
710	Government Geologist, Perth	W.A.	Rippon Hills and Balfour Downs	Manganese	Beneficiation Tests		48		468
712	Warman Equipment Co., Perth	W.A.	Capel	Zircon	Concentration		16		6
						Totals	154	1,300	1,088

DIVISION VI

Annual Report of the Inspection of Machinery Branch of the Mines Department for the Year 1959

Operations under the Inspection of Machinery Act, 1921-1958

Annual Report of the Chief Inspector of Machinery and Chairman of the Board of Examiners for Engine-Drivers for the Year ended 31st December, 1959, 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, 1921-1956, for the year ended 1959.

E. E. BRISBANE,
Chief Inspector of Machinery.

Section 1.

Inspection of Boilers, Maintenance, etc.

(See returns Nos. 1, 2 and 3.)

Under the Act "Boilers" 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 purpose;

(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 or other pipes; feed pumps and injectors and other equipments necessary to maintain the safety of the boiler.

Return No. 1.

New boilers respective of various types registered over the past year are recorded in this return, and figures indicate a sharp increase compared with new registrations during the previous period.

Again it is pleasing to report that the number of vessels of local manufacture by far transcends the number imported: in fact, during 1959 there were 68 more units made in this State than in the preceding year.

Return No. 2.

Therein is recorded the number of useful boilers of each type contained in the register of this Branch at the close of the year. It will be noted that of the total there were 1887 vessels not in use.

Return No. 3.

This summarises the operations for the year. It is of interest to observe that 55 boilers manufactured here were exported to other States in fulfilment of orders, also 13 to overseas destinations.

RETURN No. 1.—SHOWING THE NUMBER OF BOILERS OF EACH TYPE, AND COUNTRY OF ORIGIN OF NEW REGISTRATIONS FOR THE YEAR ENDED 31st DECEMBER, 1959.

	Countries of Origin					
	United Kingdom	U.S.A.	East. States	West. Aust.	Unknown Sources	Total
Vert. Stationary	....	....	....	6	....	6
Returned Multi. Stat. Underfired	....	....	....	5	....	5
Ret. Multi. Stat. int. Fired	....	....	....	78	....	78
Water Tube	....	....	3	2	....	5
Cast Iron Sectional	....	....	2	....	....	2
Digester	....	....	5	8	....	13
Vulcanizer	....	....	28	2	4	34
Steam Jacketed Vessels	....	....	6	8	....	14
Sterilizer	....	....	13	23	....	36
Air Receiver	39	1	31	64	11	146
Gas Receiver	9	1	3	40	2	55
Lorance	....	....	1	1	....	2
Autoclave	....	....	....	3	....	3
Tubular Heater	....	....	1	....	....	1
Water Monteju	....	....	....	1	....	1
Saddle Back	....	....	1	....	....	1
Flash Tank	....	....	....	1	....	1
	48	2	94	242	17	403

RETURN No. 2.—SHOWING CLASSIFICATION OF VARIOUS TYPES OF USEFUL BOILERS IN PROCLAIMED DISTRICTS ON 31st DECEMBER, 1959.

Types of Boilers	Districts Worked from Perth	Districts Worked from Kalgoorlie	Total
Lancashire	45	23	68
Cornish	229	59	288
Semi-Cornish	15	1	16
Vert. Stationary	425	38	463
Vert. Port.	39	10	49
Vert. Multi. Stat.	47	4	51
Vert. Multi. Port.	9	1	10
Vert. Pat. Tubular	50	1	51
Loco. Rect. F/Box Stat.	75	20	95
Loco. Rect. F/Box Port.	162	17	179
Loco. Circ. F/Box Port	94	2	96
Locomotive	79	11	90
Water Tube	558	77	635
Ret. Multi. U/fired Stat.	260	7	267
Ret. Multi. U/fired Port.	....	5	5
Ret. Multi. Int. Fired Stat.	109	5	114
Sterilisers	457	22	479
Autoclaves	45	2	47
Digesters	291	7	298
Gas Receivers	315	....	315
Air Receivers	1,706	572	2,278
Vulcanizers	434	9	443
Steam Jacketed Vessels	611	14	625
Not Elsewhere Specified	175	4	179
Total Registration, Useful Boilers	6,230	911	7,141
Total Boilers Out of Use, 31st December, 1959	1,319	568	1,887

RETURN No. 3.—SHOWING OPERATIONS IN PROCLAIMED DISTRICTS DURING YEAR ENDED 31st DECEMBER, 1959.

Boilers	Districts Worked from Perth	Districts Worked from Kalgoorlie	Total	
			1959	1958
Total number of useful boilers registered	6,230	911	7,141	6,907
New Boilers registered during year	403	10	413	311
Boilers Inspected—Thorough	3,751	340	4,091	3,786
Vessels exempt under Act constructed for export—Thorough	12	....	12	6
Boilers inspected—Working	1,160	3	1,163	721
Boilers condemned during year temporarily	3	1	4	4
Boilers condemned during year permanently	110	5	115	86
Boilers sent to other States during the year	55	....	55	55
Boilers sent from other States during the year	94	....	94	123
Boilers sent to other countries during year	13	....	13	2
Transferred to other Departments	1	....	1	2
Transferred from other Departments	3	....	3	7
Re-instated	2	....	2	....
Converted	1	....	1	....
Number of notices of repairs issued during year	443	22	465	548
Number of Certificates issued, including those issued under Section 30, during year	4,837	340	5,177	3,755

MAINTENANCE AND MISCELLANEOUS.

Much is now being achieved toward care and maintenance of boiler plants by owners generally. There still continues to be, however, some instances of boilers fitted with automatic control equipment suffering damage due to management and boiler attendants alike disregarding the boiler manufacturers' recommendations relative to routine procedures ensuring efficiency of functioning of control appliances. Notwithstanding directions indicated on makers' plates attached to boilers, requirements in these instances appear to be blandly ignored.

In such cases it would seem it has not been appreciated by these operators that sludge can deposit in control chambers and, if these are not regularly blown through under pressure, the build up of deposits will ultimately obstruct the floats housed therein from having freedom of descent as the boiler water level is lowered by evaporation.

This retardation of movement of a float prevents its associated equipment from setting feed water pump in operation at the predetermined low water mark, and furthermore, the float is precluded also from bringing the furnace flame cut-out mechanism into operation as the boiler water continues to recede. As a consequence, serious overheating of the heating surfaces develops as these progressively become uncovered by water.

In a few instances these low water conditions have not been discovered until the water in the boiler had been reduced to a degree where the surface of the water was much below the furnace crowns.

Deformation of the overheated furnace tubes has fortunately not occurred but this was due to the fire tubes springing in their expansions in the tube plates and causing some reduction of boiler pressure by consequent leakages: also dropping of pressure by diminishment of heating surfaces as upper rows of tubes become uncovered by evaporation of boiler water conjointly with escape of steam through the stop valves to the services it was performing.

In one case where the boiler was connected by a header to other boilers a feed back of steam which would have sustained top pressure in the affected vessel perhaps causing collapse of the furnace tube, was avoided by the provision of a non-return valve in the branch line to the header which is required by this department when two or more boilers are connected to a common steam supply line.

In case it be of some interest I would mention here that although over recent years the supply of boilers to industry has been subject to an increasing demand, their use for providing power for the operation of engines has undergone a decline, especially with regard to the goldmining industry.

The position has now arisen that in only two instances in the spheres of mining in this State is machinery powered by steam—a winding engine at Gwalia and another small winding engine at Boulder: all other winding machinery has been converted to electrical operation.

Section 2.

EXPLOSIONS AND INTERESTING DEFECTS.

The only incident of an explosion to report is one which relates to a fuel gas explosion relative to a water tube boiler of a well known make. This unit which for convenience here is designated as "A" boiler is coupled with two boilers of similar manufacture designated as "B" and "C": normally the services of only two units are required at any one time. The plant operates under automatically controlled firing with tar fed pilot burners.

Boiler A was being shut down and B had been put on line at the time of the occurrence: firing of A was being reduced under manual control and during this procedure was on Pyro gas only, the pilot flame having been extinguished.

The boiler attendant stated he had cause to believe that the control instruments on A were defective and had sent for the maintenance fitter. At this time he noticed that a flame failure had occurred, and further stated he had opened wide both the forced and induced draught dampers and shut off the fuel supply: he then concentrated on B boiler.

Around this time the fitter arrived on the scene to check the instruments and in the process found the forced draught damper shut: this he opened immediately a furnace gas explosion occurred.

It would appear that the boiler attendant had inadvertently closed this damper and when it was opened by the fitter the admission of air caused an explosive mixture with the concentration of gases.

The effects of the resultant explosion was confined to upper areas and all the roof bricks were dislodged and were found lying in a disordered heap on top of the boiler.

No cracking of the side walls was revealed and all explosion doors were free. At the time of the eruption the by-pass damper to the air heater was in the open position.

The boiler itself and the baffles did not suffer damage and the result of a subsequent hydraulic test was satisfactory.

Defects.

Vehicle Hoist.

See report under Accidents to Persons, Section 5 hereinafter.

Air Receiver.

Two cracks, one 4 in. length and the other 2 in., each in a longitudinal direction developed in the shell of a horizontal 6 ft. 0 in. x 2 ft. 0 in. x ¼ in. air receiver and extended from the extremities of the transverse footing at one end of the platform supporting the compressor and motor.

This footing was fillet welded along its edge directly to the shell and there can be no doubt that vibrations of the compressor unit over nine years of service had introduced concentrated fatiguing of the shell metal at both ends of the circumferential weld attachment of the platform to the receiver at the compressor end.

Heat Exchangers.

Repairs of two heat exchanges 14 ft. 6 in. length, 23 in. diameter, 1 in. thickness of fusion welded manufacture became necessary when cracks developed in the weld metal around nozzles attached to these vessels: the exchangers were manufactured from 18 per cent. Chromium, 8 per cent. nickel stabilised stainless steel.

Prior to commencement of repairs it was decided to X-ray all welding in these units. It was then found that there were also cracks in the longitudinal and circumferential welds of the shell and bonnets but these had not progressed to the same degree as those around the stand pipes.

It was decided to remove the stand pipes and remake the welds, gouge out the cracks in the longitudinal and circumferential seams and fill the resulting cavities with electric welding. The cracks in the weld securing flanges to the ellipsoidal heads were more extensive than those on the shells and it was decided to machine the original weld out and remake it.

Before removing the stand pipes jigs were made so that they could be correctly positioned for re-welding.

The stand pipes in one shell were removed by drilling around the stand pipes and cutting the material between the holes. The standpipes on the other shell were removed by a different method at another engineering works: in this case the shell was set up in a boring machine and a boring bar passed through the standpipe and the outer section of metal of the wall of the standpipe itself at its attachment to the shell being cut away.

The first method of removing the stand pipes resulted in the metal being removed from the shell and the second method in the metal being removed from the stand pipes; the shell and stand pipes were then subjected to an acid etch to determine any original weld metal remaining and this was removed by machining and grinding.

The shell and stand pipes were then built up by electric welding, then the stand pipes machined back to the original diameter, the excess build up of metal on the shell being taken off in the preparation for welding.

The position of the cracks in the longitudinal and circumferential seams as shown on the radiographs were marked on the shell and the weld metal above the cracks removed by grinding and after a certain amount of grinding the cavity was dye checked and if the crack still showed, further grinding was carried out until a dye check showed the cavity to be crack free, and it was then ground boat shaped to minimise stress concentration when rewelding.

For the repair process Chromoid No. 2 welding rods were adopted: these were flux covered and inert gas was not used. Immediately prior to their use the rods were baked in an oven for at least one hour at a temperature of 350° F.

Before welding, the surfaces to be welded were cleaned with carbon tetrachloride, after each run was put down the slag was removed by scraping, grinding and brushing; no chipping hammers were used as this could set up points of local work hardening; no carborundum wheels were used, as a particle of carbide which may become embedded in the weld could under the action of heat from the next run result in free carbon being formed causing inter granular corrosion.

No brushes of carbon steel were allowed as these could result in a smear of carbon steel on the weld which being an impurity would result in anodic corrosion. The two tools which were found most suitable for cleaning were fibre lock grinding wheels (aluminium oxide) from 1½ in.-9 in. diameter and rotary files. The run was then dye checked before the next run was made.

During the repair the temperature of the vessel was not allowed to exceed 150° F. and at the completion of the repair all the welds were ground flush and polished.

Before welding in but after having been built up and machined back to size the stand pipes were subjected to a solution treatment; they were heated in the furnace to 1020-1040°C. and held there for two hours then cooled rapidly by blowing compressed air over them. This resulted in the ferrite grain structure of the weld metal becoming Austenitic, the same grain structure as the parent metal.

After the repairs had been completed the shells and bonnets were stress relieved by raising to 850-890°C. and held there for four hours, then cooled by opening both end doors of the furnace and allowing the night air to blow through.

The vessels were then x-rayed and the radiographs showed the weld to be free of any defects

A study of the radiographs made before repairs strongly suggested the cracks were a cross between a hot and cold tear, that is, they had occurred at the time of manufacture when the weld metal was semi plastic and had, in the case of the stand pipes, extended due to working and outside stresses.

Section 3.
INSPECTION OF MACHINERY.
(See Returns Nos. 4, 5 and 6.)

When the year closed the register contained 42,007 groups of machinery, an increase of 1,651 groups compared with the year 1958. Similarly to the previous year there were 12 additional lifts registered during the period now under review.

RETURN No. 4.—SHOWING CLASSIFICATION ACCORDING TO MOTIVE POWER OF GROUPS OF MACHINERY IN USE OR LIKELY TO BE USED BY PROCLAIMED DISTRICTS AND WHICH WERE ON THE REGISTER DURING THE YEAR ENDED 31st DECEMBER, 1959

Classification	Districts Worked from Perth	Districts Worked from Kalgoorlie	Totals 1959	Totals 1958
No. of Groups driven by Steam Engines	129	376	505	530
No. of Groups driven by Oil Engines	3,008	742	3,750	3,591
No. of Groups driven by Gas Engines	24	148	172	172
No. of Groups driven by Compressed Air	4	62	66	65
No. of Groups driven by Electric Motor	34,555	2,917	37,472	35,958
No. of Groups driven by Hydraulic Pressure	1	....	1	9
No. of Groups driven by Hand	39	2	41	31
	37,760	4,247	42,007	40,356

RETURN No. 5.—SHOWING OPERATIONS IN PROCLAIMED DISTRICTS DURING YEAR ENDED 31st DECEMBER, 1959 (*Machinery only*)

Classification	Districts Worked from Perth	Districts Worked from Kalgoorlie	Totals 1959	Totals 1958
Total Registrations Useful Machinery	37,760	4,247	42,007	40,356
Total Inspections made	27,118	3,292	30,410	30,067
Certificates (bearing Fees)	5,583	501	6,084	6,731
No. of Extension Certificates issued under Sec. 42 of Act	....	....	....	....
Notices issued (Machinery dangerous)	387	10	397	516
Certificates (Steam without fees)	13	....	13	24

RETURN No. 6.—SHOWING CLASSIFICATION OF LIFTS ON 31st DECEMBER, 1959

Types	How Driven	Totals 1959	Totals 1958
Passenger	Electrically driven	250	245
	Hydraulically driven	1	....
Goods	Electrically driven	121	119
	Hydraulically driven	1	1
	Belt driven	3	4
Service	Electrically driven	84	79
	Hydraulically driven	1	1
Escalators	Electrically driven	19	19
		480	468

ACCIDENTS TO MACHINERY.

There were only four accidents to machinery considered of note and details of these are contained in reports Cases A, B, C and D under Accidents to Persons, Section 5 hereinafter.

Section 4.

PROSECUTIONS FOR BREACHES OF THE ACT.

There were no prosecutions to be recorded but some action of lesser character was necessary in a number of cases to impress on owners of engines and the various descriptions of cranes their obligation under the Act to have their machinery operated by drivers who are the holders of the requisite certificates of competency issued by this department.

ACCIDENTS TO PERSONS.

(See returns Nos. 7, 7A and 7B.)

Section 5.

The first and second returns show accidents to persons in which machinery subject to the Act is involved, the former relating to serious occurrences and the latter those classified as being of only minor nature: the third return (7B) refers to accidents caused by machinery which was not subject to registration with the department but investigated in compliance with a provision in Section 50. The total of incidents in the three categories numbered eighty-seven.

I very much regret reporting that in two cases the accidents met with tragic results. One of the persons who died was injured by machinery which was not subject to the Act.

The first of the fatalities related to a washing machine in an institution. The deceased who was the Engineer of the Home was, at the time of the accident, operating this machine and it is understood that frequently he assisted in the activities of the laundry.

The machine involved was a horizontal drum type washing machine and it is driven from an overhead lineshaft which simultaneously drives a spin dryer, a mangle and a drying fan. The drive from the lineshaft to the machine is by 2 in. wide flat belts one open the other crossed. There are three pulleys on a common shaft, and the middle pulley is fixed to the shaft and the other two are free running.

By means of an automatic reversing mechanism both belts are alternatively engaged on the central pulley thereby driving the internal drum of the washing machine through a pair of reduction gears. The drum is thereby rotated a few revolutions in each direction alternately. In the neutral position the two belts are running on the two outer free running pulleys.

On the right hand side of the machine is fitted a hand brake comprising a screwed spindle with an operating handwheel at the upper end and at the lower end is a brass segmental brake shoe which is applied by turning the hand wheel thereby applying the brake shoe to the brake wheel fitted to the main drive shaft.

When loading and unloading the machine the inner drum is in a stationary position with its hinged door in line with the outer drum sliding door opening. In this position the reversing mechanism is disengaged by putting the sliding gear into neutral position thereby running the belts onto the free running pulleys and the hand brake is applied to prevent any untoward movement of the drum.

On returning to duty subsequent to an afternoon tea interval the laundress saw the lower part of the deceased with his head and arms inside the machine. It was then noted that the internal revolving drum had moved from its normal loading position to approximately half the depth of the opening.

The hand brake which was not applied to its normal extent was released: the driving gear at the time was in neutral position. By rotating the gear wheel the internal drum was returned to its loading and unloading position and the drum door which was lying across deceased's back was lifted in order to extricate him.

Following the accident the action of the machine was demonstrated to a representative of this department—firstly the internal drum was put into loading position and no movement of the drum was apparent with the brake normally applied.

However, when the brake was released, the drum assisted by the out-of-balance force due to the weight of the inner drum hinged door, moved gradually to the point where the door was in its lowest position. This movement was initiated by the open flat belt which was found to be slightly contacting the fixed pulley thereby giving impulses to the drive gear. The brake was then normally applied and no movement of the drum occurred.

The machine loaded with clothing and water was then operated. With the reversing mechanism in neutral and the brake released entirely no movement of the drum occurred.

It was observed that the brake hand wheel is approximately 5½ in. diameter and is very smooth. With wet soapy hands and considering the rather small diameter of the handwheel an effective grip cannot always be assured.

Instructions were issued by the department to—

(a) fit a suitable extension arm to the brake handwheel with hand grips to afford more effective application of the brake under all conditions and

(b) make suitable adjustments to the belt guides to ensure that belts are completely clear of the centrally fixed pulley and are running on the loose pulleys without possibility of contact with the fixed pulley when the drive is in neutral position.

This machine is rather old, registered 25 years ago and was in poor mechanical condition: this however was definitely not a contributory factor to the accident.

It would appear that the occurrence was due to the brake not being adequately applied by the deceased by reason of his hands being wet and soapy, or by oversight.

The other fatal accident occurred in a garage when a laden vehicle-hoist violently dropped onto a mechanic working underneath thereby causing his death by asphixiation.

This appliance was of the hydraulic type operated in conjunction with compressed air commonly used in commercial garages and had been in service for 24 years.

On removing the ram chamber from its foundation in the ground it was found that the end plate had completely parted from the cylinder due to most extensive corrosion of the mild steel shell having taken place around its exterior from a position 8 inches above the bottom, tapering to very thin metal around the end plate itself. It was also noted that the welding of the inserted end plate to the shell was of poor standard.

Following are extracts from the preliminary and secondary reports of the Inspector of Machinery who investigated the circumstances surrounding the fatality—

"I have to report that late afternoon Monday 21st December, 1959 I received a telephone message that a fatal accident at a Garage had occurred in which a hydraulically operated car hoist was involved. I attended the scene of the accident as soon as practicable, arriving there at about 5.20 p.m. and ascertained the circumstances surrounding the accident, which were as follows:—

> During that morning an International Truck was brought into the garage for repairs. It was raised on the hydraulic service hoist at about 1 p.m., and the now deceased began working on it. The repairs necessitated the draining and removal of the sump. He periodically attended other customers leaving the truck upon the hoist. At approximately 3 p.m. he was underneath the hoist when it suddenly collapsed trapping him by both legs and forcing his head into a tin of oil previously used for draining the sump. Other persons adjacent to the garage heard the crash of the falling hoist and ran to the scene to give assistance. It was found necessary to jack up the truck and lever the rails of the hoist up to release the injured man, who died shortly afterwards from his injuries.

The only maintenance carried out on the hoist was a periodical check of the oil level in the reservoir, and the oil sealing gland packing at the head of the ram casing. The oil level in the reservoir was topped up some 3 months ago, and the gland was repacked about one month prior to the accident.

The oil reservoir is of 4 cu. ft. capacity and when full would contain about 25 gallons of oil. The hoist casing would contain approximately 10 gallons of oil when the hoist was seated at its lowest point. The total oil in the system under these circumstances would be approximately 35 gallons. The capacity of the casing with the ram fully extended is approximately 4.6 cu. ft. Since neither chamber is in excess of 5 cu. ft. the machine is not subject to the provisions of the Inspection of Machinery Act. An investigation of the accident was however proceeded with under the provisions of Section 50.

On my arrival at the garage I examined and tested the hoist. The pressure gauge on the oil reservoir showed 25 lb per square inch pressure. The air compressor was then started and pressure built up to 100 lbs per square inch: air was then admitted to the oil reservoir. The pressure fell quickly to 25 lb per square inch again. There was no sign of movement in the hoist, and no evidence of air or oil leaking from the air lines or visible portion of the hoist itself. I then removed the oil filler plug from the top of the oil reservoir and sounded it with a metal rod for a dipstick. I found it to be completely empty of oil, there being only a slight trace on the bottom of the rod. From these tests I concluded that a serious structural defect had occurred in the hoist somewhere below ground level. The exact nature of this defect can only be ascertained by dismantling the hoist and will probably entail excavating the hoist from its foundations. The air compressor and receiver supplying air to the hoist was examined and found to be in good working order. The safety valve on the air receiver was of 1" diameter. When dismantled it was found in good order, and capable of functioning correctly. It relieved at 135 lb per square inch gauge pressure. The pressure gauge was removed and tested. It was not fitted with a glass but was otherwise mechanically sound. The gauge reading was 25 lb per square inch at atmospheric pressure and when tested against a test gauge, read 110 lb per square inch at 100 lb test pressure. The gauge was thus reading in excess of the true pressure.

A circumstance worth noting is that heavy rain fell on the 20/12/59, the day prior to the accident, and it was stated that the yard adjacent to the garage was under water on the morning of the 21st. A well or sump some 6 ft. deep adjoins the wall of the garage in the close vicinity of the hoist: this was pumped out during the morning and the yard drained of surplus water. On the 22nd—the day after the accident it was noticed and pointed out to me that a crack had developed in the brick wall of the garage, opposite the hoist. On the 23rd I was again in the garage, and noticed that the crack had extended from the top practically to the bottom of the wall indicating some subsidence of the ground in the vicinity.

In the makers' installation instructions, it will be noticed that mention is made of a "special safety leg" for attachment to the hoist platform. This can be fitted to any hoist with little expense or trouble and expressly guards against a sudden fall in level of the hoist.

On inquiry I find that in some circumstances, such as a shortage of oil in the system, a sudden drop in the level of the hoist is quite common, and could cause head injuries to the operator. Careful operators using old type hoists, use some type of prop such as a heavy billet of timber. Modern hoists now being installed are fitted with a simple safety leg some 3 ft. in length, which would prevent a complete collapse of the hoist. The possibility of this occurrence has therefore not gone unnoticed by manufacturers, and the fitting of such a device has a great deal of merit.

Any further investigation or removal of the hoist awaits the approval of the Coroner.

Further to my foregoing report I have to advise that investigations have been continued under instructions from the Coroner.

On Wednesday 6/1/60, I again attended the garage where the hoist involved in the accident was being dismantled. The pipe line from the oil reservoir to the hoist was uncovered and dismantled. This was in fair order although corroded slightly at one section where it had been buried in the floor of the garage. The hoist itself was partly excavated, but due to the heavy concrete in which it was embedded. it was impossible to free it entirely in the time available. It was therefore decided to remove the ram from the casing, leaving the casing in the ground. When this was done the oil sealing gland packings were removed. These were found to be in practically new condition, and properly fitted. The casing was then examined internally. The was no oil present in the cylinder, but the bottom end was covered by a 2" depth of water. At this stage no obvious defects were visible. An attempt was then made to fill the vessel with water, to enable a hydrostatic test to be carried out. It was found, however, that the casing would not hold water, thus proving that the casing itself had failed.

On Monday 25/1/60, I examined the withdrawn casing, at the Police Yard. It was corroded externally to some extent in a band some 4" wide, about 30" from the top flange. Sections of the vessel in this area were easily dented with a test hammer. The bottom 8" of the casing was corroded heavily, the extreme bottom, being wasted to a feather edge around the full circumference. A few light blows of the hammer were sufficient to produce several holes in the walls of the casing in this area. The bottom end plate was completely detached and when examined. the fractured portion where it had torn away from the casing measured less than 1/32" (approximately 0.030 inches). The thickness of the casing at an uncorroded area, measured 3/16", and the thickness of the bottom end plate ½". Attachment of the end plate, was by a single fillet weld without any edge preparation, leg lengths of the fillet being approximately 3/8" on the bottom end plate, and 1/8" on the casing as far as could be judged, taking account of the wastage.

The design of the casing meets the requirements of the S.A.A. Boiler Code C.B.I. part V in respect of Class 3 unfired pressure vessels, with the exception of the method of attachment of the bottom end. This Code of course was not in force at the time of manufacture of the vessel in 1936.

The cause of this failure is obviously the the heavy corrosion, affecting the bottom end of the casing. The manner in which

these hoists are installed, precludes any regular inspection of the vital parts, for this type of defect. Use of a much greater corrosion allowance should therefore be required when considering new designs and the provision of a safety leg or similar means of support is essential to prevent a sudden total collapse of the hoist in case of a failure of the casing."

It will be observed that this particular unit was not fitted with a safety leg. In the past such hoists have not been subject to inspection under the Inspection of Machinery Act but this department is taking appropriate action now to gather within its jurisdiction equipment of this kind.

The following reports relate to certain other accidents resulting in serious injuries considered to be associated with conditions which should be brought into prominence.

Case A.

Crane Sling.

Injuries in this instance were inflicted when a two-leg chain sling failed under grossly overloaded conditions.

A fabricated steel structure weighing 7-7½ tons was being removed from a transport vehicle at a large engineering works per medium of a 25-ton capacity overhead travelling crane and the use of a ½-inch chain sling having two legs secured to the structure at an angle each to each 60°. The load had been raised approximately 18 inches when one chain snapped immediately followed by a fracture of the other leg.

The impact of the falling load onto the vehicle precipitated a workman together with a length of other steel material weighing about two hundredweight off the truck: he was struck with this material and received lacerations to his back and right thigh.

Examination of the broken links of the chains revealed fracture at the stub welds: the material showed fine grain structure with no sign of fatigue.

The safe working load of this sling under conditions in which it was being used was 1½ tons: that it was being seriously overstressed is obvious. The crane driver stated that he could not from his position in the crane cab estimate the size of the chain.

It is very apparent that the person in charge of the operation was quite unaware of lifting capacities of slings and it is considered that far too often is the handling of loads, particularly those of the more heavy character, left by management to subordinates without ensuring they are sufficiently knowledgeable for the work entrusted to them: such practice is much to be deprecated.

Case B.

Passenger Lift.

In this instance a not overloaded lift ran through to the buffers and two ladies who were passengers suffered from shock.

This lift which serves six floors was installed approximately thirty years ago: the machine is driven by a two-speed A.C. motor and is fitted with oil immersed A.C. brake equipment and controlled by car switch.

At the time of the occurrence it was being used as an express unit between top and ground floors and was being operated by a relief driver.

Upon departmental examination it was noted that the brake path and brake lining was much saturated with oil: the climatic conditions were hot and there was every appearance of the oil having overflowed on to the brake parts below.

Although the brake to some degree retarded the machine, the car landed on the buffers with appreciable force.

Case C.

Emery Wheel.

A lad aged 12 years received an injury to his knee cap when struck by a fragment of an emery wheel which burst approximately 20 feet from where he was standing. This accident arose from somewhat piquant circumstances.

A person who, with his wife, was sitting in a beer garden became interested in a small motor with an emery wheel attached to the spindle he observed on the back of a vehicle in the hostelry premises: his interest was raised by his desire to have a small emery in his home workshop.

He located the owner who stated that the motor was a Ford T model starter, was for sale and thereupon proceeded to demonstrate its operation.

The battery of the inquirer's car was used for the power supply and the leads from the emery wheel motor were connected across half of the cells of the 12 volt battery. Upon the motor performing satisfactorily the owner of the emery wheel, etc., then said that the old motors of that description would run on any voltage and connected this one across the 12 volt supply for a demonstration, and again set it in motion.

When an Inspector of this department was making an investigation into the accident he was informed by the prospective purchaser of the machine that he knew little about emery wheels but realised that at this second demonstration the unit was running too fast and immediately took action to disconnect the leads to the battery: unfortunately, before he could put his intentions into effect the wheel burst.

Surprisingly he and the owner together with a third man though virtually standing over the apparatus when the emery disintegrated, escaped injury, but a fragment struck the lad who was appreciably distant at the time.

Case D.

Emery Wheel.

This was an incident whereby a labourer suffered severe injuries to his left hand when an emery wheel directly driven by a portable air motor disintegrated.

The machine had been issued for use complete with grinding wheel and guard: subsequently, the wheel and guard were removed, a wire brush substituted and the machine temporarily mounted on a post for the purpose of cleaning the ends of reinforcement rods preliminary to butt welding of these together.

Later, the grinding wheel was re-fitted to the machine by an inexpert person and the cheek plates were then omitted; also, the guard formerly supplied with the unit was not attached.

There was no evidence of overspeeding of the machine: undoubtedly the accident was caused by failure of securing the emery wheel with the requisite cheek plates designed and supplied for that purpose.

Consequent upon this occurrence instructions were issued by the owners that emery wheels on future occasions were to be attached to machines by a fitter.

Case E.

Rubber Mill.

In this instance an operator was feeding a piece of crude rubber into the rolls of a rubber milling machine when one of his hands was drawn into the rolls and severely crushed.

Whilst carrying out this operation the rubber sheet was folded back on itself and the operator placed his hand between the folds to enter the material to the rolls.

The rubber seized his fingers and these together with his hand were trapped.

This machine was fitted with a trip wire mechanism along the length of the unit which quickly reverses the direction of rotation: this functioned in the emergency and saved the operator from suffering more extensive injuries.

RETURN No. 7.—SHOWING NUMBER OF SERIOUS ACCIDENTS BOTH FATAL AND NON-FATAL WHICH OCCURRED IN PROCLAIMED DISTRICTS DURING THE YEAR ENDED 31st DECEMBER, 1959

" F " denotes Fatal

Industry	Circular Saw	Buzzer (Planer)	Spindle Moulder (Shaper)	Belts and Shafting	Chain Drive	Stapling Machine	Press (Metal)	Punch (Metal)	Wiredrawing and Working	Lathe	Drilling Machine (Metal)	Conveyor (Belt)	Chain Sling	Swaging Machine	Chilean Mill	Washing Machine	Rolls	Mixer (Concrete)	Mixer (Other)	Doughbreak	Doughcutter	NH^3 Expansion Valve	Teasing Machine	Winding Shaft	Ore Roaster	Cornering Machine	Bag Printer	Bag Elevator	Totals per Industry
Woodworking and Furniture	3	3	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	9
Metal Working and Engineering	....	1	....	1	....	....	5	1	4	....	1	1	1	1	1	....	1	....	....	....	....	....	....	....	....	....	....	....	18
Printing and Allied Industries	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	1	....	....	4
Fertiliser Manufacture	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	3
Mining	1	....	....	....	....	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	1	1	....	....	....	5
Food and Drink Processing	....	....	....	4	....	....	....	....	....	....	....	1	....	....	....	....	1	....	1	1	1	1	....	....	....	....	....	....	10
Building Materials and Building	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	1	....	....	....	....	1	....	....	....	....	....	3
Other	1	1	....	....	1	....	....	....	....	....	....	....	....	....	....	1F	....	1	....	....	....	....	....	....	....	....	....	....	(1F)5
Totals per Type of Machine	6	5	3	5	1	1	5	1	4	1	1	5	1	1	1	1F	3	2	1	1	1	1	1	1	1	1	1	1	(1F)57

MINOR ACCIDENTS

RETURN No. 7A.—SHOWING NUMBER OF ACCIDENTS NOT CLASSED AS "SERIOUS" UNDER THE ACT AND NOT INCLUDED IN RETURN No. 7 BUT WERE REPORTED AND INVESTIGATED DURING THE YEAR ENDED 31st DECEMBER, 1959

Industry	Circular Saw	Buzzer (Planer)	Belts and Shafting	Chain Drive	Abrasive Wheels	Press (Metal)	Wiredrawing and Working	Conveyor (Belt, Roller)	Cooling Fan	Brushmaking Machinery	Farinograph	Can Sealer	Crane (Tower, Mobile)	Totals per Industry
Woodworking and Furniture	....	2	....	....	....	....	....	....	....	....	....	....	....	2
Metalworking and Engineering	....	1	....	....	2	....	1	....	1	....	....	....	....	5
Fertiliser Manufacture	....	....	....	....	....	....	....	1	....	....	....	....	....	1
Mining	1	....	....	....	....	....	....	....	....	....	....	....	....	1
Food and Drink Processing	1	....	1	....	....	....	....	1	....	....	1	1	....	5
Building Materials and Building	....	....	1	....	....	1	....	....	....	....	....	....	1	3
Other	....	....	....	1	....	....	....	....	....	4	....	....	1	6
Totals per Type of Machine	2	3	2	1	2	1	1	2	1	4	1	1	2	23

RETURN No. 7B.—ACCIDENTS INVOLVING MACHINERY NOT SUBJECT TO THE INSPECTION OF MACHINERY ACT REPORTED TO AND INVESTIGATED BY THE DEPARTMENT DURING THE YEAR ENDED 31st DECEMBER, 1959, IN COMPLIANCE WITH SECTION 50 OF THE ACT.

"F" denotes Fatal

Industry	Buzzer	Abrasive Wheels	Plate Rolls	Car Hoist	Chocolate Wrapper	Totals per Industry
Metalworking and Engineering	....	....	1	1(F)	....	2(1F)
Food and Drink Processing	....	....	....	....	1	1
Building Materials and Building	....	1	....	....	....	1
Glass Manufacture	1	....	....	....	....	1
Domestic	....	1	....	....	....	1
Other	1	....	....	....	....	1
Totals per Type of Machine	2	2	1	1(F)	1	7

GENERAL.

During the year under review accidents involving injuries were more prevalent among the woodworking sections of industry than in any other trade, and quite a large proportion of these arose from machines being used for purposes for which they are hazardous: in some cases guards which were provided were laid aside.

Power presses caused injuries to five persons and among these incidents reasons for the mishaps were neglect of maintenance—faulty repairs of guarding appliances—deliberate action by a machine operator in removing portion of the guard fence—removal of complete guard from a machine for some particular process work.

A number of accidents investigated continue to reveal that gloves are a no small source of injuries. In a previous annual report I referred to this factor and in that instance expressed the desirability of work gloves being manufactured with open finger ends, and not with tips as now supplied to the market.

The appreciably protruding tips on numerous occasions have been caught in rolls and gearing, and persons' fingers and even arms have as a consequence been dragged into mechanism: excessively open and loose cuffs of gloves have also been the cause of accidents by becoming fouled with moving machinery.

It is, of course, idle to suggest that the finger tips of working gloves as now manufactured could be snipped off if desired: if this were done the stitching would draw from the material.

(Here follow returns Nos. 7, 7A and 7B.)

Section 6.

EXAMINATION OF ENGINE DRIVERS, CRANE DRIVERS AND BOILER ATTENDANTS.

The Board of Examiners granted 107 engine drivers', 133 crane drivers' and 100 boiler attendants' certificates.

Compared with the previous year these figures indicate decrease 32, decrease 132 and increase 5 respectively in the number of certificates granted.

Section 7.

AMENDMENTS TO ACT.

No amendment to be reported.

Section 8.

STAFF.

There has been no change in the number of officers in the clerical section but there is a deficiency of two on the strength of the inspection staff. It is anticipated, however, that the number of Inspectors will be restored to the previous complement during the year 1960.

Despite steadily increasing industrial activities in many areas of the State which reflect in a greater volume of work also for this Branch the staff as a whole has faithfully responded to every call made upon it: I wish to express thanks to all its members for the spirit in which they have given every endeavour to overcome the many difficult occasions which have arisen.

In the course of the year 122 sets of plans of new designs of boilers and unfired pressure vessels, together with cranes were examined and constructively criticised where necessary: approximately 215 separate prints were incorporated in the aforesaid number of designs.

In addition to the foregoing, 41 drawings of designs of projected new lifts were examined for Permits for Erection.

Our appreciation is again extended to the Police Department which, as in previous years, assisted this Branch in reporting machinery accidents to us immediately they come to the notice of its officers. Such co-operation invariably enabled our officers to take action in investigating occurrences within a very short period following incidents—a factor which obviously is most desirable.

On behalf of those members of our staff, including myself, who in the course of duty have had occasion to consult with other officers in various sections of the Department of Mines I convey our sincere regard for the harmonious spirit which we have always met.

J. F. WINZAR,
Deputy Chief Inspector of Machinery.

DIVISION VII

Government Chemical Laboratories Annual Report—1959

Under Secretary for Mines:

I have the honour to present to the Hon. Minister for Mines a summarised Annual Report on the operations of the Government Chemical Laboratories for the year ended 31st December, 1959.

The staff of the Laboratories at 31st December, 1959, numbered 64, being 45 professional officers, 11 general and 8 clerical. This shows a slight improvement in availability of professional staff during 1959 but we still have vacancies in three Divisions and repeated advertisements have failed to obtain suitable qualified applicants.

Administration.

The Laboratories consist of five Divisions, a Physics section, a central office and library all under the control of the Director (Government Mineralogist, Analyst and Chemist) as follows:—

Director—L. W. Samuel, Ph.D. (Lond.), B.Sc. (Hons.), F.R.A.C.I., F.R.I.C., M.A.I.A.S.

Agriculture, Forestry and Water Supplies—R. C. Gorman, B.Sc., A.R.A.C.I., M.A.I.A.S., Deputy Government Agricultural Chemist.

Food, Drugs, Toxicology and Industrial Hygiene—N. R. Houghton, B.Sc., A.R.A.C.I., Deputy Government Analyst.

Fuel Technology—R. P. Donnelly, M.A., B.Sc. (Oxon.), M.I.Gas. Eng., A.M.I.Chem.Eng., M.Inst. F., Fuel Technologist.

Industrial Chemistry—A. Reid, M.A., B.Sc. (Aberd.), A.R.I.C., Chief Industrial Chemist.

Mineralogy, Mineral Technology and Geochemistry—G. H. Payne, M.Sc., A.W.A.S.M., A.R.A.C.I., Deputy Government Mineralogist.

Physics Section—N. L. Marsh, B.Sc., Physicist and Pyrometry Officer.

Library—Miss C. R. Hammond, B.Sc., Librarian.

Office—Miss D. E. Henderson, Senior Clerk.

The close association of these Laboratories with other Government Departments and with kindred associations was maintained during 1959 and various members of the staff are members of the following Committees:—

Atomic Energy Commission—Commonwealth, States Committee.

Cereal Chemistry Group of the Royal Australian Chemical Institute.

C.S.I.R.O.—State Committee.

Food and Drug Advisory Committee.

Insecticides Committee.

Oils Committee—Government Tender Board.

Paints Advisory Committee—Government Tender Board.

Swan River Conservation Board.

Technological Standing Committee on hydrogen sulphide in sewerage installations.

Veterinary Medicines Advisory Committee.

Water Purity Advisory Committee.

During the year the former Swan River Reference Committee ceased to function and was replaced by the Swan River Conservation Board.

Some of these Committees do not meet regularly but others do and are very active and occupy considerable time of the officers concerned, not only for the meetings, but also for inspection, preparation of material and analysis of samples.

Equipment.

No major items of equipment were obtained during the year under review but a number of smaller items were purchased to assist us to cope with increased work and to extend our facilities for service to other Government Departments.

Accommodation.

For some time past it has been evident that the present accommodation at the Laboratories is insufficient. This has been particularly so for the Office, Library and Refectory but in the past few years has also become clear for the Agricultural Division in particular. Of recent years several primary industries have established Industry Research Funds and these moneys have enabled the Department of Agriculture to expand its activities considerably. In consequence, these Laboratories have received an increase in work from the Department of Agriculture, an increase which we have been unable to cope with satisfactorily. Even imposing restrictions on the work done for the general public has not solved this problem and is in any case a most undesirable solution. The lack of other chemical facilities in this State make it very necessary that we should be able to undertake all chemical work required by the public and it is hoped that our representations for building extensions will bear fruit early.

These remarks apply to the situation as it is at present, but as pointed out in some of the Divisional Reports which follow, there is great scope for the extension of our work were accommodation and staff available.

Staff.

The Metropolitan Water Supply, Sewerage and Drainage Department is converting the sewage treatment works at Subiaco to the activated sludge process and included in the building programme is a laboratory which is expected to be complete at the end of March, 1960. It is proposed then to transfer the staff engaged on sewage work from the present unsatisfactory accommodation at the Smith Street Annexe Laboratory to the new Laboratory at Subiaco. It is proposed also to transfer this staff from the administration of the Government Chemical Laboratories to that of the Metropolitan Water Supply, Sewerage and Drainage Department as it is considered that this will increase administrative efficiency. Only the sewage work and staff will be so transferred, all other chemical work for the Metropolitan Water Supply, Sewerage and Drainage Department will be done in these Laboratories as at present and we will always be available for consultative, advisory and special work for that Department.

General.

The total number of registrations during 1959 was 3,591 covering 17,483 samples. These were practicaly the same as for 1958, namely 3,628 and 17,870 respectively. As in 1958, there was a greatly reduced number of sewage samples examined compared with previous years because of the operation of the activated sludge process at the Subiaco Treatment Works.

The samples received were allocated to the various Divisions of the Laboratories according to the specialized work undertaken by each Division. In a number of cases work was done on the same sample in more than one Division so that in the table below some samples occur more than once and the total does not agree with the figure quoted above. This co-operation between Divisions helps to foster the policy that we are one Government Chemical Laboratories and not five separate Divisions, that the problems in one Division may be assisted by specialists from another Division. It is also further support for the value of one centralised chemical laboratory instead of chemical sections in various Government Departments.

Division	No. of Samples
Agriculture, Forestry and Water Supplies	5,505
Food, Drugs, Toxicology and Industrial Hygiene	10,104
Fuel Technology	387
Industrial Chemistry	32
Mineralogy, Mineral Technology and Geochemistry	1,546
	17,574

Table I shows the source of the samples and their allocation to various Divisions. Although the reduction in the number of sewage samples noted for 1958 was continued for 1959, this category was still the largest numerically.

The number of samples received each year does give an approximate measure of the activities of the Laboratories but does not completely describe our work, not only because of the variable number of determinations per sample but also because it is not possible to give a statistical account of the time and effort devoted to the various Committees previously mentioned, advice to Government Departments and the public, attendance at courts of law, visits to industrial establishments and so on.

TABLE I.

Source and allocation of Samples Received During 1959.

Source	Division					
	Agriculture	Food and Drug	Fuel Technology	Industrial Chemistry	Mineral	Total
Agriculture Department	3,819	523	11	1	1	4,355
Departmental	....	1	57	....	12	70
Factories Department	2	49	5	....	2	58
Fisheries Department	78	....	....	....	....	78
Government Geologist	26	....	....	....	205	231
Government Tender Board	....	15	....	....	....	15
Industrial Development Department	3	....	17	....	13	33
Lands Department	4	14	....	1	....	19
Metropolitan Water Supply	184	7,712	....	1	....	7,897
Mines Department	3	7	....	....	24	34
Police Department	13	681	....	....	....	694
Public Health Department	12	191	....	....	....	203
Public Works Department	211	109	109	6	9	444
State Batteries	1	....	....	....	133	134
Swan River Reference Committee	....	114	....	....	....	114
War Service Land Settlement	68	....	....	....	....	68
Other Government Departments	8	9	4	5	8	34
Pay—						
Commonwealth	4	101	2	....	23	130
Hospitals	3	71	....	13	....	87
Milk Board	....	270	....	....	....	270
Public	913	205	181	4	337	1,640
State Building Supplies	20	....	....	....	....	20
University of Western Australia	48	....	....	....	....	48
Western Australian Government Railways	....	12	....	....	....	12
Other Government Concerns	13	19	....	1	....	33
Free—						
Public	4	1	....	....	779	784
Royal Mint	....	....	1	....	....	1
University of Western Australia	68	....	....	....	....	68
Total	5,505	10,104	387	32	1,546	17,574

Fees were charged for work undertaken for some Government Departments, for Commonwealth Government Departments, Hospitals, Milk Board and the general public but a considerable number of free examinations were made for the general public, mainly for mineral identification and assay, to assist prospectors. The revised Regulations governing operations of the Laboratories were implemented from 1st January, 1959.

The summarised reports of the individual Divisions which follow show the wide field covered by the Laboratories and this is also illustrated by the fact that during 1959 we examined samples from 15 of the 27 Government Departments shown in the Public Service List, 1959.

Although the total number of samples received in 1959 and 1958 were comparable there were some marked alterations in the numbers of various types of samples. Comparing 1959 with 1958 there was:—

(1) a great reduction in the number of samples of wheat grain (1367 to 45);

(2) a reduction in the number of samples received under the Fertiliser Act (131 to 89);

(3) a marked increase in the number of samples of tobacco leaf (96 to 487);
(4) an increase in silage samples (64 to 117);
(5) a great increase in soil samples (311 to 1315).
(6) a reduction in the number of water samples (1866 to 1407);
(7) a marked increase in industrial hygiene samples (86 to 305);
(8) a marked decrease in the number of investigational sewage samples (1461 to 428) balanced by;
(9) a nearly twofold increase in the number of samples from the activated sludge process for sewage (1099 to 1951);
(10) an appreciable increase in the number of boiler trials (72 to 124);
(11) the cessation of the railway trials with coal;
(12) a considerable increase in the number of mineral identifications (285 to 423);
(13) an increase in the number of ores of iron (95 to 170), and of manganese (30 to 66);
(14) a marked reduction in the number of ores of titanium (154 to 27).

L. W. SAMUEL,
Director.

AGRICULTURE, FORESTRY AND WATER SUPPLY DIVISION.

The total number of samples received in 1959, 5,505, is a decrease of 8 per cent. on 1958. The main reason for the decrease in numbers is the small number of wheat grain samples received, compared with 1958. As the Department of Agriculture, now has a new cereal laboratory in South Perth they are doing their own protein determinations on wheat, previously done in this Division. The decrease in number of samples received has not meant any decrease in work, as a wider range of determinations, especially on soils, has been required.

Because of staff and accommodation shortage there has been a back log of 2-3 months of work over most of the year. The increasing requirement of the Department of Agriculture for more chemical work necessitates immediate additional accommodation as it is not possible to give all the service asked for, with the present staff and building. Further space is required for sample preparation, especially for large size samples and storage of samples and apparatus as well as additional laboratory space including specialised rooms and general laboratory benches.

Table 2 lists the type and number of samples received in 1959.

TABLE 2.

Agriculture, Forestry and Water Supply Division.

	Agriculture Department	Public Works Department	Metropolitan Water Supply	Public Health Department	Fisheries Department	Government Geologist	War Service Land Settlement	Police Department	Other Government Departments	Pay—Public	Pay—State Building Supplies	Pay—Other	University of W.A.	Free	Total
Cereals—															
Barley Plant	62	....	....	....	....	....	....	....	....	....	....	....	....	....	62
Millet Grain	8	....	....	....	....	....	....	....	....	....	....	....	....	....	8
Oat Grain	18	....	....	....	....	....	....	....	....	....	....	....	....	....	18
Oat Plant	110	....	....	....	....	....	....	....	....	....	....	....	....	....	110
Wheat Grain	45	....	....	....	....	....	....	....	....	....	....	....	....	....	45
Fertiliser and Manure—															
Fertiliser Act	89	....	....	....	....	....	....	....	....	....	....	....	....	....	89
Lime (sand and stone)	24	....	....	....	....	....	....	....	4	6	....	2	....	....	36
Copper Ore	17	....	....	....	....	....	....	....	....	....	....	....	....	....	17
Superphosphate	14	....	....	....	....	....	....	....	....	....	....	....	....	....	14
Other	22	....	....	....	....	....	....	....	....	3	....	4	....	....	29
Horticulture—															
Citrus	14	....	....	....	....	....	....	....	....	....	....	....	....	....	14
Tobacco	487	....	....	....	....	....	....	....	....	....	....	....	....	....	487
Vine	182	....	....	....	....	....	....	....	....	....	....	....	....	....	182
Other Fruit	31	....	....	....	....	....	....	....	....	....	....	....	....	....	31
Other Vegetables	29	....	....	....	....	....	....	....	....	....	....	....	....	....	29
Other	27	....	....	....	....	....	....	....	....	....	....	....	....	....	27
Miscellaneous—															
Faeces and Urine (sheep)	16	....	....	....	....	....	....	....	....	....	....	....	32	....	48
Fuel Oil and Ash	....	....	....	....	....	....	....	....	....	19	....	....	....	....	19
Flue Gas	....	....	....	....	....	....	....	....	....	....	15	....	....	....	15
Deposits	....	1	4	....	....	....	....	....	2	3	....	2	....	....	12
Flour	21	....	....	....	....	....	....	....	....	1	....	....	....	....	22
Glass	....	....	....	....	....	....	....	13	....	....	....	....	....	....	13
Linseed	222	....	....	....	....	....	....	....	....	....	....	....	....	....	222
Other	30	1	1	1	....	....	....	....	2	14	5	6	3	2	65
Pasture and Fodder—															
Clover	548	....	....	....	....	....	....	....	....	....	8	....	....	....	556
Feeding Stuffs Act	63	....	....	....	....	....	....	....	....	....	....	....	....	....	63
Feeding Stuffs, Euro and Quokka	....	....	....	....	....	....	....	....	....	....	....	....	76	....	76
Kochia brevifolia	49	....	....	....	....	....	....	....	....	....	....	....	....	....	49
Lucerne	10	....	....	....	....	....	....	....	....	....	....	....	....	....	10
Lupin	72	....	....	....	....	....	....	....	....	....	....	....	....	....	72
Poultry Meal	34	....	....	....	....	....	....	....	....	....	....	....	....	....	34
Silage	101	....	....	....	....	....	....	....	....	16	....	....	....	....	117
Vetch	47	....	....	....	....	....	....	....	....	....	....	....	....	....	47
Other	130	....	....	....	....	....	....	....	....	5	....	5	5	....	145
Soil	1,288	3	....	....	....	....	....	....	....	24	....	....	....	....	1,315
Water	9	206	179	11	78	26	68	....	13	814	....	1	....	2	1,407
Total	3,819	211	184	12	78	26	68	13	21	913	20	20	116	4	5,505

Soils.

1,315 soils were received, a more than fourfold increase on 1958. In the case of soils the number of samples is not necessarily a true indication of the amount of work involved as in some cases as many as 16 different analyses are required on the one sample.

Of the soils received the following were the more important:—

(1) 17 soils from the Hyden-Forrestania area were analysed in detail to give some fundamental information about the soils in this area, where the local authorities are hoping for similar development as on other light lands that have been recently developed in the reliable rainfall areas of the State.

(2) From an investigation into structural deterioration of older developed soils from Nangeenan, Merredin, Corrigin and Yealering, 80 soils were analysed for organic carbon. In all except the Merredin sand plain soil there was a significant reduction in organic carbon in the developed compared with the virgin soils. An increase in bulk density and a decrease in water-stable aggregates was found by the Department of Agriculture for the developed compared with the virgin soils.

(3) Over 50 samples of soils were analysed for total and exchangeable potassium. These were mainly from the higher rainfall areas of the State, where suspected potash deficiency in the soil is limiting or likely to limit clover growth.

(4) From an interaction of variety, soil and climate experiment on wheat quality 254 samples were analysed for total nitrogen. Initial results of the experiment indicate no correlation between soil total nitrogen and grain protein.

(5) 480 samples from Wongan Hills Research Station were analysed for nitrogen in a study of sampling procedure on light soils. From each of 4 replicates of 4 treatments, 30 cylinder samples 2⅜" diameter x 3" deep were taken at random on a one yard grid. The samples were halved, one half was analysed to give individual analysis, the other half —samples bulked and four representative samples were taken of the bulked sample. Although there was great variation in the individual samples, the mean or weighted mean of the individual samples agreed very well with the subsamples of the bulked samples and with the mean of these. The results of the 30 samples from one plot are given below; these indicate that the method of sampling and bulking gives a representative sample of the plot, but also shows a three-fold variation for individual samples.

TABLE 3.

Soil Sampling.

	Nitrogen per cent. dry basis
Range (30 samples)	0·020–0·059
Mean	0·032 (7)
Weighted mean	0·032 (5)
Sub samples of above samples bulked—	
A	0·032
B	0·032
C	0·033
D	0·033
Mean	0·032 (5)

(6) 79 soils from apple orchards in the Bridgetown and Kendenup districts were examined for exchangeable cations and clay content. These soils had been irrigated for up to seven years with water as high as 280 grains of total soluble salts per gallon. The results of analysis showed no accumulation of soluble salts in the profile and no increase in the exchangeable sodium percentage in the clay. This is probably due to the generally light texture of the soils, the high salt content of the irrigation water which would flocculate the clay fraction and increase permeability, the few heavy rates of watering and the high winter rainfall which would leach out any accumulation of salts which occurred during summer.

(7) 90 soils from an experiment at Wongan Hills Research Station were analysed for nitrogen and hydrochloric acid soluble phosphorus. These samples were taken from two rates of application of superphosphate experiments, there being 5 replicates of 3 rates of superphosphate in each of the two experiments. The object was to determine what part of the applied phosphorus, applied every cropping year over 30 years (7 crops) was still present in the layers of soil sampled. Very good agreement was obtained within replicates indicating that the method of sampling was sound; however after allowing for phosphorus removed in the crops, a third to a half of the added phosphorus could not be accounted for. This may be due to several reasons, two of which are, the allowance made for phosphorus in the grain of 0.25 per cent is probably low for the high rates of fertiliser treatment and the 0"-12" sampled was not of sufficient depth as obviously in the higher rates of application some of the added phosphorus had been leached below 12".

Table 4 below shows the phosphorus found in the soil and the phosphorus added, removed in the grain and unaccounted for.

TABLE 4.

Rate of superphosphate added (lb./acre)	0	75	150	150	225	300
Phosphorus found in soil—	p.p.m.—dry basis					
0–4 in.	17	26	34	43	54	59
4–8 in.	12	17	20	24	33	41
8–12 in.	13	16	15	16	20	25
Total, 0–12 in.	14	20	23	28	36	42
	lb./acre of superphosphate					
Equivalent to superphosphate over 0–12 in.	615	875	1010	1175	1573	1830
Phosphorus removed by grain (7 crops)	20	145	190	155	170	170
Total phosphorus accounted for in soil and grain	635	1020	1200	1330	1740	2000
Excess over *nil* treatment	....	385	565	695	1105	1365
Total superphosphate added (7 applications)	....	525	1050	1050	1575	2100
Applied superphosphate not accounted for	....	140	485	355	470	735

(8) Fifty-four samples from a plantation at Carnarvon were examined in connection with the failure of a bean crop irrigated with a relatively saline water, that had a high "residual" sodium carbonate value (HCO_3^- — (Ca^{++} + Mg^{++}) in milliequivalents per litre) of 6.2 m.e./1. Soil analyses did not show high exchangeable sodium percentages or high pH values, hence failure of the crop, if due to the irrigation water, must have been due to the 70 grains of total soluble salts per gallon and not to the bicarbonate iron.

(9) Another sample of soil from Carnarvon where a bean crop had failed, was suspected of being high in arsenic. Analysis showed only 0.8 p.p.m. of arsenic which is quite normal judging by normal United States soils which range from 0.3 to 38 p.p.m. The bean crop failure could more probably be attributed to the relatively high soil pH of 9.7.

Waters.

There was a reduction of nearly 25 per cent. in the number of water samples received in 1959 compared with 1958. This could be attributed to two reasons, firstly the continuing good seasonal conditions in the farming areas and secondly metropolitan water restrictions have caused an influx of boring contractors into the more attractive conditions in the city, leaving relatively few in the country for farmers to establish new bores.

(1) The routine examination of existing and proposed public water supplies was continued. Weekly samples from the Serpentine Pipehead dam showed that the water quality was very similar to Canning Dam and Mundaring Weir water. The small volume impounded in the Pipehead Dam was reflected by the total soluble salts figure which is normally about 20 grains per gallon but after the onset of heavy winter rains this dropped rapidly to about 12 grains in August and September, but a month later had risen to 20 grains again.

(2) An abnormality was observed in the monthly depth and surface samples from Wellington Dam. Previous analyses of this and other reservoirs had indicated little stratification of the water but in August, 1959 there was a rapid increase in the total soluble salts in the depth samples and a corresponding, but normal for this time of the year,

decrease in the salinity of surface samples. This anomaly can possibly be explained by the fact that the initial run-off from a catchment is generally high in total salts. This water being heavier would flow into the bottom of the dam and later run-off being lower in total salts would lie on top. It took more than two months for convection currents and other mixing factors to remove the stratification of the water in the dam and bring the depth and surface samples to approximately equal salinities again.

(3) A survey of fluoride concentration in public water supplies throughout the State was carried out in 1959. Of the country water supplies examined only the following had greater than 0.1 p.p.m. of fluoride, Carnamah 0.2 p.p.m., Cue 1.5 p.p.m., Geraldton 0.2 p.p.m., Meekatharra 0.3 p.p.m., Mt. Magnet 0.2 p.p.m. and Sandstone 0.4 p.p.m. The artesian bore water used to supplement the hills supply for the metropolitan area had 0.5 p.p.m. of fluoride.

(4) Detailed analyses of monthly samples from dams in the York-Beverley area were done for the Fisheries Department in connection with the establishment of trout in dams. To date there is no evidence of any correlation of any of the analyses with trout numbers or size.

(5) Two unusual samples of rain water from tanks were received from widely spaced centres, Greenbushes and Carnamah within a fortnight of each other. In both cases farmers had complained of the bright pink coloration which had suddenly developed in the water, without any obvious explanation. Microscopic examination of the water revealed the coloration to be due to the presence of a red species of the algae-like organism euglena.

(6) A sample of water from an unnamed small lake near Dangin was found to have 41 per cent. of total soluble salts. Ducks landing on this lake had difficulty in taking off again as salt became encrusted in their flapping wings.

(7) Because of the current interest in the keeping of exotic fish and the susceptibility of these fish to small amounts of copper in water, a method was investigated for the removal of the copper added to scheme water to control the growth of algae in reservoirs. The following recommendation was found to lower the copper content of the water to a safe level of about 0.05 p.p.m.—

> Add 1 oz. of coarsely powdered good quality aluminium to 1 gallon of water in a plastic or enamelled container and allow to stand with occasional stirring for 2 days. The water can then be decanted off from the settled powder and used with safety. The aluminium powder can be used to treat a second but not a third batch of water.

(8) Because of the increased usage of cement lined pipes by the Country Water Supply Department, problems have arisen from the consequent high pH of the water, pH values as high as 11 or 12 being quite common. Until the cement lined pipes age, the only satisfactory treatment that could be recommended for the water was aeration or recarbonation.

Fertilisers.

(1) Fertiliser Act.—(a) Although only 89 samples of official Fertiliser Act samples were received in 1959, a total of 120 were analysed and reported, the extra numbers being due to those received late in 1958 which could not be analysed until 1959. Department of Agriculture fertiliser inspectors seemed to be paying too much attention to fertilisers that are sold in small quantities such as lawn, garden and rose fertilisers and not enough attention to those sold in large quantities to farmers and market gardeners. Small differences in the percentages of the constituents can involve large sums of money in the latter fertilisers whereas in the case of the home garden fertiliser most of the cost is in the packaging and small differences in the percentages of the constituents are not so significant in the cost of the fertiliser.

Table 5 below shows the number of main constituents checked and whether or not they comply with the Fertiliser Act and Regulations.

TABLE 5.

Fertiliser Act Samples Reported, 1959.

Constituent	Samples Analysed	Complied	Deficient
Nitrogen, N	92	81	11
Water soluble potash, K_2O	62	49	13
Phosphoric anhydride, P_2O_5			
Water soluble	74	61	13
Citrate soluble	109	107	2
Acid soluble	105	98	7
Total	109	106	3
Copper, Cu	19	15	4
Zinc, Zn	19	12	7

(b) All 6 samples of urea analysed were higher in biuret than the guarantee.

(2) An investigation was started on the citrate soluble form of phosphorus in Christmas Island rock phosphate, as it has been consistently found that approximately 10 per cent. of the total phosphorus was citrate soluble, as determined by the Fertiliser Act method of analysis. It was thought that this unexpectedly high citrate soluble phosphorus may have been due to the fineness of grinding of the rock phosphate and that colloidal material was passing through the filter papers. Examination of the greater than, and less than 150 B.S. sieve fraction showed no significant differences in the citrate soluble phosphorus by the standard method. When the ratio of sample to ammonium citrate extracting solution was altered from the standard 1:50 to 1:400 appreciable differences were observed between the two fractions as well as a considerable increase in the amount dissolved. With a solid:solution ratio of 1:400, 48 per cent. of the whole sample dissolved, 29 per cent. of the fraction greater than 150 B.S.S. and 64 per cent. of the fraction less than 150 B.S.S. This increase in citrate solubility by increasing the solution to sample ratio indicates the formation of a saturated solution in the standard method, limiting further solution of the rock phosphate. This was confirmed by re-extracting the residue from the standard determination (1:50) again by the standard procedure and repeating this again. With the first extraction 14.0 per cent. of the sample dissolved, with the second extraction 12.4 per cent. (based on the original weight) was dissolved and with the third extraction 14.4 per cent. was dissolved, making a total of 40.8 per cent. of the sample or approximately 15 of the original 36 per cent. P_2O_5 in the rock phosphate dissolved by three extractions with ammonium citrate solution, compared with five per cent. in the first extraction.

The inference from these results is that the citrate soluble portion of rock phosphate is very arbitrary and little reliance should be placed on it as indicating a plant available form of phosphorus when determined by the standard method of analysis.

(3) Two representative samples of commercial superphosphate were examined to see if there were any variations in phosphorus content in different particle sizes. There was negligible difference between fractions from greater than 3 mm. diameter down to 0.2 mm. diameter. However the less than 0.2 mm. diameter size had about 14 per cent. less phosphorus than the larger sizes. This decrease in phosphorus in the fine size was attributed to the silica and iron and aluminium oxides present in ground rock phosphate which would not react with sulphuric acid and would remain in their finely divided state.

(4) Samples of iron chelate and manganese sulphate which had caused damage when sprayed on leaves were compared with satisfactory samples but in neither case could significant differences be obtained to explain the field observation.

(5) Nine samples of Christmas Island rock phosphate were analysed for fluorine. The fluorine content ranged from 0.9-1.5 per cent., which is sufficiently low for the samples to be used as a phosphate supplement for poultry and stock without any fear of them being responsible for fluorosis.

Pastures, Fodders and Stock Foods.

(1) Feeding Stuffs Act.—63 official samples of stockfood were received in 1959.

Table 6 below shows the number of main constituents checked and reported in Feeding Stuffs Act samples and whether or not they comply with the Act; these include several samples received in 1958 but not analysed till 1959.

TABLE 6.

Feeding Stuffs Act Samples Reported, 1959.

Constituent	Samples Analysed	Complied	Deficient	Excess
Crude protein	81	68	13	....
Crude fat	76	64	7	5
Crude fibre	75	67	....	8
Sodium chloride	79	65	7	7
Phosphoric anhydride	81	56	10	15
Calcium	82	52	13	17

(2) The 101 silage samples received is an indication of the current interest in making silage as a nutritious supplement for feeding stock in summer. The majority of these samples were again from the Australian Dairy Products Board silage competition.

(3) A final 81 samples of pasture and herbage were analysed in connection with the University Biology Department's investigation into quokka, euro and tamar nutrition.

(4) 167 samples of safflower and linseed samples were analysed for oil content. The official A.O.A.C. refractive index method for determination of oil in linseed was found to be equally applicable to safflower seeds.

(5) Because of the ability of xanthophyll in plants when eaten by poultry to brightly colour the yolks of eggs, a number of xanthophyll determinations were made on a variety of poultry feed supplements. Xanthophyll was not determined directly, but indirectly as the difference between total carotenoids and B carotene. The figures for these constituents in various feeds are given in Table 7.

TABLE 7.

Poultry Food	B Carotene	Carotenoids
	Parts per million dry basis	Parts per million dry basis
Barley meal	12	107
Capeweed	3	3
Clover meal	5–44	96–287
Clover hay	15–399	129–1040
Lucerne meal	16–30	200–210

(6) Public Health Department interest in protein deficiency disease (Kwashiorkor) in some North-West natives was responsible for the determination of the essential amino-acid lysine in three samples of aboriginal foods, flour made from seeds of indigenous plants. These seeds known by their aboriginal names Wakati, Tjuntalu and Wangunu contained 0.84, 0.57 and 0.07 per cent of lysine respectively.

(7) A sample of Ice Plant (Tryophytum sp.) growing at Corrigin on land too salty to support other vegetation was found to be relatively high in protein, 10.7 per cent on dry basis, but also had an unusually high ash of nearly 50 per cent, which included nearly 22 per cent of sodium chloride.

(8) High oxalate content was noted in 22 samples of Kochia brevifolia analysed. These had 6.4-14.7 per cent oxalate. A sample of "Fat Hen," Chenopodium sp., was found to contain 7.4 per cent oxalate.

Cereals.

(1) *Barley.*—(a) 81 samples of grain from lattice square variety yield trials at Avondale, Wongan Hills and Glen Lossie Research Stations were analysed for nitrogen.

(b) 6 samples of green barley plants, Beecher variety, were analysed for proximate feeding stuffs analysis from grazing and recovery trials.

(2) *Oats.*—(a) Of 106 samples of oat plants examined for their feeding value, 30 were from grazing and recovery trials at Avondale, Merredin and Wongan Hills Research Stations. Examination of the analysis of similar samples over the past years indicated that there was reasonable correlation between crude protein and (i) crude fat, (ii) crude fibre and (iii) nitrogen free extract.

(b) A further 120 samples of green oat leaves were analysed from a glasshouse experiment testing the susceptibility of 5 oat varieties to manganese deficiency at high and low level of water treatment on a gravelly loam-sand. Manganese sulphate was applied at rates of 0, 14 and 28 lb/acre. Manganese deficiency symptoms decreased with added manganese, were more severe in the low than in the high level moisture conditions and were less pronounced in the Avon and Algerian varieties than in the Ballidu, Dale or Fulghum varieties. There was no significant difference between varieties in the uptake of manganese from the nil treatment, but the variety Algerian took up more manganese than other varieties from the 14 and 28 lbs/acre treatments.

(3) *Wheat.*—(a) Only 215 wheat grain samples were analysed in 1959 compared with 1,200 in 1958. As mentioned in the introduction these samples are now done at the Department of Agriculture's new Cereal laboratory.

(b) Analysis of the 1958/59 F.A.Q. wheat and flour prepared from it in a Brabender mill, are given below with the 1957/58 figures for comparison.

	F.A.Q.			
	Wheat		Flour	
	1958–59	1957–58	1958–59	1957–58
	%	%	%	%
Moisture	10·2	10·1	11·8	12·0
Protein as analysed	9·1	10·4	8·2	9·6
Protein at 13·5% moisture	8·8	10·0	8·1	9·4
Ash at 13·5% moisture	1·26	1·21	0·63	0·59
Maltose figure (Kent Jones)	....	....	2·96	3·09

The reduction in protein in the 1958/59 season is no doubt due to the excellent season in which a record yield was grown.

Plant Nutrition.

(1) *Banana Leaves.*—Eight samples from Carnarvon were analysed for boron, calcium, chloride, copper, magnesium, manganese, molybdenum, nitrogen, phosphorus, potassium, sodium, sulphur and zinc to find normal levels for these nutrients as the basis of further work on banana nutrition. A high requirement or luxury aborption of potassium by bananas was indicated by the presence of 3.90-4.74 per cent potassium on dry basis in the leaves. Past analyses have shown that the fruit and skin also have a high potassium content; 2 per cent and 9 per cent on dry basis respectively have been found.

(2) *Carrots.*—Carotene was determined on eight samples of roots from the Wembley Vegetable Research Station. These analyses confirmed previous observations that a simple field test for grading carrots in order of their carotene content would be to very finely grate them and arrange the grated samples in increasing order of the depth of their pink colour. The carotene was found to be approximately 85 per cent of the total colouring matter of the carrots.

(3) *Celery.*—The relatively high tolerance of celery to salt was observed in two samples from Balcatta. The healthy and affected samples had 5.46 and 7.66 per cent of sodium chloride respectively.

(4) *Clover.*—Of the 548 samples of clover received the following were of most interest:—

(a) 135 samples of Dwalganup subterranean clover from experiments at Wannamal and Wongan Hills showed—

(i) At Wannamal on red gum soil, increasing rate of phosphorus application had no effect on phosphorus uptake but on white gum soil it increased phosphorus and decreased potassium uptake.

(ii) At Wannamal increasing rate of potassium application increased potassium uptake on both red gum and white gum soils.

(iii) At Wŏngan Hills, in a rate of superphosphate experiment on soil that had previously had a total of 800 lb./acre, increasing rates of superphosphate (1) slightly increased calcium uptake, (2) had little effect on phosphorus uptake and (3) decreased potassium uptake.

(iv) On land at Wongan Hills that had previously had little added superphosphate, increasing rates of superphosphate (1) slightly increased calcium uptake (2) increased phosphorus uptake and (3) decreased potassium uptake.

(b) 83 samples from varying rates of superphosphate and rock phosphate trials on peaty sands showed—

(i) At Pingrup the uptake of phosphorus from equivalent amounts of superphosphate or rock phosphate was similar at all levels of application up to 8 cwts./acre, at which rate there was considerable increase in the uptake from superphosphate.

(ii) At Mt. Barker the uptake was comparable at all levels.

(iii) At Denmark from equivalent amounts of rock phosphate, fine rock phosphate dust and superphosphate the uptake of phosphorus from the former two, was slightly greater than from superphosphate.

Department of Agriculture yield figures have shown that on acid peaty sands of pH 5 like these soils, rock phosphate gives higher clover yields than equivalent amounts of superphosphate.

(c) 20 samples from the Esperance Plains Research Station showed that each additional 10 cwts./acre of superphosphate was responsible for an increase of 0.06 per cent. phosphorus in the leaves and petioles.

(d) From a rate and source of potassium experiment at Bramley Research Station, the results of analysis of 68 samples showed—

(i) Potassium uptake increased with added potassium as potassium chloride.

(ii) Felspar as used in glass manufacture increased potassium uptake at 3 cwts./acre level but decreased it for increasing rates above the level.

(iii) Felspar ground to less than 300 mesh had little effect on potassium uptake at rates of 3 or 6 cwts./acre but at higher rates it increased potassium uptake.

(e) A further 96 samples from glasshouse trials, on soil from Muchea and Bramley, on rate and source of application of potassium were analysed. On both soils increasing additions of potassium either as potassium chloride or felspar less than 325 mesh, increased the uptake of potassium. More potassium was taken up from the felspar on the Muchea sand than for the Bramley soil.

(f) From three rates and source of phosphorus fertiliser experiments at Bramley and Esperance Plains Research Stations 120 samples were analysed for phosphorus; these showed—

(i) At Bramley on gravelly sand there was little difference in phosphorus uptake when superphosphate was applied as 2 cwts./acre in 1957 and 1958, 4 cwts./acre in 1957, 8 cwts./acre in 1957. From equivalent amounts of rock phosphate the uptake was slightly less. 16cwts./acre in 1957 of superphosphate gave a 2½ fold increase in phosphorus whereas equivalent rock phosphate gave only a slight increase.

(ii) At Esperance on soil that had previously had ½, 1½ or 3 cwts./acre of superphosphate, phosphorus uptake increased with added superphosphate, but equivalent amounts of rock phosphate were not effective.

(g) A large number of samples were analysed for confirmation of nutrient deficiency symptoms.

(5) *Currant Vines.*—(a) 12 samples of leaf blades and stalks that had had (i) no spray (ii) Cuprox spray and (iii) Ziram spray were analysed after thorough washing to remove surface contamination, to see if toxic amounts of copper or zinc had been absorbed. No significant differences between sprayed and unsprayed samples were found.

(b) 5 samples of currant grape vine canes were analysed in detail in an investigation into the possible chemical factors involved in vine fruitfulness.

(c) 130 samples of leaves from an intensive sampling programme into a salt affected area on a vineyard at Caversham were analysed for chloride.

(6) *Lupins.*—(a) 36 samples of lupins from a varying rate of application of superphosphate and rock phosphate dust on the slightly acid sandy soils at Eneabba, were analysed for phosphorus. Table 8 below shows that the phosphorus uptake by the lupins shows a similar trend to Department of Agriculture yields but not so pronounced.

TABLE 8.

Yield and Phosphorus Content of Lupins.

Treatment			Yield	Phosphorus, P
1956	1957	1958	Dry basis	Dry basis
lb./acre	lb./acre	lb./acre	cwts./acre	%
600 R.P.	....	....	24·8	0·13
400 R.P.	....	....	17·4	0·11
200 R.P.	....	....	10·0	0·10
600 R.P.	600 R.P.	600 R.P.	40·9	0·18
400 R.P.	400 R.P.	600 R.P.	39·8	0·16
200 R.P.	200 R.P.	200 R.P.	29·2	0·14
50 Super	50 Super	50 Super	4·6	0·08
100 Super	100 Super	100 Super	9·8	0·08
200 Super	200 Super	200 Super	29·9	0·10

R.P. = Rock Phosphate.

Yields measured over three years by the Department of Agriculture for either 200 lb./acre of rock phosphate or superphosphate have been comparable, but annual rates of 50 or 100 lb./acre of superphosphate gave very low yields.

(b) 28 samples for an annual rate of superphosphate application of rates of 100-700 lb./acre in 100 lb increments increased the phosphorus uptake of the lupins from 0.08 to 0.25 per cent. Each additional 100 lb. of superphosphate was responsible for an increment of 0.03 per cent. in the phosphorus content of the plant.

(7) *Oak Leaves.*—Suspected poisoning of an oak tree with arsenic was confirmed by the presence of 40 p.p.m. of arsenic in dead leaves from the tree.

(8) *Orange Leaves.*—Leaves from a tree which had severe leaf drop were found to have 3.13 per cent. sodium chloride. Leaves from another tree showing severe chlorosis were found to have only 4 p.p.m. of zinc confirming visual symptons of zinc deficiency.

(9) *Rose Leaves.*—The high tolerance of roses to manganese was shown in some healthy leaves from Bassendean which had 1230 p.p.m. of manganese without any signs of toxicity symptoms.

(10) *Tobacco.*—Of the 487 tobacco samples received the following were of interest:—

(a) 24 samples were analysed for total and reducing sugars, total organic acids, citric, malic and oxalic acids in an investigation into the relationship these play in tobacco quality.

(b) 24 samples from an experiment on the effects of irrigation treatment were analysed. The treatments were (i) no water (ii) watered with 2" whenever plants had wilted by midday (iii) watered 1" per week until harvest commenced (iv) watered 1" per week until harvest complete. These treatments had no effect on nitrogen uptake; treatments (ii), (iii) and (iv) doubled the chloride uptake, and potassium uptake increased from treatment (i) to treatment (iv).

(c) 12 samples from a rate and type of potash fertiliser experiment at Manjimup Research Station were analysed for potassium and chloride. Chloride increased with the addition of potassium sulphate but decreased with additional potassium nitrate. Potassium uptake was not significantly altered by either fertiliser.

(d) 144 samples from a fertiliser experiment at Manjimup on old and new land were analysed.

Fertiliser treatment of these was all combinations of 50, 100, 200 and 300 lbs/acre of nitrogen fertiliser; 200, 400 and 800 lbs/acre of phosphorus fertiliser and 150, 300 and 600 lbs/acre of potassium fertiliser. Nitrogen uptake was only increased on the new land and only with the highest rate of nitrogen fertiliser application. Phosphorus uptake generally increased with added phosphorus and decreased with added potassium on both the old and new land. Potassium uptake increased with added potassium but was not significantly affected by added nitrogen or phosphorus. Chloride uptake was irregular and showed no general relationship to the fertiliser treatment.

(11) *Miscellaneous Plants.*—Apple, cauliflower, lettuce, parsnip, peach, pear, plum, pumpkin, onion, strawberry and tomato leaves were analysed for confirmation of visual deficiency symptoms.

Miscellaneous.

A very wide range of samples grouped under this heading was examined, those of most interest include:—

(1) *Corrosion and Deposits.*—(a) An investigation into the cause of discoloured water in the hot water service of the South Perth Community Hospital was made and recommendations were made to alleviate the trouble. These included water treatment, temperature control and installation of cement lined or copper pipes in the cold water supply. A feature of this hospital as well as several other metropolitan and country hospital hot water services is the false economy of installing cast iron boilers in preference to a copper tube calorifier.

(b) Corrosion of copper piping in the sterile water service at the King Edward Memorial Hospital was examined and recommendations previously made by these Laboratories in 1944 were confirmed.

The frequent occurrence of corrosion of copper piping in hot water services should serve as a warning to architects that the specifying of copper pipes is not the complete answer to water corrosion problems. Experience at the King Edward Memorial Hospital has shown that to hide water services inside concrete floors and beams, though good from an appearance point of view, is not practical from a maintenance point of view.

(c) The very severe corrosion of the evaporative condenser, copper eliminator plates of the air-conditioning plant in a new building was investigated. The cause of the corrosion is apparently the high humidity and high local concentrations of salt caused by evaporation of spray from the cooling water.

(d) A piece of 3" galvanised water pipe which had been installed in the North Cunderdin Main, was after 12 months of use found to have a large amount of loose irregularly shaped white deposit on the inside. This deposit was found to be nearly all zinc oxide and zinc hydroxide caused by the corrosion of the galvanising by the high pH water. The water passing through the pipe, though originating from Mundaring Weir had passed through several miles of new cement lined pipes which caused the pH of the water to rise to around 12.

(e) Several samples of boiler and engine scale were examined and recommendations for water treatment to prevent their recurrence were made.

(f) Corrosion of printing machinery and equipment at the new Government Printers office in Subiaco was investigated and recommendations made to alleviate the trouble.

(2) *"Checking" of Spaghetti.*—A local manufacturer requested assistance in the problem of "checking" of spaghetti. His product though apparently satisfactory at the end of manufacture was found several days later to have developed checks and cracks making the spaghetti very brittle and almost unsaleable. An investigation into this problem showed that it was the drying technique in the manufacture of the spaghetti that was at fault. The initial drying of the spaghetti was taken too far, the "sweating" period was operated at too low a humidity causing further drying and the final drying period gave a product too low in moisture content.

(3) *Spectrography.*—Again this year a wide variety of samples including various minerals, crude oil ashes, gold concentrates, deposits and water samples were examined. The semi-quantitative method developed in 1958 has proved very useful.

After attending the Spectroscopy Conference in Melbourne in June a decision was made on the value of the newly developed atomic-absorption spectroscopy to this Division. It is intended to proceed with making the necessary equipment to adopt our medium quartz spectrograph for this purpose and it is hoped that this will be functioning early in 1960.

(4) *Selenium in Sulphur.*—As chemists from a local fertiliser manufacturer were unable to determine small quantities of selenium in sulphur this was carried out by our trace laboratory. A sample of Chinese sulphur was analysed to see if it met its specification of 0.001 per cent. selenium and a sample of American sulphur was analysed for comparison. The Chinese sulphur was found to have 0.0009 per cent. and the American sulphur 0.00005 per cent. selenium.

(5) *Industrial Fluorosis.*—Further investigations of the evolution of fluorine from clay burning industries were undertaken.

(a) At Caversham in the vicinity of a tile factory, a number of vegetation leaf samples were taken in the direction of the prevailing wind away from the factory. All these samples showed abnormally high fluorine contents which must have been due to atmospheric pollution from the factory, but it is unlikely that any of these were high enough to be harmful to the leaves.

(b) At Armadale Brickworks a number of air and flue gas samples were taken under varying conditions of wind direction and velocity. The analyses of these samples pin-pointed the stacks from the pressed brick kilns as being the major source of atmospheric pollution. Slight atmospheric pollution at distances of half a mile from the brickworks was found but this was too low to constitute any hazard.

Further evidence of fluorine damage to vegetation in the vicinity of the brickworks was observed and confirmed by analysis. Mature acacia leaves from an acacia tree which in July, 1958, were found to have 3,610 p.p.m. of fluorine were found to have 5,470 p.p.m. of fluorine in July, 1959.

FOOD, DRUGS, TOXICOLOGY AND INDUSTRIAL HYGIENE DIVISION.

As in recent years most of the work of this Division during 1959 consisted of chemical examinations for the Departments of Public Health, Police, Agriculture, Public Works, the Metropolitan Water

Supply, Sewerage and Drainage, and the Milk Board of W.A., but a wide variety of miscellaneous work was performed for other Government Departments and the general public. Following some staff changes the personnel of the Division comprised thirteen permanent officers and one temporary officer. Three of these were located at the Sewage Annexe Laboratory, Lincoln Street, and the remainder at the main Government Chemical Laboratories, Adelaide Terrace.

Ten thousand one hundred and four samples were received during the year, being a decrease of 105 compared with 1958. There was a sharp decline in the number of samples examined in connection with investigations into sulphide corrosion in sewers, but a marked increase in the samples from the Pilot Plant for the treatment of sewage effluent by the activated sludge process. The overall effect has been an increase in sewage work because more chemical examinations per sample are required on those from the Activated Sludge Pilot Plant than on those from sulphide corrosion tests.

Samples other than sewage showed a slight increase as indicated in the following table:—

Classification	1956	1957	1958	1959
Milks	227	240	189	281
Cheese	72	40	54	113
Exhibits—Alcohol	154	164	229	316
Human Toxicology	146	162	284	290
Animal Toxicology	31	46	64	69
Industrial Hygiene	75	132	86	305
Criminal Cases	33	15	61	58
Sewage—				
Routine	2,854	3,194	3,467	3,291
Investigational	7,012	6,696	1,461	428
Country	22	72	14	45
Trade Wastes	4	18	44	133
Activated Sludge	....	....	1,099	1,951
Ocean Effluent	....	....	1,540	1,617
Pollution Surveys—				
Swan River	231	237	205	128
Bunbury	50	72	48	48
Ocean Beaches	145	146	113	239
Total, Sewage Samples	9,917	9,981	7,605	7,465
Other than Sewage	1,830	2,364	2,604	2,639

Table 9 shows the source and description of samples received during 1959.

Foods.

A total of 431 samples of foods of various kinds were examined, compared with 390 in 1958. Two hundred and seventy of these were samples of cows' milk submitted by the Milk Board of W.A., and consisted largely of milks which were suspected of being adulterated or of failing to comply with the standards required by the Regulations under the Milk Act. Of these samples 4.5 per cent. contained less than the legal minimum amount of milk fat (3.2 per cent.) but 64 per cent of the samples contained less than the legal minimum of solids not fat (8.5 per cent.), and 90 per cent, failed to comply with the legal standard for freezing point of milk (0.540 degrees Centigrade below zero). The distribution of analytical figures is shown in the following tables:—

Milk Fat.

Per Cent. in Sample.	Per Cent. of Total Samples.
Less than 3.00	0.8
3.00 - 3.19	3.7
3.20 - 3.49	14.2
3.50 - 3.74	16.9
3.75 - 3.99	15.4
More than 3.99	49.0
	100.0

Milk Solids not Fat.

Per Cent. in Sample.	Per Cent. of Total Samples.
Less than 8.00	7.1
8.00 - 8.24	14.6
8.25 - 8.49	42.7
8.50 - 8.74	22.5
8.75 - 8.99	10.5
More than 8.99	2.6
	100.0

Milk.
Freezing-point.

Degrees C. below Zero.	Per Cent. of Total Samples.
Less than 0.500	3.1
0.500 - 0.509	1.1
0.510 - 0.519	6.8
0.520 - 0.529	38.0
0.530 - 0.539	40.8
0.540 - 0.550	9.8
More than 0.550	0.4
	100.0

In presenting this distribution of the analytical figures it is emphasised that these were samples for which there was *prima facie* evidence of their failure to comply with legal standards.

One hundred and thirteen samples of cheese were analysed for the Department of Agriculture as control checks of the quality of the cheese produced by the factories in this State. Of this number 93 per cent. contained more than 50 per cent. of fat calculated on the moisture-free basis. This shows a marked improvement over the previous year when 54 samples were analysed and only 60 per cent. of these complied with this standard for fat content.

Only eleven samples of food were submitted by the Government Tender Board. These comprised tomato sauces, pickles and chutneys which were examined as a check on their suitability for supply to government institutions.

Thirty samples of food were examined for the Public Health Department. These included frankfurts and sausages analysed for starch and preservative content, ham for which obvious deterioration was due to a deficiency of salt, and mincemeats, some of which contained preservative contrary to the Food and Drug Regulations.

A sample of meat which possessed an unusual odour was considered to have absorbed the odour of an aromatic type of disinfectant, although it was not possible to confirm this by chemical tests.

A can of prunes with cereal which showed obvious signs of internal pressure was found to contain hydrogen gas. Although the contents were sound and the internal lacquer of the can appeared superficially to be in good condition, close examination revealed "pinpoints" where the lacquer had lifted and the metal had been attacked.

Four samples of olive oil were subjected to a detailed examination and two of them were found to have been adulterated with peanut oil.

A sample of a dairy confection was submitted following a complaint of its "bitter" flavour. Examination revealed only the acid taste due to rancidity. Partial decomposition had obviously occurred, but the cause was not apparent.

Only nine samples of milk were analysed for the Public Health Department. Although all of these were satisfactory in respect of fat and solids content they failed to comply with the legal standard for freezing point.

Several "umpire" samples of food were examined for the Crown Law Department following disputed analyses in Court proceedings.

Human Toxicology.

Two hundred and ninety samples from 91 cases were examined in connection with death from suspected poisoning.

In 37 cases no poison or drug was detected, while in 54 cases a poisonous substance or other physiologically active drug was identified on analysis. Details are listed in the following table:—

Poison or Drug.	No. of Cases.
Barbiturates	23
Carbon monoxide	17
Carbromal	4
Chlorpromazine	3
Strychnine	3
Chloral	2
Arsenic	2
Organic phosphate	2
*Various (one of each)	7
Negative	37
	100

* Malathion, cyanide, nicotine, lead, zinc chloride, petrol, potassium permanganate.

TABLE 9.

FOOD AND DRUG DIVISION.

	Agriculture Dept.	Factories	Lands Dept.	Metropolitan Supply Water	Public Health Dept.	Public Works Dept.	Police Dept.	Swan River Ref. Com.	Tender Board	Other Govt. Depts.	Pay—Hospitals	Pay—Air Dept.	Pay—Com. Health Dept.	Pay—Milk Board	Pay—W.A. Govt. Railways	Pay—Public	Pay—Other	Free	Total
Food—																			
Cheese	113																		113
Milk					9					1				270			1		281
Various	1				21				11	2						2			37
Industrial Hygiene—																			
Air		41			8					4						5			58
Blood and Urine					22						20		2		12	167	6		229
Various		8			6						2		2						18
Miscellaneous—																			
Cattle Dip	15																		15
Criminal Cases							58												58
Crayons					12														12
Drugs and Medicines					14					2									16
Natural Vegetable Products	161																		161
Oxygen												81							81
Paper Bark	23																		23
Pasture	12																		12
Tallow																	12		12
Vermin Poison	41																		41
Water	2			57	85	9										7			160
Wines and Spirits	54						6												60
Pesticide and Insecticide	29				1					2						2			34
Various	16				10	7	5		4	8			8			13	3	1	75
Pollution Survey—																			
Bunbury						48													48
Ocean Beaches				239															239
Swan River			14					114											128
Trade Waste				131	1					1									133
Sewage—																			
Activated Sludge				1,951															1,951
Country						45													45
Investigational				426													2		428
Routine				3,291															3,291
Ocean Effluent				1,617															1,617
Toxicology (Human)—																			
Exhibits (Toxicology)							288									2			290
Exhibits (Alcohol)					1		314									1			316
Specimens (Patients)					1						49					3			53
Toxicology (Animal)—																			
Specimens	56						7						3			3			69
	523	49	14	7,712	191	109	678	114	15	20	71	81	15	270	12	205	24	1	10,104

In a number of cases more than one poison or drug was detected, and in 21 of the cases where a sample of blood was available, alcohol was found to be present.

Blood-Alcohol Analyses (Post mortem).

There was a considerable increase in the number of samples of blood and urine analysed for alcohol content. Of these, 183 were samples of blood submitted by the Police Department in connection with traffic accidents or sudden death from various causes. The distribution of analytical figures was as follows:—

Per Cent. Alcohol.	Number.
Negative	89
Less than 0.10	18
0.11 - 0.15	17
0.16 - 0.20	23
0.21 - 0.25	18
0.26 - 0.30	11
0.31 - 0.35	3
More than 0.35	4
	183

Included in this number were 34 samples of blood from 17 cases in which heart and femoral blood were both examined separately for alcohol content. This work was carried out for the Police Surgeon in order to ascertain the alcohol levels in these two sources of blood when death occurred after the ingestion of any appreciable quantity of alcohol. Five of these cases proved to be negative; the other twelve are listed hereunder:

Alcohol Per Cent.	
Heart Blood	Femoral Blood
0.11	0.12
0.14	0.12
0.15	0.15
0.16	0.16
0.17	0.17
0.19	0.20
0.20	0.19
0.20	0.22
0.22	0.22
0.25	0.26
0.26	0.28
0.36	0.37

Voluntary Blood-Alcohol Tests.

Following recent amendments to the Traffic Act which allowed persons charged with "driving while under the influence of alcohol" to submit a sample of blood for analysis of alcohol content, 125 such samples were analysed in 1959 for the Police Department. The results of these analyses are set out in the table below, the figures being the alcohol content of the blood at the time of the alleged offence, calculated by the formula prescribed in the Blood Alcohol Test Regulations 1958. The Act states that if the blood alcohol content at the time of the alleged offence is 0.15 per cent. or greater it shall be prima facie evidence that the person was under the influence of intoxicating liquor at that time.

Blood-Alcohol Analyses (Sobriety Test).

Per Cent. Alcohol.	Number.
Less than 0.15	4
0.15 - 0.20	30
0.21 - 0.25	45
0.26 - 0.30	30
0.31 - 0.35	11
More than 0.35	5
	125

Animal Toxicology.

Sixty-nine specimens from 32 cases of suspected accidental or malicious poisoning of animals were examined during the year. In 13 cases no poison was detected, and in 19 cases a poisonous substance was identified, as detailed in the following table:—

Poison.	No. of Cases.
Arsenic	4
Strychnine	7
Chlorinated hydrocarbon	5
Sodium fluoroacetate	1
Lead	1
Mercury (? organic)	1
Negative	13
	32

Examinations were made for the Department of Agriculture of samples from pigs which had been fed on wheat treated with thiram (tetramethylthiuram disulphide) and hexachlorobenzene respectively. After slaughter of the animals, samples of liver, fat and muscle were analysed in an endeavour to determine the distribution of these compounds in the body. No thiram was detected in any of the samples, but analysis showed the presence of organic chlorine compounds, particularly in the specimens of fat.

Industrial Hygiene.

There was a considerable increase in the number of samples received in connection with problems of industrial hygiene, 305 during 1959 compared with 86 during 1958. These comprised 229 samples of urine or blood from persons exposed to actual or potential hazards, chiefly of lead.

Of more than 200 samples of urine which were analysed for lead content, 61.5 per cent. contained less than 0.08 part per million (milligram per litre) which is considered to be the normal upper limit for lead in the urine of lead workers. The distribution of the figures obtained in these analyses is given in the following table:—

Lead (Pb) parts per million	Per Cent. of Total samples.
Less than 0.08	61.5
0.09 – 0.15	21.2
0.16 – 0.20	10.8
More than 0.20	6.5

Of the 38.5 per cent of samples which were found to contain more than 0.08 p.p.m. of lead, a considerable proportion were repeat analyses carried out for investigational or supervisory purposes.

Thirty-six analyses were also carried out on specimens of urine for other toxic metals, although not all these were associated with industrial toxicology. These comprised analyses for thallium, 23; mercury, 6; arsenic, 5 and copper and zinc, 1 each.

Fifty-five samples of air were received in connection with investigations into potentially hazardous working conditions. In the majority of these the concentration of lead dust or fume was in question when problems of ventilation were being examined, but samples were also analysed for arsenic, carbon monoxide, phosphine and toluene.

Miscellaneous samples included paints and varnishes which contained toxic solvents and two dust respirators whose efficiency was suspect.

Sewage Control.

The Annexe Laboratory situated at Lincoln Street, North Perth, continued to undertake chemical sewage control work and other investigations for the Metropolitan Water Supply, Sewerage and Drainage Department and examined a total of 7,465 sewage samples during the year.

Three thousand two hundred and ninety-one samples represented routine chemical control in connection with the operation of the treatment plants at Subiaco, Swanbourne and Fremantle.

Only a small number of samples were examined in 1959 in relation to sulphide corrosion problems of sewers. On the other hand there was a considerable increase in the number of samples from the Activated Sludge Pilot Plant. This had been completed during 1958 and was built to furnish the necessary information for the design of a full scale plant to treat sewage effluent by the activated sludge process, and so ensure a "cleaner" effluent for eventual discharge into the ocean. From this pilot plant 1,951 samples were analysed during the

year, while an additional 1,617 samples were examined in connection with problems of chlorination of the effluents from the existing treatment plants at Subiaco and Swanbourne.

One hundred and thirty-three samples of trade wastes were examined during the year. This number was much greater than usual, and was the result of investigations to locate the sources of high organic loading of the sewage being received at the treatment works.

Pollution Surveys.

(1) *Swan River.*—Following the decision of the previous year the collection and analysis of Swan River samples were conducted at three-monthly intervals when the whole of the river was sampled on each occasion.

Selected points were also examined at six-monthly intervals for the Lands and Surveys Department.

With the establishment late in the year of a statutory body, the Swan River Conservation Board, it is expected that this work will be continued in future in close co-operation with an inspector of this Board.

(2) *Leschenault Inlet, Bunbury.*—The normal summer and winter surveys were made, in March and July, when 48 samples were analysed. The general pattern of pollution followed the trend observed in surveys of past years.

(3) *Metropolitan Ocean Beaches.*—Examinations of sea water from metropolitan ocean beaches were made in January, May and November, when 96 samples were collected and analysed. The annual "Ocean Outfall" survey was extended to cover three days at weekly intervals when a total of 143 samples were analysed from the section of the beach adjacent to and north of the point where the effluents from the Subiaco and Swanbourne treatment plants discharge into the ocean. No unusual area of pollution was noted as a result of this extended survey.

Miscellaneous.

(1) Deep water sampling of the waters of the Canning Dam and Mundaring Weir was carried out from April to September when 57 samples were collected and analysed. It was shown that oxygen was present in the water of these dams in the winter months as well as in the summer, and that the concentration is uniform and independent of depth.

(2) Fifteen samples of dipping fluids received from the Stock Branch of the Department of Agriculture were analysed as a measure of control of concentration. The reduction in the number of such samples follows earlier experimental work on a method of analysis of arsenical dips which could be used by stock officers in the "field." As a consequence the need for laboratory check tests has been reduced.

(3) Although only 4 samples of detergents were registered for analysis, consideration had to be given to a much greater number in order to advise the Government Tender Board as to those which appeared to be most suitable for use in government institutions. To examine and report on a large number of complex samples of this nature requires an amount of detailed work and time the magnitude of which is not adequately conveyed by the subsequent written report.

(4) Samples of drugs and medicines were examined for the Public Health and Police Departments and for the Government Stores. These included amidone tablets, castor oil, quinine bisulphate, Q.E.S. tablets, phials of pethidine hydrochloride solution, morphine sulphate solution, potassium permanganate and suspected abortifacient pills.

A sample of a rheumatism powder was found to contain Epsom salts, Glaubers salts and sodium bicarbonate flavoured with peppermint. Five samples of tablets were found to be composed largely of sugars and/or starch, and to contain only a minute amount of any medicinal compound.

(5) Eighty-one samples of "high altitude" oxygen for use in R.A.A.F. jet aircraft were examined for the Aeronautical Inspection Directorate. This oxygen is prepared to exacting specifications for this purpose, and laboratory checks of each batch are carried out in addition to the routine factory inspection tests.

(6) Following the publicity of the previous year regarding the conditions of sale of toys and other goods containing celluloid, only two such samples were received in 1959. Both were highly inflammable and analysis disclosed that they contained celluloid but were not marked with the warning label required by the Public Health Department.

(7) Fifty-eight samples were received in connection with criminal or other police enquiries. These included samples of paint and glass from automobile "hit-run" cases, and various foods following complaints of alleged poisoning. In only one instance was any noxious substance detected in these samples. Samples of fabric and lipstick, cigarette butts, clothing and linen were examined in cases of suspected murder and of criminal assault.

(8) Only 6 samples were received from the Liquor Inspection Branch of the Police Department, in connection with the suspected "watering" of spirits, but 54 samples of wine were examined for the Department of Agriculture in relation to problems of control of acidity or sulphite content.

(9) Thirty-four samples of pesticides of different kinds were received during the year. Eleven samples of dieldrin or chlordane emulsifiable concentrates were examined for compliance to tendered specifications, while samples of 2.4 D, M.C.P. 30 and benzene hexachloride were submitted for varying chemical analyses. The compatibility of a malathion preparation with various other spraying oils was the subject of a brief investigation for the Entomology Branch of the Department of Agriculture.

(10) Seventy-four samples of water were examined for the Public Health Department in an endeavour to trace movement of underground water supplies and/or of possible contamination of these sources. Added fluorescein was used as an indicator, but although the method used was capable of detecting flurescein in a concentration as low as one part in 1,000 million, none was observed in the samples submitted.

(11) Forty-one samples of vermin poisons examined for the Agriculture Protection Board consisted largely of poisoned oats which were analysed for sodium fluoroacetate content. A brief test was made of the volatility of fluoroacetamide, while a number of fox baits were examined for their strychnine content.

(12) Following observations made in another State, 12 samples of children's "crayons" comprising 96 colouring pencils, chalks, etc. were examined for the presence of lead. In four of these, an imported brand, appreciable quantities of lead were detected on analysis, but no statement of the presence of this substance appeared on the label of the package.

(13) A sample comprising a number of novelty "streamer bombs" was found to contain chlorate, red phosphorus and antimony in the charge. When "exploded" they produced a cloud of fume in which the "spent" components of the charge would be dispersed. It was calculated that the use of these novelties in a small hall could easily produce an undesirable concentration of antimony.

(14) As in previous years a variety of miscellaneous samples were examined in the normal course of the activities of the Division. These included suspected oil finds, ambergris, ink, tallows, paper barks, artificial dyes, crude salt, a fire-proof fabric, cotton wool, chrome plating solution, and "misused" postage stamps.

Numerous enquiries were received during the year, usually by telephone, but also by personal application at the Laboratories. Endeavours were always made to assist with the required information or advice, although some enquiries involved the expenditure of considerable effort and time.

Expert evidence at Criminal, Coroners' and other Courts was tendered by Messrs. Houghton, Southern, Sedgman, Wood and Tulloch in connection with their official duties.

During the year a small amount of investigational work was possible, notably in developing a method for the determination of dieldrin by use of the

infra-red spectrometer, but there still remain many problems in connection with the examination of modern foods, drugs, detergents, pesticides, plastics and other materials which are now in common use. These problems demand a good deal of time and work for their proper investigation, but they cannot be undertaken by the present staff while the volume of "routine" work remains at its existing level.

FUEL TECHNOLOGY DIVISION.

The report is divided into three sections:—

(1) Coal and other fuels, their analyses and examinations. Confirmation of a general tendency for the ash fusion point of coal seams to fall with increasing depth of seam is noted. It is a result of interest to those users who require high ash fusion point coals and suggests that the only permanent source of such coal for the future will be the Stockton Mines.

The occurrence of helium in oil bore hole gases is also reported.

(2) Domestic use of fuel on open fires. An explanation of the operation of open fires is advanced and a result leading to the substitution of 5 in. round metal flue pipes for 9 in. masonry flues is described.

(3) Industrial work. Here the successful operation of a large 15 tons per hour flash drier designed to our specification for ilmenite concentrates is reported. The method has not been used in the Australian beach sand industry before although it proves to have marked advantages in control, low power cost, fuel economy and ease of installation and operation.

Three hundred eighty-seven samples, analyses and investigations have been undertaken relating to the foregoing work during the past year, the description and origin of these being given in Table 10.

TABLE 10.

FUEL TECHNOLOGY DIVISION.

	Departmental	Department of Industrial Development	Public Works Department	Other Government Departments	Pay Commonwealth Air Department	Pay Public	Royal Mint	Total
Briquetting Coal, Char, etc.	3	11	....	....	....	....	....	14
Coal—								
Boiler Trial	....	....	59	....	....	65	....	124
Survey	11	....	....	....	....	....	....	11
Other	2	....	....	....	....	12	....	14
Flash Driers	1	....	....	....	....	10	....	11
Gypsum and Plaster	6	....	....	....	....	13	....	19
Sawdust, Smuts, Flue Gas, etc.	26	....	49	1	....	76	....	152
Miscellaneous	8	6	1	19	2	5	1	42
Total	57	17	109	20	2	181	1	387

Coal and other Fuels.

(1) *Ash Fusion Point.*—Coal of high ash fusion point has been used preferentially for carburetted water gas manufacture from Collie coal and for firing of ceramic kilns. It has the advantages that it does not clinker. Such coals have been available from a number of seams in the past. The Black Diamond was amongst the best of these. When it was shut down coal from the Ewington was a suitable alternative. Recent samples taken down the dip of a Ewington Mine have shown a marked drop in ash fusion point. The figure near the surface and in the open cut used to be 1400°C but the dip samples are now down to 1220-1260°C. Although the figure is not low enough to cause difficulties in plant operation any further fall will probably cause clinker trouble which will be aggravated by the rather high ash content of the Ewington coal.

Other seams which show the same trend of falling ash fusion point as they get well underground are Hebe, Neath and Western as listed in Table 11.

The only working Collie seam which shows a steady high ash fusion point is the Stockton. As its ash content is only 7.0 per cent. it is now the best available hard coal at Collie for carburetted water gas manufacture and other industries requiring such a coal. Unfortunately the mine may shortly be closed down.

TABLE 11.

Effect of Depth of Seam on Ash Fusion Points of Some Collie Coals.

Mine	HEBE		EWINGTON		NEATH		WESTERN	
Lab. No.	7030/58	13340/59	15706/58	15705/58	15006/56	4625/59	12069/58	15458/59
F.L.S. No.	121	130	126·3	126·2	110	127	124	131·2
Date	15/5/58	30/9/59	20/11/58	20/11/58	28/8/56	20/3/59	4/9/58	17/11/59
Position in mine	22 chains down dip	30 chains down dip	4 dip east, 3 chains back	4 dip east face	No. 1 heading No. 4 left slant	No. 2 slant	Entrance to new tunnel	Left slant 10 bord
Ash Fusion Point—								
Softening °C.	1460	1135	1330	1190	1360	1280	1360	1130
Blobbing °C.	1480	1190	1340	1200	1380	1300	1390	1140
Fluid °C.	1500	1280	1350	1210	1400	1320	1440	1150

(2) *Drill Samples.*—A number of core samples from a seam on the South Eastern part of the field was submitted. The seam intersected is said to be a continuation of the Wyvern seam but the analyses show that the coal has the general character of all coals from this end of the field namely a D.A.F. Calorific Value of about 12,500 B.t.u./lb. and a D.A.F. Volatile Matter of 32-33 per cent. Both these values are lower than the Wyvern seam worked at the Western end of the field. They confirm the tendency to lower calorific values and volatile matter associated with higher moisture and greater porosity at the Eastern end of the field.

(3) *Coked Briquettes.*—Only one batch of samples has been examined in connection with the coking project at Welshpool, Department of Industrial Development. The work there is regarded as completed and awaits commercial development when, no doubt, further experimental work will be required.

(4) *Ion Exchange Properties of Collie Coal.*—The ion exchange properties of coal from the Hebe seam have been examined. The coal in the natural condition has no useful exchange capacity, but it sulphonates with concentrated sulphuric acid at 90°C. The sulphonated coal has then an exchange capacity of 6,000-7,000 equivalent grains of $CaCO_3$ either in sodium ion or hydrion exchange per cubic foot of material. The figure though good is not remarkable and does not recommend the sulphonated coal as a replacement for other similar materials used commercially.

(5) *Boiler Tests on Collie Coal and Wood.*—At the request of the Public Works Department tests were carried out on the Lancashire Boilers and the steam using system at Claremont Hospital. The brickwork of the boiler setting was found to be in a leaky condition. Leakage of steam from the services of the hospital was also found. Both these conditions have now been rectified. The separate steam consumptions of the laundry and kitchens were measured. The figures obtained are of use in determining the future provisions for steam in the laundry and favour the retention of solid fuel. In the course of this work other wood using boilers were examined for tightness of setting against inleakage of air. Only the Colonial type with an outer metal case was found to give good flue gas analyses of 13.0 per cent. and more carbon dioxide.

(6) *Helium in Natural Gas from Oil Bores.*—Samples of natural gas received for general gas analysis from exploratory oil bore holes have been further analysed for us by mass spectrographic methods at the laboratories of B.P. Refinery (Kwinana) Ltd., for the presence of helium. Their analyses indicate figures of 0.37 per cent. and 0.5 per cent. in two samples and as according to Canadian authorities such percentages are commercially recoverable, verification of the occurrence is desirable.

(7) *Miscellaneous Samples.*—Samples of coal from users were analysed. The origin of most of these samples is the Hebe seam at Collie and the regular examination of these enables consistency of quality to be checked from this important seam. There is little variation in ash content and the moisture varies from 25 per cent. in summer to 30 per cent. in wet winter weather. (Table 12.)

TABLE 12.

Hebe Seam Coal Samples.

Seasonal Variation of Moisture in Coal.

4 week period ending	Moisture	Ash
	%	%
27/12/58	26·0	3·1
24/1/59	26·0	3·2
21/2/59	25·6	3·7
21/3/59	26·0	4·0
18/4/59	25·6	3·2
16/5/59	25·2	3·6
13/6/59	28·0	4·5
11/7/59	30·0	5·0
8/8/59	28·2	3·4
5/9/59	27·2	4·2
3/10/59	27·2	3·6
31/10/59	28·2	3·7
28/11/59	24·4	3·5
26/12/59	27·5	3·0

(8) *Sawdust Briquettes.*—Samples of extrusion compressed briquettes of pine and eucalypt sawdust were submitted by the Forestry Department for combustion examination. The eucalypt briquettes were not so firmly bound as those from pine wood. No doubt the high resin in pine sawdust gives a good briquetted bond. Both kinds of briquette expanded when they got hot in the fire and became fragile so that they burnt very much like a bed of sawdust. As a fuel they would have some merit but would require considerable care to get good results.

Domestic Appliances.

Attention has been given to the design and performance of open fires. From this work it appears in an open fire there are two systems of air flow to be considered. The first is that of the fire itself and the other is the draught of air which it induces through the open front of the fire.

The fire itself is self sufficient in draught since the U-tube effect of the hot air in the fire and immediately above it is in a state of imbalance with cold air outside the fire. It has been shown that a fire burns just as quickly without a chimney above it as with one. The rate of burning of a fire is controlled mainly by the height to which the fuel is piled on a grate and the freedom of draught through the grate. Chimney draught and flow, provided they are adequate to remove smoke play only a minor role.

The hot gases from the fire leave by the chimney flue above the fire and in doing this they induce a current of air from the room into the front of the fire. The amount of air drawn in is determined by the open frontal area of the fire and the size of chimney opening.

It is an object of good open fire design to reduce the amount of air drawn into the front from the room to a minimum so long as the flue area is not reduced to such a figure that the fire smokes. By suitable streamlining of the flow of combustion gases and smoke it is possible to operate a fire with a frontal opening of 1.0 square foot with a flue of 5 in. diameter and flue gas velocities which approach 15 fps. Such figures are regarded as being close to the limit for wood burning open fires. They are associated with the indrawing of about 3,000-4,000 c.ft./hr. of air from the room.

Such a figure contrasts with figures characteristic of ordinary brick open fires which draw in as much as 20,000 c.ft./hr. of room air and thereby have a poor heating performance. Nevertheless even at so large a figure the amount of heat removed from the room is not a high percentage of the heat in fuel and is perhaps no greater than 10 per cent.

The real demerit of brick open fires is that for short term heating so much of their heat is lost to their surrounding brickwork. Until this brickwork is thoroughly hot, there is not very much heat left to impart to the room and the room heating is therefore markedly reduced by the heat loss associated with the large flue gas volume.

Otherwise it seems probable that 20-30 per cent. of the heat in fuel can be emitted as radiant heat by a fire. If the fire is of metal construction so that it exerts a convective heating effect as well the extra amount of heat obtained is a further 20-25 per cent. of the heat in the fuel.

Metal open fires of suitable design therefore owe their increased efficiency to convective heating, low warm air efflux from the room and rapid heating up, since their effect is not delayed through need to heat up surrounding brickwork.

The work is not yet completed as it has been confined to fires with a relatively small frontal opening of metal construction. It is hoped to extend it to a more complete investigation of large brick fires. The more valuable development however would be to develop free standing metal fires with small flues to replace present day brick fireplaces with large chimneys based on 9 in. square flues.

Industrial.

(1) *Flash Drying of Ilmenite.*—Work commenced in 1957 on the flash drying of heavy beach sand concentrates has now been rounded off by the successful operation of a large, 15 ton per hour, drier. The performance of the plant is very close to the originally predicted figures. The operators regard it as a most satisfactory unit. It is low in power and fuel costs. It is easy to control and requires only minimum supervision. It has the additional merit that it dries and elevates 40 ft. to the top of the plant in one simple

process. The method has not been attempted before in the Australian beach sand industry probably because of lack of the specialised knowledge which we have built up on the pneumatic handling and separation of finely divided solids. Unfortunately on none of the plants for which we have provided the basic design data has it been possible to get detailed test data on which future designs can be based. Nor has it been possible to get basic data for drying performance by pilot plant work.

The work has comprised three tests, none under satisfactorily steady conditions, but all indicative of general easy and efficient working. Two of the tests were carried out on an experimental 7 in. diameter drier and one final test on the full scale 19. in. diameter, 15 tons per hour unit. Predicted and actual test figures set out below show gratifying agreement. (Table 13.)

TABLE 13.

Flash Drying of Ilmenite.

Comparison of Predicted Results with Actual Results.

The design of the flash drier was calculated on a basic requirement to dry 15 tons per hour of ilmenite sand containing 8 per cent. moisture. The following table compares the predicted behaviour with the actual behaviour as measured in a short period test run on 25/11/59. The actual results are not an accurate measure of the performance because

(i) the plant was not in a state of equilibrium when tested;

(ii) the oil consumption rate was not measurable during the test. The figure used was assessed over a period by the operators.

—	Assumed or predicted	Actual
Ilmenite feed—wet, tons per hour	15	18
wet, lb. per min.	576	672
Moisture in feed—per cent.	8·0	7·25
Fuel	Light fuel oil	Heavy fuel oil
lb. dry ilmenite per lb. of oil	78·1	93·9
Furnace loss—per cent. of heat in oil	20·0	*14·8
Drier loss—per cent. of heat in oil	8·0	Not determined
Drier diameter—inches	17	19
Transport Gas : ex furnace—		
1. Volume—c.f.m. at N.T.P.	3,400	3,185
2. Temperature—T.°C.	800	812
3. Velocity—f.p.s. at temperature T. °C	141	107 (128 f.p.s. in throat)
Outlet Gas—		
1. Volume—c.f.m. at N.T.P.	4,975	4,127
2. Temperature—T.°C.	145	195
3. Volume—c.f.m. at T.°C.	7,615	7,076
4. Velocity—f.p.s. at T.°C.	80·6	59·9
Evaporation—lb. water per hour	2,690	2,826
Solid : Gas loading : lb. ilmenite per lb. gas—		
1. At inlet	1·96	2·56
2. At outlet	1·38	2·14
Friction losses in drier—inches w.g.	9·35	7·75

* *See* (i) and (ii) above.

(2) *Dust Arrestment on Gypsum Flash Drier.*—A flash drier installed some years ago to our suggestions for the conversion of gypsum to plaster of paris continues to operate successfully. It has however never solved completely its effluent dust problem. We have been asked to measure this and determined a figure of 45 lb., of dust per hour from a plaster production of 5,600 lbs. per hour or close to 1.0 per cent. As a production loss this is small but its nuisance effect is considerable. It was found that 66 per cent. could be removed by 8 in. multi-cyclone type units if these were installed before an exhaust fan. Removal was however complete when the experimental cyclone unit used was installed after the fan under conditions which gave a saturated outlet gas from the cyclones. Our recommendation was therefore to add an exhaust fan and a wet cyclone at the tail end of the plant. The operators intend to do this.

(3) *Rotary Kiln on Gypsum.*—A rotary kiln producing plaster of paris was investigated to find the cause of erratic setting time of the product. It was found that the gypsum was being over roasted. Correction of the finishing temperature to give a higher moisture content—approaching the theoretical 6.2 per cent. gave a more satisfactory product.

In connection with this work the correct description of the figure obtained for breaking strength of gypsum bars when subject to a bending moment test has arisen. The expression "breaking strength" has been agreed on with C.S.I.R.O. Building Research Section. It was subsequently found on a visit to the latter body that it has now devised a test which gives a figure for the breaking strength of a beam as the actual bending moment of a straight unnotched beam. The test, though requiring some elaboration in the machine used, has the merit that there is no uncertainty about the effect of notching a bar on its strength. As our observations are that the breaking strengths of notched bars are considerably influenced by the notching the use of more elaborate equipment would be justified if standardisation of this test was required. At the present time the comparative tests which can be made are adequate for the guidance of operators.

(4) *Sawdust as a Boiler Fuel.*—Contact has been maintained with one firm which hogs its waste and fires it for steam raising on its factory. After considerable development and adjustment the firm has now a satisfactory system of handling and firing which is probably not paralleled elsewhere in Australia. The intensity of combustion which can be achieved is such that there is some danger of burning out of firebars in a furnace area which is not roofed by water tubes. The conclusion from this is that the Dutch oven method of firing wood waste is not acceptable where the waste is fired by spreaders under controlled combustion conditions. The experience suggests that if sawdust was used to fire driers the size of furnace used would have to be generous and the amounts of air used would have to be considerably in excess of theoretical requirements if overheating of combustion chambers is to be avoided.

The large cyclone installed on these boilers for dust arrestment continues to operate satisfactorily. A comparative performance was determined for a multi-cyclone system on another boiler installation. This gave excellent dust removal but the size of particle to be removed was much larger than normal and was practically unaccompanied by any fines—81.8 per cent. was greater than 85 B.S. mesh. The performance is not therefore critical of multi-cyclones in removing fine sawdust fliers.

It has been found that sawdust smuts from these boiler installations are electrically conducting. It is known from other work which we have carried out that charcoal has to be taken to about 700°C to make it conducting, by production of a sufficient state of graphitisation. It is concluded therefore that the smuts which are always associated with sawdust firing have actually been raised to ignition but thereafter suddenly quenched. Observations in fire tube boilers support this as sparks of burning sawdust are often seen in the tubes to be suddenly quenched and will then, no doubt, emerge as smuts.

The position on sawdust fired boilers is at present that dust arrestment equipment is now considered essential for smut arrestment.

General.

The Fuel Technologist visited the Eastern States in the course of the year to attend a symposium on fuel at Newcastle and to visit research establishments on that side of Australia.

It was found that our coking research is in some respects in advance of work being done there. Our special activities in sawdust burning, flash drying, cyclone design and gypsum treatment are also original and advanced by standards of similar work there.

INDUSTRIAL CHEMISTRY DIVISION.

The year was a busy one reflecting in some measure the slowly increasing tempo of Western Australian secondary industry. There were interesting trends in this continued expansion, some of them mirrored in the nature of the technical queries received. It was found possible to do a limited amount of research work on diverse subjects but the total output of research work was low due to calls of other work on the small staff.

The work can be classified under three headings:—

(1) Technical enquiries.

(2) Physical and chemical testing in connection with developing projects and the examination of material failures.

(3) Research work.

Technical Enquiries.

In all 3,407 technical enquiries were received in the course of the year, some by personal calls, some by telephone and one or two by letter. Of this number it was found possible to answer 2,165 without much delay either from personal knowledge or by reference to card indexes and literature generally. One thousand two hundred and twelve enquiries required further investigation and in many cases had to be referred to specialists in various lines. At the end of the year 30 queries were outstanding of which it was felt 12 could not be answered satisfactorily.

An approximate break-down of the enquiries showed that they comprised:—

	Per Cent.
(a) Plastics	27
(b) Queries relating to the supply of raw materals, machinery and to agencies supplying materials and to specifications for chemicals or chemical plant	22
(c) Paints and paint pigments and vehicles	19
(d) Cement and concrete	12
(e) Other building materials	11
(f) Miscellaneous	9

Of the enquiries received approximately 38 per cent. had their origin in Government Departments and 62 per cent. were from private industry and members of the public.

The answering of technical enquiries absorbed an appreciable amount of time but this expenditure of time appears to be well justified by results. A number of clients reported increased production efficiency and increased production as a result of technical talks and a number of new products came on the market following upon our advice on formulation and processing. Enquiries came from many fields of activity, from architects, manufacturers and manufacturers' agents, lawyers, chemists, builders, doctors, engineers and even an undertaker.

In order to answer enquiries it is very necessary to have a good liaison with suppliers of chemicals and machinery and with experts on various special branches of secondary industry. The writer would like to convey his warm thanks to the many friends in these fields whose help and encouragement enabled the satisfactory answering of so many enquiries.

Physical and Chemical Testing.

In all 32 samples have been examined and reported upon for various Government Departments and for the public. As in previous years methyl benzoate has been recovered and xylene purified on behalf of Royal Perth Hospital. Examination of plaster boards and of bricks were carried out for the State Housing Commission.

(1) For the Public Works Department an investigation of a new seamless flooring preparation was made. The results were promising and it is clear that this material within certain limits should be of interest to architects generally. It is understood that one of the floors in Claremont Mental Hospital is to be treated with this material, the raw materials for which are 80 per cent. Western Australian in origin.

(2) Some work was done on a new type of fly screen for Public Works Department. The screen was made of fibre glass coated with polyester plastic. This material has decided advantages over some of the conventional types.

(3) Undercoats and surface treatments for special plastic mapping sheets have been investigated and qualified success obtained.

(4) The use of phenolic based resin for the lining of water pipes and valves was given some attention at the request of the Metropolitan Water Supply, Sewerage and Drainage Department. The coatings resist corrosion adequately but there is some doubt as to their resilience and the possibility is that in making up or breaking down pipes they might tend to crack.

(5) Of samples submitted by the public perhaps the most interesting was an oil bottle stand, the colours on which were darkening on exposure in garages. The trouble was traced to the presence in the atmosphere of small quantities of sulphide gases which attacked some of the pigments used in the enamels. A change in the pigments used in the paints should correct the condition.

Research Work.

The demands of sample testing and of answering technical enquiries did not leave a great deal of time for research work on the part of the small staff. Nevertheless some interesting work was done and some results which may be important have been obtained. Research was focused principally on four topics:—

(1) Painting of karri timber.

(2) Cement additives.

(3) Scaevola spinescens.

(4) Glueing of timber sashes.

(1) *Painting of Karri Timber.*—Work has continued on the problem of finding a durable painting system for karri timber. 144 karri panels painted with various painting systems have recently been exposed at the South Fremantle Power House.

The premature failure of paints applied to karri timber is now thought to be due to cracking between the fibres of the wood possibly caused by changes in moisture content. In this connection it has been found that primers applied to karri timber are more durable when applied to wood with intermediate moisture content (20-30 per cent) than when applied to either dry (10-20 per cent moisture) or wet (greater than 30 per cent moisture) wood.

It has also been demonstrated that ultra-violet light exerts a considerable influence on the rate of break-down of a paint system applied to karri. A painted karri plywood frame used for supporting test panels was severely degraded where the frame was not protected from sunlight by the test panels and unaffected where it was protected. This observation would indicate that painted karri timber could be safely used where it is not exposed to direct sunlight e.g. southerly exposures, linings for eaves etc.

It is thought that the function of ultra-violet light is to accelerate the ageing of the film, causing hardening and embrittlement. This is not serious on most substrates which do not "move" with change in atmospheric conditions, but is serious with karri where movement of the timber, and in particular, cracking, is severe.

The problem has been approached in two ways:—

(1) Application of a primer which will remain soft throughout its life, so that subsequent coats are insulated from small movements of the substrate.

(2) Inclusion of ultra-violet inhibitors in the top coats to prevent hardening and embrittlement of the primer so that it will be able to compensate for movements of the substrate.

Breakdown of the paint film by a reaction between the paint and some portion of the wood is now considered unlikely. A variety of chemical pretreatments applied to karri panels before painting did not increase the life of the paint applied above it, and extracts of karri when added to paints have had no effect on their life when applied on glass and exposed outdoors.

Further work on primers, ultra-violet absorbing pigments and inhibitors and on the effect of atmospheric moisture changes on the structure of karri are contemplated.

(2) *Cement Additives.*—The use of additives in cement and concrete for the purpose of modifying their properties along desired lines has recently increased in popularity and a surprisingly large number of proprietary substances have been sold or suggested as cement additives. It is desirable to have some check on the efficiency or otherwise of the various types of additives and to some extent also of the various brands of additives available on the local market. For these reasons some work has been begun on this subject.

At the request of the Principal Architect, Public Works Department, four samples of cement additives were examined as to their effect in plasticizing concrete, and for the presence of materials likely to have a deleterious effect on the quality of the concrete in which they are used. Although the recommended rate of use per bag of cement is the same for all four samples, the total solids content (weight/volume) varied from 40.2 per cent to 9.4 per cent. Two of the additives were found to contain sugars.

Work is at present in progress to determine whether the use of these additives, purported to be salts of lignosulphonates acid will enable the water/cement ratio of concrete to be decreased with a subsequent reduction of shrinkage, an important factor in the construction of large concrete structures.

(3) *Scaevola spinescens.*—Work on the identification and assay of the alkaloids and glycosides of Scaevola spinescens has been continued. These compounds are present in very small quantities and are extremely unstable, making the task of identification more than ordinarily difficult. During the year quantities of Scaevola spinescens were obtained from a different locality to that normally used. It was found that Scaevola spinescens from the new locality did not contain any trace of alkaloids. It is not known whether the extract from it differed in its physiological properties.

Progress on this research has been very disappointingly slow, almost entirely because of the inability of staff members to devote anything but occasional attention to the project.

(4) *Glueing of Timber Sashes.*—At the request of the Timber Development Association some work has been begun on the relative merits of five different glues for the glueing of window sashes. Sample sashes have been exposed on testing frames in the laboratory grounds for over a year without any visible deterioration. A second set of sashes has been submitted to a number of tests of artificial conditions of high humidity and temperature without any detectable deterioration. The work is continuing.

(5) *Miscellaneous.*—In addition to the four main topics of research, investigations have been carried out on a number of minor topics. Of these projects work on Darwinia citriodora, on protective coatings for metals and on waterproofing of ground and basement floors are sufficiently interesting or important to deserve mention.—

(a) Samples of leaves and flowers from plants grown at Red Hill and National Park have been collected at regular intervals and assayed for their oil content at different seasons of the year. During these routine examinations, minute quantities of a crystalline material were obtained. Spectrometric and photo-spectrometric analysis showed that this crystalline material appeared similar, but not identical, with Baeckeol, a phenol present in Darwinia grandiflora.

As it is possible that the antibiotic properties of Darwinia citriodora are associated with this compound, efforts are being maintained to obtain larger quantities of the crystals for identification and measurement of their antibiotic activity.

(b) Numerous cases of paint failures on metals have come to our attention during the past and previous years. The majority of failures were obviously due to incorrect, insufficient, or inefficient surface preparation of the metal before painting, although some cases were clearly due to the choice of the wrong type of paint for the particular conditions obtaining. Some work has therefore been done on the various possible methods of surface preparation with a view to assessing the relative advantages and disadvantages under given sets of conditions. Although much work has been done in various parts of the world on this subject a certain amount of extra effort is required to define optimum preparation for W.A. conditions. As most of the test work has to be submitted to long term exposure tests it is not possible to give any definite conclusions at the moment but it is possible to say that for some types of paint very considerable care is necessary for preparing the surface; this is particularly true of some types of epoxies, polyesters and polyurethanes.

(c) The problem of waterproofing ground and basement floors which are to be covered with linoleum, vinyl tiles or other flooring preparations is one which will need attention in the New Year. A number of cases of lifting of the flooring have occurred under puzzling circumstances. Some preliminary investigations have been completed.

Summary.

While some progress has been made on investigations of the type of work for which this Division was originally equipped it is now quite clear that much more could be done and the need for semi-scale investigations in particular is daily growing. The Division has the necessary equipment for this work but unfortunately staff is not meantime available for the pursuit of topics of developmental research. If Western Australia is to develop her secondary industry developmental research must be pushed ahead with all speed.

MINERALOGY, MINERAL TECHNOLOGY AND GEO-CHEMISTRY DIVISION.

One thousand five hundred and forty six (1,546) samples were received in 1959, compared with 1,270 the previous year.

The main sources of samples were:—

General public (free)	779
General public (pay)	337
Geological Survey Branch	205
State Battery Branch	133

Table 14 details the nature and source of all samples received in the Division. Some samples were examined for a single property or element, and some for many.

TABLE 14.

MINERAL DIVISION.

—	Pay	Free	Government Geologists	State Batteries	Departmental	Other State Govt. Depts.	Commonwealth Pay	Total
Aggregates	17	....	....	....	....	2	....	19
Alloys and Metals	40	....	....	....	....	....	....	40
Burnt Lime	15	....	....	8	....	3	....	26
Ceramics	5	10	....	....	1	....	....	16
Mineral Identification	24	394	....	....	....	5	....	423
Minerals and Ores—								
Beryl	9	24	....	....	....	1	....	34
Bismuth	2	10	....	....	....	....	....	12
Copper	8	55	....	....	....	8	....	71
Gold, ores	58	83	38	....	....	....	....	179
Gold, tailings	....	....	....	89	....	....	21	110
Gold, umpires	....	....	....	34	....	....	2	36
Gypsum	12	6	....	....	....	....	....	18
Heavy sands	1	11	....	....	....	....	....	12
Iron	2	26	141	....	....	1	....	170
Lead	2	14	....	2	....	....	....	18
Lithium	4	12	....	....	....	....	....	16
Magnesite	41	7	....	....	....	....	....	48
Manganese	13	18	24	....	11	....	....	66
Tantalite-columbite	20	17	....	....	....	....	....	37
Tin	3	11	....	....	....	1	....	15
Titanium	19	6	....	....	....	2	....	27
Others	27	61	2	....	....	8	....	98
Miscellaneous	15	14	....	....	....	26	....	55
Total	337	779	205	133	12	57	23	1,546

With the staff now at full establishment, all bench space is fully occupied. While the staff is adequate to handle day by day work from the public and other Departments there is a lot more investigational work that could be done if more space and staff were available. For example, the number of complete chemical analyses of minerals and rocks carried out in recent years falls very far short of that carried out in earlier years due mainly to the increased demand for general chemical work that, in most cases, cannot be carried out elsewhere in the State.

Competence in handling complete analyses of rocks and minerals can be achieved only by experience and until a dozen or so analyses of this type have been carried out by an individual much time is required in checking and repeating determinations on each sample. The time available to obtain this experience has been so restricted by the demands of other work that only one or two chemists have had the opportunity of gaining the necessary experience. It is most desirable that all chemists become competent at this work.

The experience gained in routine assays for individual metals provides only a background for complete analyses since traces of elements which escape separation by routine procedures have to be followed up to avoid reporting them wrongly at later steps in the analysis.

The identification, analysis and recording of mineral occurrence throughout the State is a primary function of this Division and it is found that pressure of routine work frequently militates against the complete fulfilment of that function. Every attempt is made for identifications and analyses to be sufficiently detailed to meet the essential requirements, often commercial, of applicants, but for the purposes of scientific recording more detailed work would be justified. In addition to more detailed work on outside samples there is no shortage of investigations that should be undertaken departmentally. To carry out this work, though, would involve taking one or two experienced chemists off the normal work of the laboratory, resulting in additional or increasing delays in reporting results: as the value of a report is often dependent on its being available within reasonable time, such delays are most undesirable.

The types of investigation which justify serious consideration in any general programme of expansion in staff and floor space include—

(a) study of the rare-earth minerals for identification and assessment of individual rare-earth components;

(b) complete analyses, by chemical, X-ray and differential thermal analysis methods of all mineral occurrences from new localities as well as of unusual mineral specimens, as, for example, viridine, colourless tourmaline, bismuth carbonates, lepidolite, montebrasite-amblygonite, triphylite-lithiophilite;

(c) development of autoradiograph techniques;

(d) vanadium staining of bricks;

(e) study and adoption of a wider range of analytical techniques;

(f) establishment of a means of positively identifying the rare-earth minerals without resorting to chemical analysis.

Alloys and Metals.

Work in this field was mostly on behalf of metal merchants who required analyses of white metal, solder, brass, bronze, nickel and zinc dross.

A number of samples of cast iron were analysed for carbon content for the Charcoal Iron and Steel Industry.

Burnt Lime.

There was again a decrease in the number of burnt lime samples submitted by the public, only 15 being received as against 28 in 1958 and 87 in 1957. Possibly this indicates an improvement in the assaying and sampling techniques of lime burners and lime buyers, leading to an agreement in analytical figures that was noticeably absent in the past.

For State Batteries, eight samples were analysed for free and combined lime as well as carbon dioxide. Two of the samples did not conform to Tender Board Specification.

Two complete and one partial analyses were carried out on products in connection with lime-sand calcination experiments conducted by Department of Industrial Development.

Photomicrographs of hydrated lime samples were produced at the request of a firm interested in the problems of ultra-fine grinding of this product. The prints showed the lime particles enlarged 1,500 times.

Cement and Concrete.

(1) *Aggregates, General.*—A number of materials were examined to assess their suitability as concrete aggregates. The tests used include petrographic and physical examinations together with the accelerated chemical tests in which the potential reactivity of the aggregate towards an alkaline environment is measured. This latter test, though it can be used to identify the presence of reactive material in the aggregate, does not always indicate whether or not that material is present in proportions which would cause abnormal expansion. A further check is therefore desirable and arrangements have been made for the acquisition of equipment to enable mortar-bar expansion tests to be carried out. To test an aggregate by this means involves storage of the test bar under conditions of controlled temperature and humidity for periods of three, or preferably six to twelve, months.

(2) *Aggregates, Coarse.*—Coarse aggregate from Mt. Phire, in the North East Division, was tested at the request of the Commonwealth Department of Works. Another coarse aggregate, on which preliminary tests were made, came from the Fitzroy River. It was sent in by the Public Works Department in connection with proposed constructional work on the Liveringa project. These water-worn stones were divided into six fractions based on general appearance and mineral composition and each fraction was tested separately. One fraction, comprising about 8 per cent. of the original sample consisted of a mixture of chalcedony and quartz and gave potential alkali reactivity figures suggesting that it would be deleterious in concrete: the remaining fractions were essentially non-reactive, coarsely crystalline quartz. Further work is in hand on this aggregate.

Considerable interest is being shown in exposed aggregate concrete work and a number of different ornamental rocks and minerals have been tested in this connection. The proposed use of Londonderry feldspar (essentially microcline) as an exposed aggregate was mentioned in the 1958 report. On theoretical grounds, based mainly on the high coefficient of linear expansion of this mineral compared with that of the matrix, an unfavourable opinion was expressed. At the request of Public Works Department further work was carried out to determine the potential alkali reactivity of the mineral and in this respect figures showed that microcline would be classified as an innocuous aggregate. Still further tests have been carried out at the University of W.A., in which 2" thick concrete slabs faced with Londonderry feldspar were subjected to twenty 1 hour cycles between 60°F and 175°F, then heated to 180°F for 1½ hours and sprayed immediately with cold water for 5 minutes before total immersion. No disintegration was evident which suggests that the difference in coefficients of expansion is not of practical significance at least during this necessarily limited number of temperature cycles.

(3) *Aggregates, Fine.*—Detailed tests were made on a number of fine aggregates, most of which were examined for conformity to Australian Standard A77-1957 (or corresponding A.S.T.M. Specifications). These include determination of water-soluble salts, organic matter, material finer than 200 mesh, grading, and potential alkali reactivity. In addition, determinations were requested on three sands for calcium carbonate, sulphide sulphur, water-soluble sulphate, sodium chloride, organic matter, iron and clay material. A sand from Perenjori was tested for possible use in locally made sand-cement bricks.

(4) *Hardened Concrete.*—Determinations of aggregate to cement ratios in hardened mortars and concretes have been carried out for the Public Works Department. One sample of cement grout, supposed to have an aggregate to cement ratio of 2 to 1 was found to have a ratio of approximately 6 to 1.

In the absence of separate samples of the original ingredients, interpretation of results is dependent on the usual assumptions that the aggregate contains neither acid-soluble calcium nor alkali-soluble silica. Departures from these assumptions contribute to the original mix calculated from the silica figures varying from that calculated from the lime figures. In one concrete, the mix calculated from silica figures was 0.9: 1: 1 (coarse aggregate: fine aggregate: cement), while the lime figures gave 1: 1.2: 1. While such discrepancy cannot be guarded against unless separate samples of the original aggregate and cement are available, the results usually are close enough to pick up gross departures from specification. It is stressed, however, that wherever possible separate samples of the original ingredients should be made available as a knowledge of their characteristics considerably enhances the value of the final interpretation.

Mineral Collections.

One hundred and twenty-five new specimens were added to the Division's Mineral Collection, all but a dozen being from localities within the State.

Though in general the collection is confined to W.A. minerals, advantage has been taken of a request from the Royal Ontario Museum for W.A. minerals in exchange for Canadian ones. New species obtained in this way include hopeite, joseite, kermesite, pararammelsbergite, polydymite, skutterudite and conichalcite, as well as additional specimens of sphene, zircon and metallic silver, the latter in a polished vein section with smaltite and niccolite. Many of these minerals have not been identified in W.A. and the specimens will serve as useful references for X-ray and optical work should the species be suspected at any time in local deposits.

An overseas mineral of particular interest was a specimen of cheralite from Southern India made available to the Laboratories through the courtesy of Westralian Oil Ltd. This mineral is a variant of monazite, carrying up to 23 per cent of thoria (ThO_2) and 4 to 6 per cent of uranium oxide (U_3O_8).

Specimens added to the collection from State sources include halite from oil drill holes at Frome Rocks in the Kimberley Division, massive rutile and martite from Yinnietharra, allanite from Hillside Station, large crystals of dravite from Yinnietharra, viridine from Mt. Dean (Eucla Division), tridymite and sanidine from Yornup, large epidote crystals from Carnarvon area, amethyst from Maroonah Station, braunite concretions from Balfour Downs, hematite pseudomorph after ? anthophyllite from between the Ripon Hills and Mt. Sydney in the Pilbara, and a fine specimen of monazite, weighing 480 g., from Cooglegong. A number of gold and telluride specimens from the Government Geologist included native gold crystallized in well-formed octahedra.

As well as the current Mineral Division collection, the Simpson Collection is also housed in the Division. This collection has proved invaluable to the mineralogists of the Division and has been used from time to time by visiting specialists. Through lack of drawer space, this collection is not set out in a manner worthy of its reputation and it is recommended that, if its permanent housing in these Laboratories can be assured, the necessary time and money be spent on its reorganisation.

Mineral Identifications.

(1) *General.*—Individual minerals will be treated below under appropriate sub-headings.

Prospectors and the general public are encouraged to send in any mineral specimens which they think may be of interest; the majority qualify for free examination in accordance with Departmental policy of encouraging prospecting. Departmental and pay samples are given priority over this free work, but with an additional mineralogist on the staff, delays have been considerably reduced compared with previous years. Except in the case of complex or unusual specimens, reports are available within a fortnight of receipt.

Equipment obtained recently has also contributed towards the more expeditious identification of mineral specimens. This equipment includes a drill for isolating minerals occurring as minor constituents of rocks, a Leitz-Jelley refractometer and an additional petrological Reichert microscope. The Swift Point Counter has proved invaluable in semi-quantitative work on rock sections and sands.

(2) *New Localities.*—By far the greatest number of new mineral localities recorded were in the North-West Division.

In this Division, *bismutite* was reported for the first time from four localities in the Upper Gascoyne, viz., Maroonah Station, Eudamullah Station, 3 miles S. of Pyramid Hill and 20 miles N.W. of Gifford Creek Station homestead. At the last locality the bismutite was associated with *metallic bismuth*. Four new recordings of *beryl* were from 3 miles S. of Pyramid Hill, Maroonah Station, 25 miles N. of Roy Hill and 10 miles N.W. of Roebourne. *Atacamite* was indentified in a copper ore from Jimblebar, and *malachite* from Mt. Florrie. Malachite was also present in a predominantly cerussitic specimen obtained in the vicinity of the Henry River - Tropic of Capricorn intersection. The occurrence of *cerussite* in this locality also had not been reported previously. *Pyromorphite* from 10 miles E. of Mangaroon homestead, *baryte* from 25 miles N. of Balfour Downs homestead, and *wad* from Eudamullah Station were other new occurrences in this Division. Also of interest were minerals of the *lithiophilite-triphylite* series from Maroonah Station and of the *amblygonite-montebrasite* series from the Onslow area.

The South-West was the only other Division from which new occurrences were reported. Green *beryl* was found for the first time, 5 miles S. of Mt. Edon, and *anthophyllite* at Payne's Find.

Minerals and Ores.

(1) *Beryl.*—Interest in beryl was stimulated by the Australian Atomic Energy Commission providing a ready market for any quantity of this mineral at a stabilized price of £15/9/0 per unit f.o.b. Fremantle for ore containing not less than 10 per cent beryllium oxide.

As a result, a large number of samples suspected of being beryl were submitted for identification, thirty-four of which proved to be that mineral.

Specimens of beryl were received from a number of localities not previously recorded in the W.A. Mineral Census. These included Mt. Edon, in the South-West Division and Maroonah Station, 25 miles N. of Roy Hill, Pyramid Hill (Gascoyne) in the North-West Division.

A specimen from the vicinity of Roebourne was a single hand specimen of white beryl with an unusual outer zoning of green beryl. As well as samples of grey beryl from Mt. Francisco, specimens of white transparent beryl were received from the same area, though unfortunately too small and too flawed to be of gem quality.

A buying firm reported the receipt of a 12-ton parcel of beryl reputedly taken from a single crystal found in the Yinnietharra area.

A sample of beryl-bearing pegmatite was tested on a laboratory scale with the object of producing saleable concentrates of beryl, mica, feldspar and other pegmatite minerals. By following the generally accepted flotation techniques recommended for this type of material, it was possible to produce a forty-fold concentration of the beryl to give a product closely approaching current market requirements.

(2) *Bismuth.*—A larger number than usual of bismuth minerals was received.

One sample, from 10 miles N.E. of Marble Bar, gave an X-ray pattern showing some variation from the standard bismutite pattern. Chemical analysis however indicated that the bismuth mineral had a formula very close to that accepted for bismutite, namely $(BiO)_2CO_3$ and that the X-ray variations were most likely due to small amounts of finely disseminated quartz and clay minerals.

A bismuth ochre originating from Maroonah Station (Ashburton) was the first bismuth mineral recorded from that locality, while some massive bismutite associated with quartz from the Eudamullah Station (Upper Gascoyne) was also the first record of bismuth in the locality. A particularly good specimen from yet a third new locality, was received from the adjacent Gifford Creek Station and consisted of bismutite and native bismuth. Practically all the bismuth specimens received occurred in a form that could readily be concentrated to the minimum 65 per cent. metallic bismuth content demanded by mineral buyers.

Bismuth minerals were identified in various concentrates and by-products resulting from tantalite treatment plants in the Nullagine area.

(3) *Copper.*—Specimens of copper minerals were received from two new localities in the Ashburton district, namely Mt. Florrie and on the Henry River, 15 miles S.W. of Mt. Palgrave. Copper minerals from the last locality occurred as malachite with traces of chalcopyrite in specimens in which cerussite was the predominant mineral.

A particularly fine specimen of malachite was sent in from Belele Station: other specimens of interest included a malachite-coated chalcocite crystal from Wyndham, massive cuprite from Jimblebar, and cuprite, malachite and atacamite from the same locality.

The majority of copper determinations were in connection with the testing of a deposit in the vicinity of Jimblebar, though a considerable number of mill products from a mine at Widgiemooltha were assayed for several metals, including copper.

In addition, eight umpire copper assays were carried out on samples forwarded by the District Inspector of Mines, Roebourne.

(4) *Gold.*—There was a big increase in the number of gold ores assayed compared with the previous year (89 in 1958, 179 in 1959), by far the biggest increase being in pay samples.

There was also an increase in the number of check assays on tailings for both State Batteries and the Northern Territory Administration, though the number as umpire assays fell from 47 to 36.

A battery sand from the Northern Territory was examined to ascertain if possible the reason for poor amalgamation returns. The sample was derived from a basic ore and on panning gave a concentrate consisting of much iron oxide with some oxidised bismuth minerals and a little very fine gold. None of the factors normally associated with amalgamation troubles, such as the presence or arsenic, antimony, partly-oxidised sulphides or coated gold, were evident. The fineness of the gold, together with the strong flow of water necessary to keep the large quantities of heavy iron oxides from building up on the plates, could be a contributing cause to poor amalgamation recoveries, while bismuth may contribute towards unsatisfactory amalgamation.

A number of mill products from a plant operating in the Coolgardie Goldfields were assayed for gold, silver, arsenic, copper, iron, sulphur and silica, and petrographic examinations made of ore from the mine.

This ore contained the sulphides, chalcopyrite, pyrite, arsenopyrite and a little secondary chalcocite with free gold and electrum (silver-rich gold) in a gangue composed mainly of quartz with some ankerite, chalcedony and a little chlorite.

A specimen of gold-bearing ore from the Upper Gascoyne assaying over 9 oz. of gold per ton, showed a gold to silver ratio of about 23 to 1. This is greatly in excess of the average for the State of approximately 4¼ to 1.

Other gold and silver ores assayed included a highly arsenical material from Fields Find, cerussitic ores from Roebourne, and high-grade oxidised copper ores from the Roebourne and Jimblebar areas.

Gold work for the Government Geologist consisted mainly in the assay of 26 diamond drill bore-cores from the Great Fingall Goldmine and 4 from the Forrest King, Coolgardie.

(5) *Heavy Sands.*—Heavy sands received were about evenly distributed between coastal and inland localities. Coastal sands from Augusta, Busselton, and Denmark were the usual type of black sand with ilmenite the predominating mineral while those from Margaret River, Kalbari beach and the Murchison River mouth carried mostly garnet. Samples of the latter, with their eye-catching pink garnet grains are received regularly each year and it is unfortunate that the garnet, which could be so readily concentrated, finds no application as abrasive material due to water-smoothing of the grains. A mild interest reported in the building trade in the use of the sand in ornamental concrete work holds some hope of a limited market.

Sands from inland localities, such as Pantapin, 20 miles S. of Kwolyin, Mukinbudin and Balingup showed a predominance in some cases of ilmenite and in others of magnetite. One, from the Balingup area, gave a high tin concentrate.

A detailed study was made of a product resulting from the air-table concentration of the non-conducting, non-magnetic fraction of a heavy sand being treated commercially in the Capel area. It was further fractionated by using Clericil solution of varying specific gravity and the products critically examined. Fairly clean products were obtained in the following gravity ranges:—

Specific Gravity	Minerals
Greater than 4·4	Zircon.
3·86–4·4	Corundum (75%), leucoxene (15%).
3·27–3·86	Kyanite.
3·14–3·27	Andalusite (60%), sillimanite (40%).
Less than 3·14	Quartz (60%), andalusite-sillimanite (35%).

The approximate quantitative composition was calculated to be zircon 50 per cent., kyanite 52.5 per cent., corundum 2.3 per cent., andalusite, sillimanite, leucoxene, each 1 per cent., together with less than 0.5 per cent. each of rutile, quartz, and spinel and doubtful traces of dravite, staurolite, topaz and garnet.

Though inclusions in the zircon were uncommon, much of the kyanite was characterised by carbonaceous inclusions rendering the grains virtually opaque. Three varieties of corundum were noted, namely colourless, ruby and sapphire. The ruby variety was the typical "pigeon's blood" pink; the sapphires, pale to deep blue, were rare.

There was a Treasure Island atmosphere about a sample of coarse sand, received in a weather-beaten bottle and stated to have been dug up in a south coast back yard. As well as glass beads, tourmaline and topaz, it contained four varieties of corundum, including ruby and sapphire of possible gem quality.

(6) *Iron.*—As in recent years, the big majority of iron ores received for analysis originated from the sampling programmes of the Geological Survey.

Over 100 bore core samples from three diamond drilling sites in the Tallering Range iron deposit were assayed for iron and the relative amounts of limonite, hematite, magnetite, pyrite and gangue minerals assessed mineralogically. In addition a number of composite group samples were prepared from the cores and analysed for iron, silica, phosphorus, titanium, magnesium, lime, manganese and sulphur.

Similar work was carried out on Geological Survey of Western Australia samples from Weld Range (Wilgie Mia) and Roy Hill.

Though most of the analytical work on iron ores is for the Government Geologist, a large number of these ores is received each year from prospectors and others for mineral identification. An interesting specimen was received from the Ripon Hills area of the Marble Bar district; it was a hematite pseudomorph after an asbestiform mineral probably anthophyllite. A specimen of martite, the iron sesquioxide believed to be a pseudomorph of hematite after magnetite, was received from the Yinnietharra Station.

(7) *Lead.*—With the severe restriction of activity of the Northampton mines, only very few lead-zinc assays were carried out during the year.

A variety of lead mineral specimens was, however, received from widely scattered parts of the State. These included galena from Mt. Jackson (Central), Moola Bulla (Kimberley) and Mt. Augustus (North West), cerussite from Maroonah and Sherlock Stations in the North West and pyromorphite from Mangaroon Station, a new locality for this mineral.

A finely ground mineral, reputedly used by Asians as a cosmetic for darkening the eyelids and expected to be a form of kohl (antimony sulphide) proved on analysis to be galena.

(8) *Lithium.*—During the year tentative enquiries were made by overseas interests regarding possible commercial sources of lithium ore, with special reference to lepidolite carrying between 3.5 and 4.0 per cent. lithium oxide. This resulted in a number of samples being received for analysis, two of which, from Yalgoo and Londonderry respectively, assayed over 4 per cent. Li_2O.

A specimen of zinnwaldite from Londonderry assayed 2.17 per cent. Li_2O.

Two specimens classified as members of amblygonite-montebrasite group were received from the N.W. Division. This group of lithium aluminium phosphate minerals has not previously been recorded in these laboratories at any localities other than Ubini and Ravensthorpe.

Other lithium minerals of interest included lithiophilite and triphylite from the Ashburton area, associated in some cases with beryl.

(9) *Magnesite.*—Further calcination tests have been carried out on magnesite samples from 18 miles E. of Ravensthorpe forwarded by the Government Geologist.

As outlined in the Annual report for 1958, initial tests showed that this material would yield a product readily conforming to specifications for caustic magnesia.

Later tests involving calcinations at various temperatures indicated that burning at temperature as low as 800° would give a free-grinding reactive calcine with an ignition loss still within the maximum limit (5 per cent.) allowed by typical specifications.

Twenty-seven magnesite samples were analysed for magnesia, lime, silica and iron on behalf of a company interested in developing an overseas market for this mineral from a high grade deposit in the Ravensthorpe area. Partial analysis of a typical sample from this deposit gave the following percentage composition:—

	Per Cent.
Magnesium carbonate, $MgCO_3$	98.1
Calcium carbonate, $CaCO_3$	0.43
Silica, SiO_2	0.74
Ferric oxide, Fe_2O_3	0.04

(10) *Manganese.*—There has been considerable activity in the field regarding manganese and as a result 66 samples were examined in the Division.

An attempt is being made to classify more closely the manganese oxide minerals of this State. Some of the more recently defined species, such as cryptomelane, ramsdellite and gamma-manganese dioxide have not previously been distinguished and if they occurred, were included under one or other of the older series, pyrolusite, polianite, psilomelane.

Identification of some of these minerals is difficult, if not impossible, without the use of X-ray techniques, but with a combination of optical, chemical and X-ray data the following oxide minerals could be distinguished.

Pyrolusite.—Tetragonal MnO_2 of which polianite is a physical variety.

Ramsdellite.—Orthorhombic MnO_2 which is a dimorph of pyrolusite.

Gamma Manganese Dioxide.—Closely related to ramsdellite but with a distinctive X-ray diffraction pattern.

Cryptomelane.—A tetragonal potassium-manganese manganate which may be regarded as the potassium-rich end of the series Mn_8O_{16} — $K_2Mn_8O_{16}$. It gives an X-ray pattern distinct from psilomelane.

Psilomelane.—The barium-manganese manganate.

Manganite.—The hydrous sesquioxide, $Mn_2O_3.H_2O$.

It is of interest to note that although the natural manganese dioxide ores used in the manufacture of dry cells include the first four species listed above, the most favoured by manufacturers remains that mined on the African Gold Coast and which is composed essentially of ramsdellite and gamma—MnO_2.

Neither of these species has been identified in the limited number of Western Australian ores so far examined by X-ray, but the possibility of finding even limited tonnages of this potentially valuable oxide justifies the routine X-ray examination of all manganese occurrences reported.

The first specimen of cryptomelane described as such originated from the Peak Hill area and had the following composition:—

	Per Cent. on Dry Basis.
Manganese dioxide, MnO_2	80.50
Manganese oxide, MnO	5.36
Silica, SiO_2	0.61
Ferric oxide, Fe_2O_3	3.22
Alumina, Al_2O_3	2.85
Titania, TiO_2	0.08
Phosphorus pentoxide, P_2O_5	0.01
Lime, CaO	0.06
Magnesia, MgO	Nil.
Barium oxide, BaO	0.15
Potash, K_2O	2.89
Soda, Na_2O	0.35
Combined water, H_2O^+	3.84
	99.92
Total manganese, Mn	55.02

Analyst—J. R. Gamble.

Two mineral specimens from the Pilbara area, identified by X-ray as psilomelane, were found chemically to contain 14.1 and 13.4 per cent. of barium oxide.

The co-operation of mining companies in suplying samples for this work is appreciated.

Analyses and mineral identifications were made of specimens from prospectors and producers, and of overseas shipments.

In addition, 21 rock samples from the Nullagine district of the Pilbara goldfields were analysed for manganese at the request of the Government Geologist. These rocks contained from 0.8 per cent. down to less than 0.01 per cent. of manganese and were part of a series taken by the Geological Survey of Western Australia in an attempt to correlate the rocks with known manganese deposits.

A sample from the same series consisted of disc-shaped concretions varying from ¼ in. to ¾ in. in diameter and composed essentially of braunite with a little iron mineral. They assayed 42.9 per cent. of manganese.

In connection with the sampling by a mineral-buying firm of a manganese ore stock-pile in the North-West, over 100 samples, the largest of the order of 2 cwt., were crushed and prepared for analysis by a public analyst.

The usual method of determining manganese in manganese ore is the Volhard volumetric method which involves a final titration with $KMnO_4$. There are alternative methods of standardisation of this solution which include direct standardisation against British Chemical Standards Ferromanganese or Manganese Ore A and indirect standardisation against standard steel or sodium oxalate. A further variant is the use, in this indirect standardisation, of either of two factors, one theoretical, the other empirical.

Comparative tests were made (in co-operation with a public analyst) and it was found that variations as high as 1 per cent. on a 50 per cent. manganese ore could be obtained, depending on the method of standardisation. As a result of a number of tests it was decided that the direct method, using B.C.S. Manganese Ore A, be adopted.

(11) Tantalo-columbate Minerals.—The 37 samples of tantalo-columbate minerals received represented a slight increase in numbers over the previous year.

The relationship between tantalum and niobium content and specific gravity of the tantalite-columbite mineral series makes the evaluation of concentrates of these minerals a simple matter in the absence of contaminants.

Many samples however, especially from new areas or from inexperienced prospectors, are complex mixtures containing varying proportions of such minerals as cassiterite, monazite and other rare earth minerals, ilmenite and garent as well as limonite, magnetite and hemetite. In addition tantalo-columbate minerals may be present in forms which are not amenable to gravity grading, such as microlite and simpsonite. Determination of the quantitative composition of such samples involves concentration and separation by electromagnetic and heavy liquid techniques as well as fairly tedious hand sorting followed in some cases by confirmatory X-ray diagnosis of the more complex fractions. There is no alternative to prolonged chemical analyses when samples do not respond to any of the above physical treatments.

The best grade of tantalite came from the Tabba Tabba and Pilgangoora fields, with a tantalic oxide (Ta_2O_5) content as high as 70 per cent., the corresponding niobic oxide figure being about 15 per cent. Most samples though were primarily of mineral from the columbite end of the series. Unfortunately there was not, during this year, a demand for columbite comparable to that for tantalite but overseas publications forecast expanding horizons in the use of niobium in the coming year.

Bismuth minerals were interesting associates of samples from the Nullagine area. Definite identification and chemical analyses of these minerals will be undertaken when the opportunity arises.

(12) *Tin.*—A sample of interest from the Split Rock area consisted of 63 per cent. monazite, 32 per cent. cassiterite and 5 per cent. euxenite.

One from Fairfield Station, in the West Kimberley, consisted of cassiterite intergrown with staurolite and a small amount of xenotime.

A rather complex concentrate received from Nullagine contained approximately 46 per cent. of cassiterite, 21 per cent. columbite, 16 per cent. ilmenite, 3 per cent. monazite and a little bismuth carbonate.

The majority of cassiterite specimens were, however, received as minor associates of tantalo-columbite concentrates. Tantalite from the Tabba Tabba and Pilgangoora areas carried up to 11 per cent. of cassiterite, though this figure was usually lower in concentrates from other localities in the North West, most being below the maximum of 7 per cent. acceptable on a penalty-free basis to mineral buyers.

(13) *Titanium Ores and Products.*—Samples of massive rutile were obtained from three localities in the Ashburton and Upper Gascoyne divisions, while massive ilmenite was recorded from the vicinities of Toodyay, Wiluna and Nullagine.

Ilmenite in the form of heavy sands has been discussed under that heading.

As expected, there was a sharp drop in the number of plant products analysed on behalf of ilmenite-mining companies. Fewer still can be expected as these industries become firmly established and leave the pilot plant stage behind.

Forty six determinations were however made on products from these plants, analyses being for phosphorus, titanium, ferric and ferrous iron, rare-earths, sulphur and manganese.

Leucoxene, regarded as a titanium-enriched alteration product of ilmenite, and having a rather indefinite composition, has become of commercial significance as it occurs in the Yoganup area in the south-west of the State. Complete analysis of a concentrate from this area showed cleaned leucoxene from this product to have the following composition:—

	Per Cent.
Titanium dioxide, TiO_2	83.74
Ferrous oxide, FeO	0.69
Ferric oxide, Fe_2O_3	12.54
Manganese oxide, MnO	0.29
Magnesia, MgO	0.01
Lime, CaO	0.10
Silica, SiO_2	0.31
Tantalic + niobic oxides, $Ta_2O_5 + Nb_2O_5$	0.16
Rare-earths oxides, R_2O_3	0.06
Soda, Na_2O	0.04
Potash, K_2O	0.02
Chromic oxide, Cr_2O_3	0.05
Phosphorus pentoxide, P_2O_5	0.08
Vanadium pentoxide, V_2O_5	0.08
Alumina, Al_2O_3	0.34
Water (free), H_2O	0.93
Water (combined), H_2O	1.16
	100.60

Analyst—M. B. Costello.

(14) *Miscellaneous Minerals.*—Other minerals received for identification, in addition to those dealt with above, included fuchsite (Coordewandy, Westonia, Meekatharra), siderite (Mangaroon, Mt. Dick), chromite (Byro), molybdenite (Shaw River), ferberite (Westonia), martite (Yinnietharra), cervantite and stibiconite (Wiluna), alexandrolite (Mukinbudin, Kulin) nontronite (Albany), graphite (Coordewandy), vermiculite (Kojonup), chalcocite (Wyndham area), rock crystal (Minnie Creek), actinolite (Toodyay), tremolite (Southern Cross), anthophyllite (Piawaning), green feldspar (Nullagine), moss opal (Ora Banda), amethyst, andalusite and jarosite.

Among the scores of iron minerals were limonite pseudomorphs after pyrite from Lyndon Station, hematite from Maroonah Station showing both rhombohedral and pseudo-octahedral partings, a number of specimens showing pronounced iridescence and some outstanding specimens of micaceous hematite. Many of the specimens of nodular pyrite originated from private water-boring activities following the exceptionally dry winter.

Massive rutile partly altered to leucoxene was received from Maroonah Station, while a specimen of corundum from Harvey occurred as remnant crystals surrounded by the micaceous alteration products margarite and dudleyite. Similarly-altered corundum was received from the Pilbara area. A hornblende rock from Ravensthorpe contained up to 10 per cent of apatite; a cave deposit from Jurien Bay assayed 9.2 per cent phosphorus.

Two rocks of interest were a gold-bearing ore from Peak Hill carrying pyrite, tetrahedrite, chalcopyrite and ankerite, and one from Mt. Dean composed of quartz, mica and the green manganese aluminium silicate mineral viridine. The viridine contained small black inclusions shown to be hematite.

An actinolite-tremolite specimen was found to polish exceptionally well but was rather coarse-grained with a tendency to split during working. It represented the coarse grained equivalent of nephrite or "New Zealand jade," a stone much in demand for its ornamental value, and further search in the vicinity for finer-grained and less brittle material was recommended.

Baryte samples were received from a number of localities but in most cases they were too stained to be of value to the paint, rubber or plastic industries. Most would probably be satisfactory, after very fine grinding, as drilling mud but failing the establishment of a oil industry in the State no great local demand can be expected in this respect. A sample from the Pilbara Goldfields, forwarded by the Government Geologist assayed:

	Per Cent
Barium sulphate, $BaSO_4$	84.5
Strontium sulphate, $SrSO_4$	0.35
Silica, SiO_2	13.8
Ferric oxide, Fe_2O_3	0.29

A few specimens received were found to be siliceous slags of artificial origin.

No australites were received during the year which is strange considering the publicity given to these objects as a result of the visits to this State of the U.S. meteorite specialist, Dr. H. H. Nininger.

Miscellaneous.

(1) *Health Hazards.*—Determinations were carried out on dust products from various sources, the figure usually required being the concentration of free silica of micron size. Chemical methods for the estimation of free silica in the presence of combined silica are not exact and the determination is frequently further complicated by the small amount of samples available. It is hoped that investigations now being planned, involving the use of differential thermal analysis, will lead to a more satisfactory procedure.

Most dust samples were received from the Chief Inspector of Factories, and included two factory dusts for estimation of the free silica present in the minus 5 micron fraction, a moulding loam for the total free silica content and a dust collected in the vicinity of a ball mill operating in a commercial ore-grinding plant.

A red powder found on the road-side was examined for the Perth Road Board and, though the inorganic portion was found to be innocuous as a health hazard, a small organic fraction was composed of a poisonous organic mercury compound.

(2) *Magnetic Separator.*—The Frantz Isodynamic Magnetic Separator was calibrated during the year. Standards of known magnetic susceptibility used for calibrating the instrument were chemically pure ferrous ammonium sulphate and copper sulphate. Nickel sulphate is also recommended as a standard but it was found that the nickel salt available became sticky too rapidly on exposure to air; however, a third set of useful figures was obtained using a reasonably pure sphalerite.

Tables were drawn up relating current and magnetic susceptibility at different transverse slopes of the separator and graphs prepared from which the magnetic susceptibility of unknown minerals can be determined.

Though the presence of impurities can in some cases seriously jeopardise the accurate interpretation of susceptibility figures obtained on an unknown, this property is a valuable diagnostic if reasonably pure minerals can be isolated.

(3) *Petrological Examinations.*—A consignment completed during the year was the detailed examination of 44 granite specimens from the Pilbara Goldfield collected by the Government Geologist. The work involved mineral identification and estimation of relative areal proportions, determination of order of crystallization and the nature of accessory minerals and inclusions, the aim being the correlation by the Government Geologist of various scattered outcrops with known tin-producing fields.

The newly acquired Swift Point Counter machine proved a great asset in obtaining reasonably quantitative figures from petrological examinations of this nature.

Spectrographic traces of tin showed in half a dozen of these rocks, chosen at random. Tin was therefore estimated in two other granites, taken from localities believed not to be tin-bearing (Lake Grace and Koorda-Bencubbin), and found to occur in concentrations of the same order as in granites from tin-bearing Pilbara areas. These results indicate that actual tin assays of the granites would not be of value to this investigation.

(4) *Police Investigations.*—Refractive indices were measured of a number of glass fragments taken by the police from the scene of a fatal car accident. For comparison purposes, similar measurements were made of glasses from known sources.

(5) *Rock Analyses.*—A programme involving the complete analyses of twelve rock samples on behalf of a Kalgoorlie gold-mining company was completed during the year.

DIVISION VIII

Annual Report of the Chief Inspector of Explosives for the Year 1959

The Under Secretary for Mines:

For the information of the Hon. Minister for Mines I am honoured to report on the work and activity of the Explosives Branch during 1959.

Importation of Explosives.

The established system of sea-borne supplies from the factory in Victoria to Woodman's Point Explosives Reserve continued without interruption, nine shipments accounting for 99.1 per cent. of the State's importations. Except for one railage, the remainder was conveyed by iron-ore vessels plying between New South Wales and Yampi Sound.

The proven practicability of transcontinental railage to meet occasional emergency has focussed attention on full-scale application to goldmining requirements. Kalgoorlie would then become a distribution centre for local industry and that in the Mt. Margaret, Dundas, Coolgardie and probably Yilgarn fields, with consequent decreased throughput at the coastal magazine area to three or four shipments yearly. Success of the scheme depends primarily on favourable freight contracts and to some extent on the Commonwealth and State attitude towards the existing maximum 37.5 tons of explosives per train. Unless this is liberalised as in U.S.A. and South Africa, where conveyance of 250 tons or more is commonplace, the demand would necessitate weekly railages, all subject to inspection and testing. Performance of these services at such frequent intervals may strain the branch's present resources of staff and equipment, but every endeavour is being made to meet the situation.

Types of Explosives.

Although gelatin dynamite, the gelignites and semi-gelatinous explosives of various grades continued to cover the main field, significant advances were made by ammonium nitrate fuel oil mixtures for quarrying and other open-cut work using large-diameter shot-holes. The same composition was also applied successfully to geoseismic blasting. The oil may be replaced to certain advantage by other reducing agents such as molasses or raw sugar. Another explosive under observation but not yet available here consists of T.N.T. and ammonium nitrate in slurried form. An interesting point is that whereas moisture may be and usually is a deteriorating influence with conventional explosives, calculated additions of water to the slurries and sugar types are essentially requisite.

Use of Explosives.

The importance of explosives in gold mining was evident from its consuming 67.3 per cent. of the State's importations. Next in order came quarrying, including limestone for cement manufacture, at 7.0 per cent. Coal and asbestos mining each accounted for 6.3 per cent. The apparent decline to 2.7 per cent. for geoseismic use may be subject to correction because of the impact made by ammonium nitrate-fuel oil mixtures in that field. The winning of lead, tin, manganese, copper and iron ores, together with pyrites, required in total 3.8 per cent. The remaining 6.6 per cent. went into public works such as main roads, water supplies and railways, and timber getting, clay for bricks and miscellaneous unclassified purposes.

Quality of Explosives.

With improved facilities now available, chemical analysis has assumed increasing importance in the assessment of quality. It is essentially required when comparing explosive composition with authorised definition and in determining oxygen balance, of which more will be said in a later paragraph. Analysis alone, however, is no substitute for visual examination, which supplemented where necessary by sensitivity and detonation velocity measurement, has been widely exercised as heretofore. The data in total enable the 1959 importations to be described as well in conformity with the nature, substance and quality demanded. Deterioration on a small scale, due to faulty storage and occasional wetting in transit, was detected, but there were no indications of explosives having been despatched from the factory other than in sound condition.

Apart from many thousand physical inspections, laboratory and field work conducted at the Explosives Reserve and elsewhere during the year comprised—

Material.	Nature of Determination.	No. of Samples.
Explosives:	Analyses, heat testing, sensitivity, detonation velocity, moisture resistance, etc.	2,690
Fuse:	Burning rate, continuity of powder column	760
Pyrotechnics:	Percussion, analysis, firing, soundness of construction	513
Miscellaneous:	Police exhibits, identification of various materials as explosives or combustibles. Examination of illicitly manufactured materials.	

Inspection.

This work resolved itself into examination of explosives on arrival, and re-examination at a later period with due heed to the manner of transport and storage. Primary inspection, conducted practically at the ship's side, served to ensure maintenance of satisfactory quality and packaging. In carrying out the secondary phase, 114 visits were

paid to mines, quarries, water supply and road works, licensed sellers' premises and other localities where explosives were kept and used. Most of the State, except the far north, was covered. In a few instances, conscientious licensees requested return calls, which course was also pursued where necessary in determining whether previous instruction had been observed. Large consuming districts like Kalgoorlie received the closest attention because of the many problems arising in explosives technology outside the routine inspectional field.

Probably resulting from a drive for safer and more secure explosives storage, most of the larger magazines proved satisfactory. Better management than formerly, such as the use of stock in order of receipt, was to some extent reflected in reduced wastage through deterioration. Against this, several glaring instances of indifference were detected among small users, often itinerant foreign quarrymen who could not or would not understand their obligations. Frequently difficult to locate, a few of the offenders had to be dealt with by withholding explosives supplies until storage facilities to the inspector's satisfaction were established.

As for years past, munitioning of service vessels at Fremantle Harbour wharves came under the Branch's inspection. A high safety level was maintained by application of the R.A.N.R. authorities' rigid code, but the disconsolate fact remained that explosives and incendiaries were handled within potentially devastating distance of protected works. The Commonwealth, about the mid-fifties, appeared to appreciate the need for an isolated deep-water jetty intended to divert explosives and certain other dangerous goods traffic from the inner harbour. Failure to take action is deplored.

Legislation.

A draft Explosive and Dangerous Goods Act prepared by Crown Law on material submitted by the Branch required considerable alteration to align its purport with what was believed should prevail. Despite further delay, introduction of the Bill during the 1960 parliamentary session seems probable. Although a dual purpose Act may be a precedent, separate legislative regulation of explosives and dangerous goods has long been practised in New Zealand and several Australasian States. Exceptions are Victoria, where, however, means are under investigation for extending control to flammables and hazardous substances outside the ambit of the Explosives Act, and Queensland, whose Chief Inspector is working on a draft which apparently embodies much that is proposed for Western Australia.

Defective and Condemned Explosives.

The singularly few reported instances of failure or poor performance this year proved on investigation to arise from misunderstanding, misuse or poor accessory equipment. Even explosive intentionally destroyed was less in amount than formerly. It comprised small quantities deteriorated by excessive temperature or humidity, opened plugs sampled for heat-testing and miscellaneous amounts of unknown age and history. A sinister-looking collection was recovered by police from a deceased criminal's hide-out, and on two occasions detonators found in cars were lodged for disposal.

Illegal practices.

A parcel posted by a man to another against whom he bore a grudge contained about half a pound of Plastergel, an explosive capable of breaking hard rock. Although neither detonator nor automatic firing device was fitted, the Court found the sender's act dangerous and unlawful. He was convicted and punished.

The Branch's technical services were also sought by the C.I.B. in connection with outrages involving damage to vehicles by explosives. Another unusual case was that of a carpenter slightly injured by an explosion on the floor of a railway workshop. Scraps of metal later recovered were of the gauge and type usual in detonators, but how such an article came to be wedged in floorboards could not be determined.

Toxic Gases from Explosions.

The old subject of post-explosive toxic gases, or "fumes" in everday parlance, again assumed prominence when extended investigation by the Mines Inspectorate at Kalgoorlie disclosed greater average carbon monoxide (CO) concentrations than in earlier determinations conducted periodically since about 1900. In seeking explanation of this retrogression the obvious first step was chemical and physical examination of commonly-used explosives. Although everything was found in order, calculation showed that the one-inch sticks now generally used afforded a proportionately greater surface for heat dissipation than the former 1⅛ and 1¼ inch diameter, with probable lower reaction temperature and less complete combustion. This theoretical line of reasoning did not justify assumption that thin plugs were the most offensive, but purported that diameter should be kept in mind when comparing results. Other sources of contamination either not fully appreciated or documented by earlier workers were the pre-explosive atmospheric composition and the production of carbon monoxide from accessories such as safety fuse. Under simulated mining conditions in a partly-ventilated underground chamber, 0.07 per cent. CO was found ten minutes after a 9 feet master fuse and eight 3 feet lengths had burnt out. Spacers employed to separate charges in a shothole came under examination, only to show some instances where carbon monoxide actually increased when ceramics replaced wood. Another aspect considered was the behaviour of certain components in explosives—for example, the low-freezing nitroglycol added to polars. Because of its greater volatility than nitroglycerin, this compound could aggravate certain fumes if impartial detonation occurred, but its potential in terms of CO was obscure. Oxygen balance, an important property of explosives, was reviewed. Broadly speaking, a balanced explosive is one in which the slightly positive nitroglycerin and other combined oxygen are so adjusted that hydrogen and carbon should burn to water and relatively harmless carbon dioxide (CO_2), respectively. Hence a strong balance would seem desirable, except for the unfortunate fact that combined nitrogen is thereby converted to oxides twentyfold more toxic than the CO which they replace. In actual practice the best results often derive from a small negative oxygen balance. So with no gainful purpose achievable by tampering with oxygen balance, the next attack was directed toward a reduction in carbonaceous matter on the reasoning that CO can originate only therefrom. Nothing could be done about the explosive composition and little in regard to the paper wrapping, but the protective wax coating appeared to offer scope for attenuation without detriment to its purpose. During manufacture the end-sealing of prewaxed filled shells often caused excessive build-up, and in deference to widespread opinion steps have been taken to do away with this surplus oxidisable material.

Such action must be regarded as an experiment: the Explosives Branch is not yet convinced that partial elimination of wax will materially reduce poisonous gases. However, to secure first-hand information, hundreds of one-inch Semigel and Gelignite samples were drawn from several shipments, the composition removed and the wax recovered by solvent extraction of the impregnated paper. Thus the weights of all three components were established and averaged as expressed below:—

—	Semigel	Gelignite 60
Weight of whole cartridge (grams)	124·35	146·62
Weight of Composition (grams)	115·70	137·46
Weight of Paper (wax free) (grams)	4·47	4·82
Weight of total protective waxing (grams)	4·18	4·34
Number of sticks in a regulation 50 lb. net case	182	155
Oxygen Balance of Composition (calculated from analysis) (gm/100 gm.)	+3·71	+5·36
Oxygen Balance of Whole Cartridge (assuming complete burning of all wax and paper) (gm./100 gm.)	—12·46	—9·14

The extent to which the paper and wax are consumed under usual shot-firing practice is uncertain. In his 1958 monograph "The Science of

High Explosives," Dr. M. Cook asserts that destruction is often incomplete, but apparently quantitative expression is unjustifiable in view of so many variables. Some authorities assume 50 per cent. combustion as a working basis, and to show the effect of this and other degrees of destruction on oxygen balance, the following figures are submitted:—

Percentage of Wax and Paper Consumed	Oxygen Balance (grams per 100 grams)	
	Semigel 1 in.	Gelignite 60, 1 in.
0	+ 3·71	+5·36
25	— 0·53	+1·49
50	— 4·51	—2·05
75	— 8·49	—5·59
100	—12·46	—9·14

These values indicate a satisfactory balance around 50 per cent. destruction, above which there appears justification for recommending the minimum of wax to give protection. This, then, is the aspect of the problem under exploitation. Negotiation and team work have culminated in a promised five-month supply of waxless-ended explosives for exhaustive long-run trials on the Eastern Goldfields, and other Australasian States have also signified interest in the innovation.

In undertaking the work just described, the Explosives Branch enjoyed valued co-operation of the State Mining Engineer and staff, the Chamber of Mines and individuals too numerous to mention. Messrs. Nobel, as manufacturers of the explosives, readily acquiesced in the plans outlined. The Victorian Chief Inspector of Explosives, after initial reluctance to reduce the moisture-resistant wax coating, later agreed to release large experimental consignments. He was doubtless influenced by deliberations of the interstate explosives conference at Brisbane, where the subject of fumes figured prominently on the agenda. Over the years another approach has been made by the Senior Inspector at Kalgoorlie in consistently advocating better ventilation whilst at the same time conceding the virtue of practices intended to suppress toxic gases at source. Whatever the results of the forthcoming trials, scheduled to run from about May to October, 1960, the necessity for ventilation will always remain.

Other Investigations.

Low heat-test results breaking sequences of no reaction in 30 minutes have been ascribed to traces of copper compounds entering the first explosive extruded after an idle period. As possible contamination from copper laboratory ware also seemed worthy of notice, a short investigation was undertaken. Copper sulphate and the commercial carbonate, in that order, proved very active, though strangely the basic chloride had little effect. These observations, so far only semi-quantitative and based on short contact between explosive and foreign material, will be continued when opportunity occurs.

About mid-year, dark green stains not previously encountered on explosive composition at first sight portended some derangement until the discoloration was proved to coincide with printing on the innermost roll of wrapping paper. Heat test and other properties were normal, and later came confirmation that a new ink had been introduced.

My predecessor's article on Explosives in the 1946 edition of "Hints to Prospectors and Owners of Treatment Plants" was rewritten and brought up to date for inclusion in the current publication. The Branch also endeavoured to assist a couple of Government departments in preparing instructions for foremen and others on the storage and use of explosives. The weightiest job of this description, however, was completion of the Perth Explosives Conference edited transcript of proceedings. Copies were sent to all concerned.

Mr. Greaves took opportunity of inspecting banana-ripening rooms in Brisbane when there on conference business. His interest in the matter stemmed from an investigation, report and evidence at a coronial inquiry into the death of a man due to explosion of an acetylene-charged chamber at Geraldton. Acetylene, he found, was banned in Queensland, and other ripening agents like coal gas and ethylene were strictly controlled and inspected in use by the Explosives Department. Under West Australian conditions these functions are exercised by the Chief Inspector of Factories, to whom an account of practices and findings in other States was duly furnished.

Explosives Reserves.

Reconditioning of approach roads, grading within the area and attention to lightning arrestors was undertaken at Kalgoorlie. The coastal reserve at Wodman's Point, apart from routine maintenance, called for little upkeep beyond replacing several chains of corroded railroad lines and renewal of the jetty turntable.

Conferences.

Mr. Greaves and the writer both attended the sixth Australasian and New Zealand Explosives Conference at Brisbane from October 20th. Business sessions, interspersed by visits to the Dakabin Explosives Reserve and similar interesting places, extended over six working days. Some of the older discussions were continued in the light of more recent knowledge and development, and in addition considerable new material came under review. From the West Australian angle, information imparted and expressed opinions on "fumes," ammonium nitrate-fuel oil explosives, lightning protection, electrostatic hazards and various other subjects have proven valuable adjuncts to the Branch's work. Even matters not ordinarily controlled by Explosives Acts but often referred to inspectors were included in the agenda. Among these may be mentioned spontaneous combustion of textiles, wastes and dusts, acetylene explosions and certain aspects of flammable liquids. On the outward journey Mr. Greaves spent five days at Melbourne to investigate modern explosives manufacture.

The writer was asked by the Premier's Department to report at Macedon, Victoria, for a short course of instruction in civil defence, commencing September 27th. The dominant theme naturally was nuclear warfare, its consequences and measures to be pursued by the civilian population, but more than a modicum of interest to the commercial explosives man emerged from the tuition, demonstrations and discussions. For example, safety distances separating a likely attack locality from blasting explosives were considered. The non-military use of fissionable material, already receiving attention in U.S.A., may eventually make inroads elsewhere and therefore some advance knowledge of this potent agent may not be amiss.

Pyrotechnics.

A Japanese manufactured missile intended to scare birds by delayed explosion when fired from a shotgun was promptly brought under notice of the Firearms Branch. Another article of similar purpose comprised impregnated rope which smoldered on ignition to explode attached charges at about 20 minute intervals. Trials according to instructions resulted in a possible fire hazard from falling incandescent particles. The explosive capsules, fairly readily removable, were found to fire instantly and violently, with probable dire consequences to juveniles thinking the things were merely crackers. The device was not banned for legitimate use, although the Agricultural Department advised that bird scaring by sound, initially successful, deteriorated progressively in effectiveness as the predators became accustomed to such disturbances.

The usual frequent consignments of shopgoods or toy class fireworks called for much inspectional, analytical and firing-test work from about March to early November. Several new contenders for a share in the local market sent advance sample boxes containing unacceptable varieties, but showed commendable readiness to modify, improve or even withdraw anything to which exception was drawn. By such reciprocal action the Branch was saved the disagreeable duty of condemning perhaps case lots which might have been imported without preliminary inquiry. We still look askance on oversize

fireworks, believing that greater weights of explosive charge and pyrotechnic composition than those established by Conference increase the danger element disproportionately. Though prohibited for general sale, the heavier lines are not restricted for public display by competent pyrotechnicians. A few of the small class were turned down because of erratic unpredictable flight, and one maker was asked to rectify faultily ejected stars which failed to extinguish before landing. It transpired that a nitrate-charcoal mixture was used because gunpowder containing sulphur was inadmissable in contact with chlorate-bearing stars. The principle was right; all British Explosives Acts disallow admixed sulphur and chlorate, but this is never construed to debar fireworks with stars and gunpowder in the same or contiguous compartments.

Staff Matters, etc.

Several minor changes in the night-watching staff occurred. To present members and those no longer with us the Branch expresses gratitude for faithful application to important if monotonous duty. Magazine Keeper Wightman and Assistant Nissen are also commended for efficient management of the Reserve. In Perth Mr. Calneggia, on the clerical side, has done a good job during a year in which Mr. Greaves' and my outdoor and interstate commitments often left him as the sole occupant of the office. In conclusion, appreciation is recorded of the cordiality extended to the Branch by all with whom it contacts.

F. F. ALLSOP,
Chief Inspector of Explosives.

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 Department for the year 1959.

The State Public Health Department, under arrangements made with this Department, continued the periodical examination of mine workers, the work being carried on throughout the year at the Kalgoorlie District Hospital and a mobile X-ray unit visited the North Coolgardie, Mount Margaret, East Murchison, Murchison, Pilbara, West Pilbara, Coolgardie, Dundas, Phillips River and Yilgarn Goldfields and Capel and Esperance outside any Proclaimed Gold or Mineral Field.

Mine Workers' Relief Act.

The examinations under the Mine Workers' Relief Act during the year totalled 5,818 as compared with 5,714 for the previous year, an increase of 104. The results of the examinations for 1959, together with the figures for the previous years, are shown in the table annexed hereto. Graphs are also attached illustrating the trend of examinations since 1940. In explanation of these figures I desire to make the following comments:—

Normal, etc.—These numbered 5,242 or 90.10 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 5,154 or 90.20 per cent.

Early Silicosis.—These numbered 551 of which 66 were new cases and 485 had been previously reported, the figures for 1958 being 46 and 483 respectively. Early silicotics represent 9.47 per cent of the men examined, the percentage for the previous year being 9.26 per cent.

Advanced Silicosis.—There were 9 cases reported and all were men who advanced from early silicosis during the year. Advanced silicotics represent 0.15 per cent of the men examined, the percentage for the previous year being 0.42 per cent.

Silicosis Plus Tuberculosis.—Seven cases were reported compared with six in 1958.

Tuberculosis Only.—Three cases were reported compared with one in 1958.

Asbestosis.—Six cases of asbestosis were reported, five of early asbestosis and one of asbestosis with associated silicosis.

Mines Regulation Act.

Examinations under the Mines Regulation Act totalled 1,451. These were in addition to the 5,818 examinations under the Mine Workers' Relief Act. There was a decrease of 68 examinations under this Act in 1959 as compared with those in 1958. Of the total of 1,451 men examined, 1,027 were new applicants and 424 were re-examinees.

Particulars of the examinations are as follows:—

New Applicants:	
Normal	1,005
Pneumoconiosis	5
Query Tuberculosis	6
Silicosis early plus query Tuberculosis	1
Other conditions	10
Total	1,027

Of the above applicants for admission into the industry, 1,005 received the Initial Certificate (Form 2), 5 received the Temporary Rejection Certificate (Form 3), 15 received the Rejection Certificate (Form 4) and in two cases no certificate was issued. Thus of the 1,027 applicants, 1,005 or 97.85 per cent were eligible for employment anywhere on a mine.

Re-examinations:	
Normal	298
Pneumoconiosis	78
Silicosis early	30
Query Tuberculosis	3
Pneumoconiosis plus query Tuberculosis	3
Silicosis early plus query Tuberculosis	3
Silicosis early plus Tuberculosis	2
Other conditions	7
Total	424

These men had previously been examined and some were engaged in the industry prior to this examination. Three hundred and thirty received the Initial Certificate (Form 2), five received the Temporary Rejection Certificate (Form 3), 30 received the Re-admission Certificate (Form 5), 31 received the Special Certificate (Form 9) and in 28 cases no certificate was issued. Thus of the 424 men examined, 360 were eligible for employment anywhere on a mine, 31 were eligible for surface work only and 33 were not eligible to work on a mine.

Grouping the two sets of figures discloses that the following certificates were issued under the Mines Regulation Act:—

Initial Certificates (Form 2)	1,335
Temporary Rejection Certificates (Form 3)	10
Rejection Certificates (Form 4)	15
Re-admission Certificates (Form 5)	30
Special Certificates (Form 9)	31
No Certificates	30
Total	1,451

The percentage of men of normal health (Initial Certificates) to the number examined was 92.01 per cent. compared with 89.33 per cent. in 1958.

(10)—37498

Miner's Phthisis Act.

The amount of compensation paid during the year totalled £13,718 9s. 8d. compared with £14,969 15s. for the previous year.

The number of beneficiaries under the Act on the 31st December, 1959, was 127, being 11 ex-miners and 116 widows.

Administrative.

The 1958 amendment to the Mine Workers' Relief Act to broaden the scope of the Act to include asbestosis was proclaimed in the *Government Gazette* of the 27th February, 1959 (Sections 5 and 7A).

The amendment to Regulation 48 under the Mine Workers' Relief Act which appeared in the *Government Gazette* of the 6th April, 1959, was only of a corrective nature.

On the 29th July, 1959, the Hon. Minister for Mines took over a new mobile x-ray unit for the radiological examination of mine workers in outlying districts and which replaces the old Austin unit. The new equipment is mounted on a five ton semi-trailer diesel Austin truck, the van for which was built by the students of the Perth Technical College under the supervision of the Public Works Department, while the x-ray plant was installed under the direction of the Public Health Department. The completed unit cost approximately £4,500.

W. Y. R. GANNON,
Chairman, Miner's Phthisis Board,
and Superintendent, Mine Workers' Relief Act.

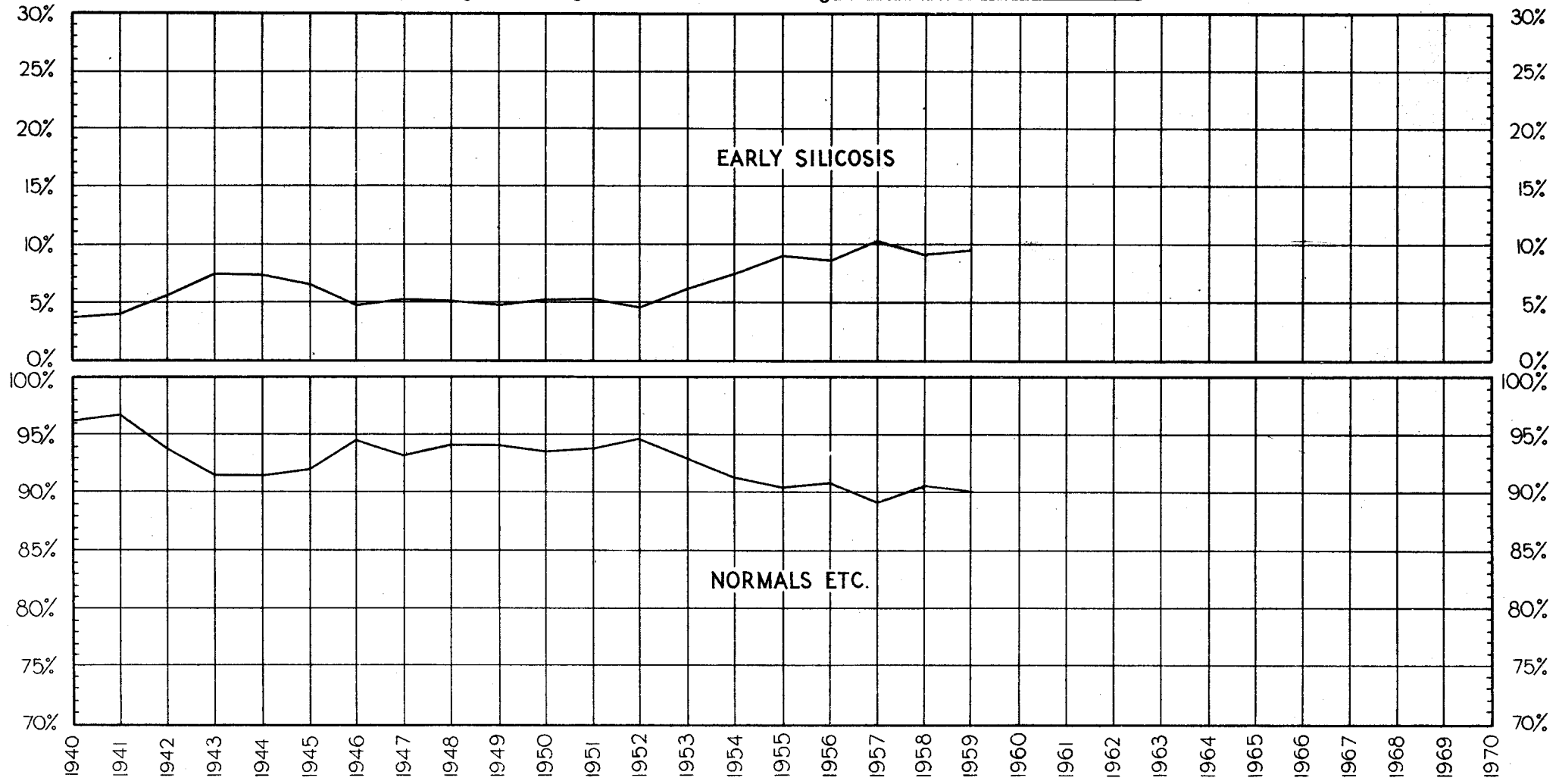
Table Showing Results of Periodical Examination of Mine Workers from Inception of Examinations (1925).

Year of Examination	Normal, etc.				Silicosis Early					Silicosis Advanced						Silicosis plus Tuberculosis							Tuberculosis Only				Total number of men examined
	Previously reported as Normal, etc.	New Cases	Total	Per cent.	Previously reported as Normal, etc.	Previously reported as Silicosis Early	New Cases	Total	Per cent.	Previously reported as Normal, etc.	Previously reported as Silicosis Early	Previously reported as Silicosis Advanced	New Cases	Total	Per cent.	Previously reported as Normal, etc.	Previously reported as Silicosis Early	Previously reported as Silicosis Advanced	Previously reported as Silicosis plus Tuberculosis	New Cases	Total	Per cent.	Previously reported as Normal, etc.	New Cases	Total	Per cent.	
1925	....	....	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
1952	5,073	....	5,073	94·6	8	234	....	242	4·5	....	4	31	....	35	·6	....	2	....	....	....	2	·1	7	....	7	·1	5,359
1953	4,474	....	4,474	93·03	74	225	....	299	6·22	....	8	24	....	32	·6	....	2	....	....	....	2	·1	2	....	2	·1	4,809
1954	5,142	....	5,142	91·33	154	275	....	429	7·62	....	22	21	....	43	·76	1	6	2	....	....	9	·1	7	....	7	·1	5,630
1955	4,559	....	4,559	90·40	63	386	....	449	8·90	....	9	22	....	31	·62	1	1	1	....	....	3	·06	1	....	1	·02	5,043
1956	4,600	....	4,600	90·78	25	401	....	426	8·41	....	8	25	....	33	·65	1	3	....	....	....	4	·08	4	....	4	·08	5,067
1957	3,925	....	3,925	89·08	30	424	....	454	10·30	....	8	10	....	18	·41	1	4	....	....	....	5	·12	4	....	4	·09	4,406
1958	5,154	....	5,154	90·20	46	483	....	529	9·26	....	15	9	....	24	·42	....	6	....	....	....	6	·10	1	....	1	·02	5,714
1959	5,242	....	5,242	90·10	66	485	....	551	9·47	....	9	....	....	9	·15	1	5	1	....	....	7	·12	3	....	3	·05	5,812
																Asbestosis:											
																	Asbestosis Early			....	....	....	1				
																	Asbestosis with Silicosis			....	....	....	5				
																									6	·10	6
																											5,818

PERIODICAL EXAMINATION OF MINE WORKERS

GRAPH No 1

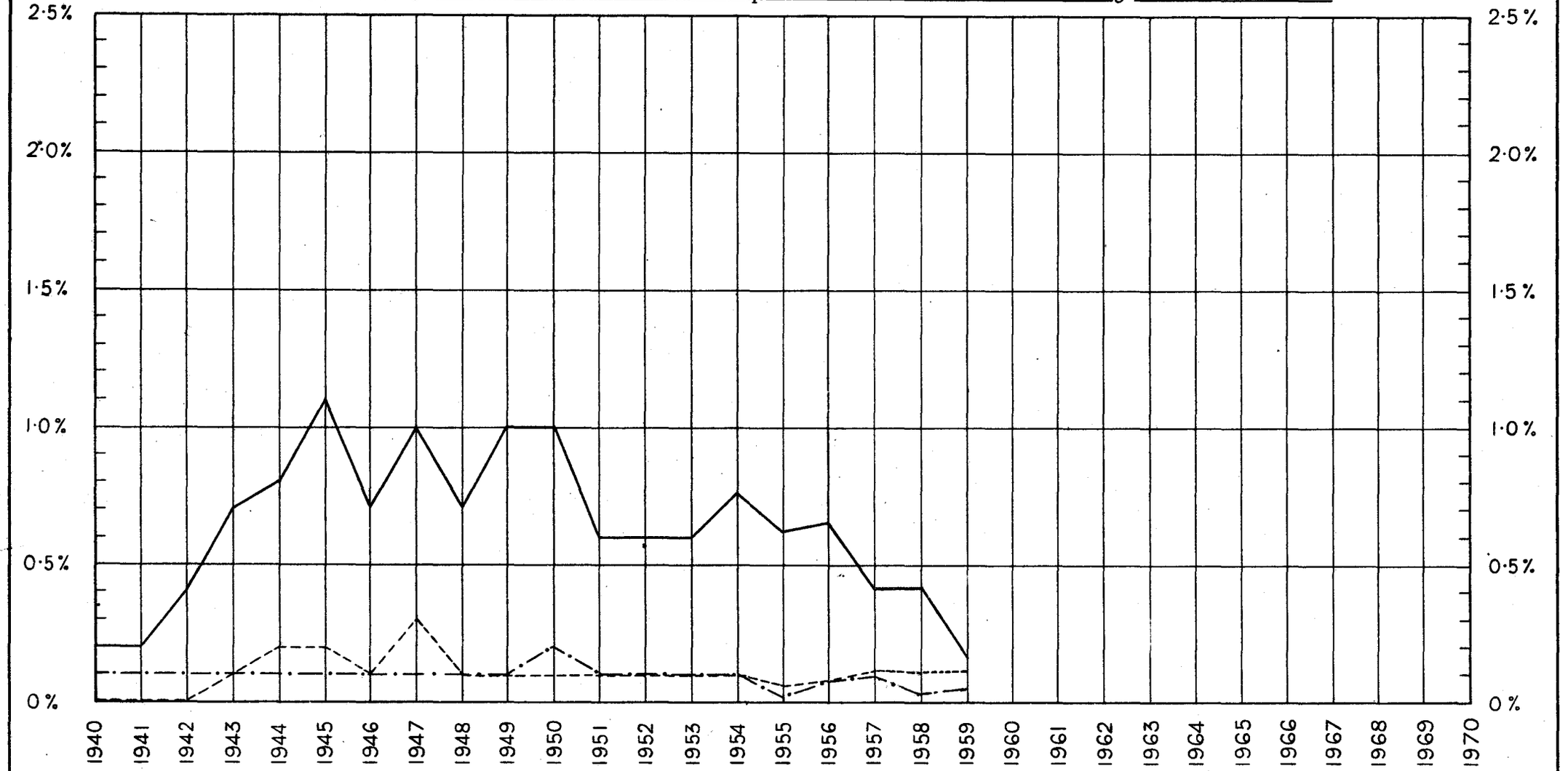
Showing Percentages of Normals and Early Silicotics from 1940 onwards



PERIODICAL EXAMINATION OF MINE WORKERS

GRAPH No. 2

Showing Percentages of Silicosis Advanced, Silicosis plus Tuberculosis and Tuberculosis only, from 1940 onwards



Silicosis Advanced ———— *Silicosis Plus Tuberculosis* – – – – – *Tuberculosis Only* —·—·—·—

DIVISION X

Report of the Chief Coal Mining Engineer for the Year 1959

Under Secretary for Mines:

I have the honour to submit the annual report on the operations of the Collie Coalfield for the year ended December, 1959.

The aggregate output of all mines was 911,434 tons, as compared with 870,882 tons for the previous year. This output is an increase of 40,552 tons or 4.45 per cent on the previous year, and is the second largest output on record. The highest output produced was during 1954 when 1,018,342 tons were produced. However, only 110,578 tons of open-cut coal or 12.14 per cent of the total were produced during the year under review as compared with 410,616 tons or 40.32 per cent of the output during 1954.

The deep mines produced, for the fifth consecutive year, a record output of 800,856 tons.

The above deep-mined output is not a true reflection of the potentialities of the deep mines, as both Western and Griffin Companies did not by any means produce to capacity. The whole of the output for 1959 could have been produced from the deep mines.

The outputs of the individual Companies for the year were as follows:—

	Tons.	*Per Cent. to Total.*
Amalgamated Collieries of W.A. Limited	633,916	69.55
Griffin Coal Mining Company Limited	130,445	14.31
Western Collieries Limited	147,073	16.14
Total	911,434	100.00

Details of the outputs of the individual mines and a comparison with the previous year are shown in Table "A".

The average value per ton was 52/4d. during 1958 and 51/9d. during 1959.

An examination of Table "A" shows that the Co-operative, Neath, Ewington and Western No. 2 Mines produced 675,250 tons or 74.08 per cent of all coal produced, or 84.31 per cent of the deep-mined output.

As previously stated, Western No. 2 Mine did not produce to capacity due to lack or orders. It is thus easy to visualise how the deep mines could have produced all the coal required by consumers.

Consumption of Coal.

Details of the consumption of coal by Government Instrumentalities and Private Consumers are shown in Table "B".

It will be noted that the W.A. Government Railways consumed 295,606 tons or 32.43 per cent of the total, the State Electricity Commission 449,345 tons or 49.33 per cent and the Collie Power Station 67,957 tons or 7.45 per cent.

Government Instrumentalities consumed a total of 812 908 tons or 89.21 per cent of the total consumption.

The consumption by the State Electricity Commission will probably reach 500,000 tons during 1960.

The consumption by other consumers will probablf remain at about the same level.

DEVELOPMENTS.

Wyvern Mine.

During the month of March a spontaneous heating occurred in some old workings. The analysis of the air samples taken in the return side of the fire indicated that the heating was in a very advanced stage and in view of the comparatively short life of the mine and the large expenditure involved in sealing off the area containing the heating, it was decided to seal off the mine on the surface, but to re-open it at a later date to recover the vast amount of materials left in the mine.

The mine was sealed off on Saturday, March 14th, and the employees transferred to the Hebe Mine. Analysis of the mine air was made by the Inspectorate each week and at the end of July it was decided that the mine could be re-opened for the recovery of materials only. The seals were removed during the week-end of July 26th and the recovery work commenced on Monday, July 27th.

Every precaution was taken to prevent any mishap and it is to the credit of all concerned that no mishaps did occur. The Company obtained the services of two persons from the Perth Fire Brigade with all the equipment necessary to carry out rescue work. It was decided on Tuesday, July 28th, after making the necessary inspections, that the services of the rescue men were no longer required.

The recovery proceeded on two shifts per day and at the end of a fortnight all materials considered to be of value, down to the water level, were removed to the surface. Materials to the value of many thousands of pounds were thus salvaged and available for use elsewhere.

The mine was then permanently sealed off and abandoned.

Stockton Mine.

During the early part of the year Amalgamated Collieries decided to cease developments at this mine and to concentrate the employees on production only. The employees were to be transferred to the Company's mechanised mines as and when the production faces at the mine terminated.

It was, however, decided to split pillars whereever possible and a few of the employees were retained at the mine for that purpose. At the end of the year the latter policy was still in operation and would probably continue for a few more months.

Ewington Open Cut.

This open cut ceased production at the end of June and was finally abandoned. Negotiations were commenced between the Company and the Miners' Union to commence another deep mine west of the Ewington deep mine. This was to be commenced as an open cut in a similar manner to the existing deep mine until sufficient depth had been reached to commence the tunnels. At the end of the year the tunnels had not been commenced and coal was still being produced by open-cut methods.

Neath Mine.

During the year the development headings reached the practical limit where production faces could be developed on an efficient and economical basis. The Company decided to concentrate production on the Retreating System in the panels previously developed. This was the beginning of the end of the Neath Mine although a considerable amount of coal will continue to be produced before the mine finally ceases production.

Production from this mine will be replaced from the Company's other deep mines, especially the Ewington No. 1 and No. 2 Mines.

Co-operative Mine.

This mine produced 231,407 tons or 25.39 per cent of the total output or approximately 30 per cent of the total deep-mined output.

At the latter end of the year the physical conditions on both the east and west sides of the mine deteriorated due to geological disturbances and involved inferior roof conditions causing loss of output. It appears that the west side is advancing towards a fault which was proved many years ago in the old west end workings and as the existing workings advance conditions will probably deteriorate further.

The quality of the coal on this side of the mine has also deteriorated due to the intrusion of dirt bands or carbonaceous shale of low calorific value. The wisdom of further developments in this direction is questionable. It would be prudent for the management to consider the introduction of selective mining on the retreating system of work, as there might be a further deterioration in the quality of the coal which would not be popular with the consumers.

Ewington Mine.

This mine produced 139,755 tons or 15.33 per cent of the total production as compared with 63,880 tons or 7.34 per cent for the previous year.

There are two seams of coal available, approximately 30 feet apart. Up to the present, production has been confined to the lower seam but arrangements have been made for the development of the top seam. The management would be well advised to concentrate on the development of the top seam and work both seams simultaneously and thus avoid duplication of main roads and equipment.

The coal from this mine enjoys a good reputation by the consumers, especially for gas-making purposes.

This mine has potentialities of becoming a large producer and such being so the management would be well advised to have the leases thoroughly bored as they are in faulted country.

Western No. 2 Mine.

This mine did not work up to capacity during the year due to lack of orders. In spite of such circumstances the mine produced 112,773 tons or 12.37 per cent of the total output as compared with 79,766 tons or 9.16 per cent of the total for the previous year. The output is thus an increase of 33,007 tons or 41.5 per cent on the previous year's output.

Considering the comprehensive programme of development undertaken during the year the above-mentioned output is highly satisfactory and all concerned are to be commended.

During the latter part of the year a commencement was made to drive two headings to the rise on the east side of the mine to couple up with the main dip headings which were abandoned due to the intrusion of vugs in the early career of the mine. Good progress was made with same and it is hoped that a connection will be made early during 1960. When a connection is satisfactorily made it will enable the management to split the air current if necessary as well as considerably increase the output if need be. The connection will provide an additional haulage road which could assume an important part in the future of the mine.

Western No. 4 Mine.

This mine was commenced at the latter end of 1957 to absorb some of the employees from the Western No. 1 Mine.

The output for 1959 was 34,300 tons as compared with 7,565 tons the previous year, a large increase considering it was obtained from development places only.

The potential of the mine is not large as the lease is very faulted and the mine will never take an important part in the future of Collie.

Hebe Mine.

Production at this mine was again restricted due to lack of orders. However, production increased from 20,432 tons in 1958 to 45,110 tons during 1959, an increase of 24,678 tons. Most of the production was obtained from development places. The potential of the mine was thus considerably increased and the mine could, given the orders, produce a large output.

During the year further experiments were made with roof bolts which proved successful. During the latter end of the year the Roof Bolting Committee agreed for all lateral work to be supported on roof bolts only, thus saving much timber and labour in its erection.

The majority of the employees are on development, yet the results are amongst the most efficient in Collie.

General.

The deep mines, for the fifth year in succession, produced a record output with 800,856 tons or 87.86 per cent. of the total output. Both the Western and Griffin Collieries did not produce to the capacity of their deep mines due to lack of orders, and, given sufficient orders the deep mines could have produced all the State's requirements of coal.

The Collie Coalfield continues to be the most highly mechanised in Australia and its efficiency could be materially improved if the Retreating System of work was adopted throughout, laying out all the production places to the rise, wherever possible, so as to produce natural drainage and avoid difficulties due to water. Such a layout has been accomplished in two mines with excellent results, both physically and economically. The layout is such that as each panel is worked out and all material recovered, the panel is immediately sealed off so there are no old workings to inspect or any to cause difficulties due to creeps or spontaneous heating. Much anxiety and expense to the management is thus avoided.

During the year more progress was made with the use of roof bolts and at one mine all the lateral production places are supported solely by roof bolts. Much time and timber is thus saved, allowing a greater proportion of time on production. The rate of advance of production places at Collie, and thus the output, is governed entirely by the rate at which roof supports can be erected The use of roof bolts, in conjunction with timber, must therefore absorb less time and timber and effect an improved efficiency and economy.

Unfortunately much output was lost at some mines due to lack of ventilation and one cannot but stress the fact that the use of a little science would avoid such losses. Efficiency of ventilation is not entirely a matter of providing a large volume of air at the working face. A lower volume of air would often suffice provided a good velocity pattern is arranged. The working comfort of the employees must be considered and there is no useful purpose served by playing strong currents of air on men working at the coal face. The thermal environmental limits for normal work in mines is a complex subject and no useful purpose can be served in labouring details of same in this report. The matter is at present the subject of intense research in England and probably their findings will be published during the next two years.

The use of horses in mines is another matter requiring attention. The opinion expressed by some people that they cannot be disposed of is

a fallacy. As an example, in England during 1938 there were 32,059 horses in the mines. During 1958 there were 10,446 horses in the mines, a reduction of 21,613 or 67 per cent. There are three mines in Collie that have successfully eliminated the use of horses and the same results can be achieved at all the other mines.

Underground Fires.

During the year only one case of spontaneous heating occurred. The heating occurred in some old workings and, peculiarly, when discovered, it had passed the incipient stage and an active fire was taking place. If the old workings had been regularly examined it is difficult to visualise how this fire could have reached such an active stage prior to discovery. To prevent such occurrences it seems apparent that all old workings should be effectively sealed off when production ceases and all useful equipment removed.

During the year there were instances of belt fires which were fortunately discovered in their early stages and effectively dealt with without serious mishap. The use of mechanised machinery for the production and transportation of coal must obviously increase substantially the potentiality of fires. All such machinery uses mineral oil as a lubricant, spillage takes place making the small coal more vulnerable to fire. The hydraulic system can become overheated, cables can be overloaded and, if lying under small coal could set fire to same. In England during 1957 ten serious belt fires occurred and one cannot but recall that during 1950 a disastrous belt fire occurred at Creswell Colliery when eighty-four men lost their lives.

An analysis of the foregoing might serve a useful purpose. Three were caused by collapsed bearings or jammed rollers in contact with small coal. One was caused by a flexible coupling in contact with coal dust. Two were caused by obstructions between belt and structure. Four were caused by the belt being jammed or stalled. The above-mentioned are common to any coalfield, including Collie.

The utmost vigilance by all concerned is of paramount importance in the prevention of belt fires. Research work is now in progress towards arriving at the setting of safety standards for fluids used in various hydraulic systems and developing non-inflammable fluids that can be safely used. No fluid has yet been produced which is entirely satisfactory in practical use. Such research work is important as the consequences of an oil fire underground could be very serious.

The use of non-inflammable belts has been stressed by the Mines Department for many years but this is not the complete answer as many fires have occurred on gear heads, tail ends and also along the conveyors, due to defective rollers.

The need for cleanliness, the elimination of small coal along the whole length of the conveyors at all times is of paramount importance in preventing belt fires. There should be an adequate supply of fire extinguishers maintained at all strategic points.

The need for some form of rescue organisation seems apparent.

Accidents

The total number of accidents was 125, which included two fatal accidents. Of the total 20 occurred on the surface.

Considering the reduction in the number of mines and especially the number of persons employed one would have expected a decrease.

During the year two fatal accidents occurred, one to a machine operator and the other to an assistant fitter. Both accidents were unfortunate occurrences that often take place in coal mining, especially when mechanised.

Table "G" shows the number of accidents at each mine and the rate of accidents per 100 men employed (effective workers on shift) per 10,000 shifts worked and per 100,000 tons produced. An examination of same shows very little change in either category.

The number of accidents in mechanised mines in most coalfields is usually less than in hand-getting mines and such is the case in the Collie Coalfield. However, a further reduction in the number of accidents would be very welcome.

G. MORGAN,
Chief Coal Mining Engineer.

TABLE A.

Tabulated Data Showing Tonnage and Value of Coal Produced from Individual Mines as Reported to the Mines Department during 1958 and 1959.

Mines	1958		1959		Increase on 1958	Decrease on 1958	Estimated Value, 1958	Estimated Value, 1959
	Output	Percentage of Total	Output	Percentage of Total				
Deep Mines—	Tons		Tons		Tons	Tons	£	£
Co-operative	222,361	25·53	231,407	25·39	9,046	....	588,771	612,571
Neath	224,906	25·82	191,315	20·99	....	33,591	595,881	506,851
Stockton	78,689	9·03	39,385	4·32	....	39,304	211,280	104,893
Ewington	63,880	7·34	139,755	15·33	75,875	....	170,348	371,292
Wyvern	37,574	4·32	6,811	0·75	....	30,763	89,238	16,176
Hebe	20,432	2·33	45,110	4·95	24,678	....	48,525	99,172
Western No. 1	44,222	5·07	....	....	....	44,222	120,022	....
Western No. 2	79,766	9·16	112,773	12·37	33,007	....	209,115	296,062
Western No. 4	7,565	·86	34,300	3·76	26,735	....	19,858	90,808
Total	779,395	89·50	800,856	87·86	21,461	....	2,053,038	2,097,825
Open Cuts—								
Ewington No. 1	5,078	·58	22,804	2·51	17,726	....	13,507	59,876
Ewington No. 2	....	....	9,250	1·01	9,250	....	....	24,456
Muja	51,739	5·94	78,524	8·62	26,785	....	122,881	174,377
Western No. 3	34,670	3·98	....	....	....	34,670	91,223	....
Total	91,487	10·50	110,578	12·14	19,091	....	227,611	258,709
Deep Mines	779,395	89·50	800,856	87·86	21,461	....	2,053,048	2,097,825
Open Cuts	91,487	10·50	110,578	12·14	19,091	....	227,611	258,709
GRAND TOTAL	870,882	100·00	911,434	100·00	40,552	....	2,280,649	2,356,534

TABLE B.

Tabulation Showing Estimated Apportionment of Coal Sold During 1959.

Colliery	Locos.	Per cent.	Trams Power	Per cent.	Private Large	Per cent.	Private Small	Per cent.	Kalgoorlie Electric and Power Corp.	Per cent.	Collie Power House	Per cent.	Total
	Tons		Tons		Tons		Tons		Tons		Tons		Tons
Co-operative	85,528	9·38	80,894	8·87	693	·08	5	....	....	....	67,126	7·36	234,246
Ewington / Ewington Open Cut	69,212	7·59	*95,828	10·51	2,842	·31	291	·03	....	....	798	·09	168,971
Neath	56,195	6·16	135,035	14·81	72	....	....	....	....	....	9	....	191,311
Stockton	25,492	2·79	12,025	1·31	1,854	·20	....	....	....	....	15	....	39,386
Wyvern	....	....	2,156	·23	761	·08	3,416	·37	1,200	·13	....	....	7,533
Hebe / Muja Open Cut / Western No. 2 / Western No. 4	31	....	38,422	4·21	13,002	1·43	32,143	3·53	39,315	4·31	....	....	122,913
	59,148	6·48	84,985	9·32	2,607	·29	329	·03		....	9	....	147,078
Total	295,606	32·43	449,345	49·33	21,831	2·39	36,184	3·96	40,515	4·44	67,957	7·45	911,438

* Includes 20,411 tons for S.E.C. Gas.

TABLE C.

Comparison of Overall Production Losses for 1958 and 1959. Showing Where Losses Occurred.

Year	Pit Top Meetings	Railway Wagon Shortages	Strikes	Other Causes	Total
	Tons	Tons	Tons	Tons	Tons
1958	4,115	450	2,600	18,115	25,280
1959	3,550	1,930	*Nil*	11,775	17,253
Increase on 1958	....	1,480	....	....	....
Decrease on 1958	565	....	2,600	6,340	8,027

TABLE D.

Tabulation Showing Estimated Apportionment of Collie Coal Sold During the Five Years 1955-1959.

Year	Railways	Per cent.	S.E.C.	Per cent.	Collie Power House	Per cent.	Cement Works	Per cent.	Kalgoorlie Electric and Power Corp.	Per cent.	Private Consumers	Per cent.	Total
	Tons		Tons		Tons		Tons		Tons		Tons		Tons
1955	318,986	34·30	353,802	39·15	51,777	5·73	65,826	8·02	37,977	4·20	75,423	8·34	903,791
1956	298,276	35·94	378,185	45·57	55,742	6·72	....	....	36,197	4·36	61,585	7·42	829,985
1957	269,712	32·16	408,464	48·70	62,523	7·46	....	....	36,661	4·37	61,293	7·31	838,653
1958	280,520	32·21	428,580	49·21	62,918	7·22	....	....	38,032	4·36	60,828	6·98	870,878
1959	295,606	32·43	449,345	49·33	67,957	7·45	....	....	40,515	4·44	58,015	6·35	911,438
Increase or Decrease since 1955	—23,380	....	+95,543	....	+16,180	....	—65,826	....	+2,538	....	—17,408	....	+7,647
Per cent. Increase or Decrease since 1955	—7·32	....	+27·00	....	+31·24	....	—100·00	....	+6·68	....	—23·08	....	+8·74

TABLE E.

Collie Coal Produced 1950-1959 (as officially reported to the Mines Department by the Producers).

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons
Open Cuts	258,310	368,330	411,344	393,147	410,616	304,130	208,541	148,779	91,487	110,578
Deep Mines	556,042	480,145	419,117	493,035	607,727	599,662	621,464	689,881	779,395	800,856
Aggregate All Mines	814,352	848,475	830,461	886,182	1,018,343	903,792	830,005	838,660	870,882	911,438
Percentage Open Cuts to Aggregate	31·72	43·41	49·53	44·36	40·32	33·65	25·13	17·74	10·51	12·14
Percentage Deep Mines to Aggregate	68·28	56·59	50·47	55·64	59·68	66·35	74·87	82·26	89·49	87·86
Persons Employed*	1,099	1,125	1,281	1,463	1,560	1,386	1,219	1,136	1,075	1,011

* Effective Workers on Shift.

TABLE F.

SERIOUS ACCIDENTS—COLLIE COALFIELD, 1959.

	Month												Total
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Major Injuries—Exclusive of Fatal—													
Fractures :													
Head	....	....	....	....	....	....	....	....	....	....	....	....	....
Shoulder	....	....	....	....	....	....	....	....	....	....	....	....	....
Arm	....	....	....	....	....	....	....	....	....	....	....	....	....
Hand	....	....	....	....	....	....	....	....	....	....	1	....	1
Spine	....	....	....	....	....	....	....	....	1	....	....	....	1
Rib	....	....	....	....	....	....	....	....	....	1	....	....	1
Pelvis	....	....	....	....	....	....	....	....	1	....	....	....	1
Thigh	....	....	....	....	....	....	....	....	....	....	....	....	....
Leg	....	....	1	....	....	....	....	....	....	....	....	....	1
Ankle	....	....	....	....	....	....	....	....	....	....	....	....	....
Foot	....	....	....	....	....	....	....	....	....	1	....	....	1
Amputations :													
Arm	....	....	....	....	....	....	....	....	....	....	....	....	....
Hand	....	....	....	....	....	....	....	....	....	....	....	....	....
Finger	....	....	....	1	....	....	....	....	....	....	1	....	2
Leg	....	....	....	....	....	....	....	....	....	....	....	....	....
Foot	....	....	....	....	....	....	....	....	....	....	....	....	....
Toe	....	....	....	....	....	....	....	....	....	....	....	....	....
Loss of Eye	....	....	....	....	....	....	....	....	....	....	....	....	....
Serious Internal	....	....	....	....	....	....	....	....	....	....	....	....	....
Hernia	....	1	....	....	....	....	....	1	2	....	1	....	5
Dislocations	....	....	....	....	....	....	....	....	....	....	....	....	....
Other Major	....	....	....	....	....	....	*1	....	....	....	†3	....	4
Total Major	....	1	1	1	....	....	1	1	4	2	6	....	17
Minor Injuries—													
Fractures :													
Finger	....	....	....	....	1	....	....	....	....	....	....	....	1
Toe	....	....	....	....	....	....	1	....	....	....	....	....	1
Head	....	....	....	....	....	....	....	....	....	....	....	....	....
Eyes	....	....	....	1	....	....	1	....	....	....	....	1	3
Shoulder	....	....	....	1	1	....	....	1	....	1	....	....	4
Arm	1	1	....	4	1	2	....	....	....	....	....	....	9
Hand	1	1	1	1	2	3	4	4	....	....	3	....	20
Back	....	2	4	3	5	3	5	3	2	2	4	1	34
Rib	....	1	....	....	....	....	....	....	....	....	....	....	1
Leg	....	1	....	2	2	1	1	....	2	2	2	....	13
Foot	....	2	....	....	....	1	....	4	1	....	2	....	10
Other Minor	....	....	2	1	2	1	2	1	....	....	2	1	12
Total Minor	2	8	7	13	14	11	14	13	5	5	13	3	108

* Fatal. † One fatal.

TABLE G.

ACCIDENT RATE FOR INDIVIDUAL MINES, SHOWING COMPARISON WITH 1958 (NOT INCLUDING CENTRAL WORKSHOPS AND OPEN CUTS).

Serious Accidents.

Mine	Number of Accidents				Total Number of Accidents		*Number Employed		Rate per 100 men Employed		Rate per 100,000 tons Produced		Rate per 10,000 man-shifts Worked	
	Surface		Underground											
	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959	1958	1959
Co-operative	9	9	24	27	33	36	261	283	12·65	12·7	14·84	15·6	5·05	5·1
Neath	3	....	32	23	35	23	264	236	13·26	9·7	15·56	12·0	5·14	4·0
Stockton	3	1	13	4	16	5	123	45	13·00	11·1	20·33	12·7	5·31	4·6
Ewington	2	5	7	16	9	21	92	148	9·78	14·2	14·10	15·0	4·10	5·8
Wyvern†	....	1	6	1	6	2	56	15	10·71	13·3	15·97	29·4	4·34	7·0
Centaur‡	1	2	....	....	1	2	....	....	....	....	....	....	....	....
Hebe	....	....	....	7	....	7	25	57	....	12·3	....	15·5	....	5·4
Western No. 1	....	....	10	1	10	1	98	....	10·20	....	22·61	....	4·12	....
Western No. 2	3	2	11	18	14	20	91	129	15·38	15·5	17·55	17·7	6·16	6·4
Western No. 4	....	....	....	5	....	5	13	44	....	11·4	....	14·6	....	4·4
Total	21	20	103	102	124	122	1,023	957	12·02	12·4	15·79	14·8	4·79	5·1

* Effective workers on Shift.
† This mine not in operation, cleaning up only.
‡ This mine not in operation, men on Muja Open Cut payroll operating screens at Centaur.
Note.—The above does not include one accident at Muja Open Cut.

TABLE H.

TABLE SHOWING FATAL ACCIDENT RATE PER 1,000 PERSONS EMPLOYED FOR EACH YEAR AND PROGRESSIVELY SINCE 1929 TO DATE.

Year	*Men Employed		Fatal Accidents		Death Rate per 1,000	
	Current	Progressive	Current	Progressive	Current	Progressive
1929	858	858	4	4	4·66	4·66
1930	896	1,754	....	....	....	2·28
1931	752	2,506	1	5	1·35	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	13,096	1	21	1·05	1·51
1947	1,032	14,938	....	21	....	1·40
1948	1,064	16,002	....	21	....	1·31
1949	1,044	17,046	1	22	0·96	1·29
1950	1,099	18,145	1	23	0·91	1·27
1951	1,125	19,270	2	25	1·77	1·29
1952	1,281	20,551	2	27	1·56	1·31
1953	1,463	22,014	2	29	1·37	1·32
1954	1,560	23,574	....	29	....	1·23
1955	1,386	24,060	1	30	0·72	1·24
1956	1,219	25,279	1	31	0·82	1·23
1957	1,136	26,415	....	31	....	1·17
1958	1,075	27,490	....	31	....	1·13
1959	1,011	28,501	2	33	1·97	1·15

* Effective workers on shift.

COAL MINES REGULATION ACT, 1946-1951.
ANNUAL REPORT OF THE BOARD OF EXAMINERS FOR MINE MANAGERS, UNDER MANAGERS AND DEPUTIES.

The Under Secretary for Mines:

We submit herewith the Annual Report of the Board of Examiners for the year 1959.

Notices of intention to hold examinations, for Managers, Under Managers and Deputies, were advertised to be held in October, 1959, but there were no applicants.

As there were no examinations held it was deemed unnecessary to hold the usual meeting of the Board.

G. MORGAN, Chairman,
Chief Coal Mining Engineer.

H. A. ELLIS, Member,
Government Geologist.

C. K. SWEENEY, Member,
Senior Inspector of Mines.

DIVISION XI

Report of the Chief Draftsman for the Year 1959

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 of the Survey and Mapping Branch for the year ended 31st December, 1959.

Staff:

The staff of the Branch at present numbers 24. There has been an increased amount of work in all sections and the staff have co-operated excellently to cope with the demand.

Three cadet draftsmen obtained the Diploma of Cartography at the Perth Technical College. Mr. R. Black was successful in winning the W. J. Kirkby Memorial Prize awarded by the Institute of Cartographers W.A. Inc. for the best results in the Diploma. Mr. Smith, also of this Branch, was runner-up.

Opportunity was taken to send Cadets out with Licensed Surveyors to obtain the necessary field experience and more senior officers carried out survey work in the field in conjunction with Geologists.

Summarised reports of the Surveys, Survey Examination and Mapping Sections follow.

Surveys.

Contract surveys in conformance with Mines Department Regulations to the value of £3,881/6/9 were carried out by two survey parties as follows:—

L. M. Norman	9 field books—96 surveys.
E. Brook	5 field books—32 surveys.
Total	14 field books-128 surveys.

In addition to these surveys of mining tenements, survey work was carried out by the Department of Lands and Surveys at the request of this Department. The work was done by Surveyor B. E. Campbell and consisted of "tying in" selected points on existing Mines Department surveys to Geodetic Stations established by him during the previous year, by use of the Tellurometer. These positions now established will enable the calculations to be completed for the laying down of the Standard Plans on the Transverse Mercator Projection in this area, once the final positions for the Geodetic Stations have been computed.

Surveys were carried out at the following localities during the year:—

Outside Proclaimed Goldfield:—
- Bickley.
- Jurien Bay.
- Byford.
- Lake Cow-cowing.
- Minninup.
- Busselton.
- Bunker Bay.
- Capel.
- Donnybrook.
- Wanneroo.

Collie Mineral Field:—
- Muja.
- Shotts.

Greenbushes Mineral Field:—
- Greenbushes.

Murchison Goldfield:—
- Mt. Magnet.
- Boogardie.
- Lennonville.
- Meekatharra.
- Nannine.
- Gavanintha.
- Garden Gully.

Peak Hill Goldfield:—
- Thaduna.

Yilgarn Goldfield:—
- Marvel Loch.
- Burbidge.
- Nevoria.
- Mt. Palmer.
- Parkers Range.
- Bullfinch.
- Manxman.
- Southern Cross.
- Lake Seabrook.

Survey Examination.

Diagrams of the surveys were drawn and examined. In addition, the drawing and computation of boundaries and areas of all existing Permits to Explore for Oil and Licences to Prospect for Petroleum were completed. It is proposed to similarly draw up on an official diagram form all future Permits and Licences.

Duplicate and original plans were prepared for 59 Lease Instruments and diagrams of surrender and resumption as required were completed.

Mapping.

The main mapping programme carried out was as follows:—

(1) Three maps of areas in the Pilbara Goldfield on 80 chain scale, prepared.
(2) Hillside 80, Pilbara Goldfield, published.
(3) Four maps of Collie, on 20 chain scale, published.
(4) Geological Map of Marble Bar, on 4 mile scale, published.
(5) Eighty one plans prepared for Geological Surveys, plus 575 prints.
(6) Ten Standard Plans, Transverse Mercator Projection, completed.
(7) Numerous surveys, from field notes, plotted on Compilation System.
(8) Interpretation from air-photos as required.
(9) Copyrapid reproductions for Chemical Laboratories, Explosives, and Inspection of Machinery Branches, with miscellaneous plans for State Mining Engineer, Kalgoorlie School of Mines and Chief Coal Mining Engineer.
(10) Diagrams and drawings, etc., for Annual Report.

Public Plans.

Number of applications dealt with	974
Number of Public Plans in Use and maintained	654
Number of existing mining tenements maintained on Public Plans	4,239
Number of Maps, Underground Plans, Sketches, etc., supplied to Public and Outstations	330

Field Inspections of various areas were carried out during the year.

The increased interest in minerals was exemplified by the great number of public inquiries for information and plans.

General liaison was maintained with various Government Departments, private companies and the public generally.

L. A. JONES,
Chief Draftsman.

MINING STATISTICS

to 31st December, 1959

Table of Contents

TABLE I.

PRODUCTION OF GOLD AND SILVER FROM ALL SOURCES, SHOWING IN FINE OUNCES THE OUTPUT AS REPORTED TO THE MINES DEPARTMENT DURING 1959, 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. § Concentrates. || Tantalum.

Mining Centre	Number of Lease	Registered Name of Company or Lease	Total for 1959					Total Production				
			Alluvial	Dollied and Specimens	Ore treated	Gold therefrom	Silver	Alluvial	Dollied and Specimens	Ore treated	Gold therefrom	Silver
			Fine ozs.	Fine ozs.	Tons (2,240 lb.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.)	Fine ozs.	Fine ozs.
Kimberley Goldfield.												
Brockman	....	Voided leases	....	....	....	....	....	....	....	1,545·75	1,455·34	....
		Sundry claims	....	....	....	....	....	7·62	7·62	2,484·00	1,871·92	....
Hall's Creek	....	Voided leases	....	....	....	....	....	....	....	423·00	477·76	....
		Sundry claims	....	....	....	....	....	27·73	....	217·05	179·57	12·64
Mary	....	Voided leases	....	....	....	....	....	82·66	951·52	399·00	210·03	....
		Sundry claims	....	....	....	....	....	....	14·36	46·85	53·66	....
Mt. Dockrell	....	Voided leases	....	....	....	....	....	9·17	13·66	1,173·70	1,206·09	93·00
		Sundry claims	....	....	....	....	....	18·89	31·31	160·00	89·64	....
Panton	....	Voided leases	....	....	....	....	....	....	....	42·95	140·47	....
		Sundry claims	....	....	....	....	....	....	6·28	6·15	18·01	....
Ruby Creek	G.M.L. 97	Ruby Queen	....	....	....	....	....	....	....	3,069·25	1,726·56	2·14
		Voided leases	....	....	....	....	....	....	16·05	12,902·20	9,619·82	....
		Sundry claims	....	....	....	....	....	12·71	....	281·25	183·30	....
	From Goldfield Generally :—											
		Sundry claims	....	....	....	....	....	....	....	....	....	†20·98
		Reported by Banks and Gold Dealers	15·76	16·67	....	5·62	....	8,837·69	1,859·84	·75	8·15	....
		Total	**15·76**	**16·67**	....	**5·62**	....	**8,996·47**	**2,900·64**	**22,751·90**	**17,240·32**	**128·76**

West Kimberley Goldfield.

Napier Range	M.C. 29	Devonian Silver Lead Mine	....	....	....	....	....	....	....	....	....	....	....	†13,575·29
	From Goldfield Generally :—													
		Sundry claims	....	....	....	....	....	1·30	24·68	1·00	2·49	....		
		Total	....	....	....	....	....	**1·30**	**24·68**	**1·00**	**2·49**	**13,575·29**		

Pilbara Goldfield.

MARBLE BAR DISTRICT.

Bamboo Creek	G.M.L. 1120	Bamboo Queen	....	....	....	....	....	....	....	....	88·50	30·99	·34	
	1107	Bulletin	....	....	45·75	8·64	....	....	....	....	891·25	425·55	2·02	
	850	Federation	....	....	....	....	....	....	8·22	3,026·00	2,203·86	6·35		
	1118	Kitchener	....	....	....	....	....	....	....	100·00	40·03	1·05		
	1095, 1096, 1097	Mt. Prophecy Leases	....	....	....	....	....	....	24·50	2,406·00	979·23	49·63		
	817	Prince Charlie	....	....	1,050·75	365·19	....	....	3·68	6,770·00	5,035·39	79·42		
	1072	Princess May	....	....	....	....	....	....	....	92·50	24·27	....		
	924	True Blue	....	....	....	....	....	....	....	2,491·75	95·96	....		
		Voided leases	....	....	....	....	....	13·54	560·19	46,237·85	53,505·43	2·62		
		Sundry claims	....	....	....	....	....	8·97	307·83	5,174·85	3,022·97	7·21		
Boodalyerrie	....	Voided leases	....	....	....	....	....	....	292·07	120·25	587·86	....		
		Sundry claims	....	....	....	....	....	....	7·16	....	....	....		
Braeside	....	Sundry claims and Producers	....	....	....	....	....	....	....	....	....	25,853·75		
Lalla Rookh	....	Voided leases	....	....	....	....	....	....	4·78	3,612·00	4,696·33	574·01		
		Sundry claims	....	....	....	....	....	....	....	7,943·00	7,675·09	....		
Marble Bar	G.M.L. 930 (956)	Alexander Leases	....	....	....	....	....	....	....	354·50	120·94	·81		
	930	Alexander	....	....	....	....	....	....	....	640·00	114·59	....		
	1094	Blue Bar	....	....	192·50	31·94	....	....	....	1,137·00	162·08	....		
	927, etc.	Halleys Comet	....	....	....	....	....	....	....	6,360·00	6,390·33	680·36		
	1125	Laura Dawn	....	....	52·00	19·86	....	....	....	95·00	73·33	3·06		
	1121	Little Portree	....	....	....	....	....	....	....	103·00	66·88	6·93		
	1089	Repeater	....	....	....	....	....	....	....	548·20	123·83	6·26		
		Voided leases	....	....	....	....	....	45·98	199·09	165,314·29	151,531·94	586·29		
		Sundry claims	....	3·53	17·00	7·67	....	67·08	255·30	20,972·54	12,803·09	9·43		
North Pole	1122 (1123) .... (1124)	Normay Leases	....	....	....	....	....	....	....	1,685·00	1,435·98	1,755·28		
		Voided leases	....	....	....	....	....	....	....	4,339·00	1,930·51	260·08		
		Sundry claims	....	....	....	....	....	....	....	669·75	298·62	15·82		
North Shaw	....	Voided leases	....	....	....	....	....	7·53	....	1,072·45	996·29	....		
		Sundry claims	....	....	....	....	....	2·84	579·91	179·75	121·72	....		

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre	Number of Lease	Registered Name of Company or Lease	Total for 1959					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	M.C. 291	Northern Territory Prospecting and Development Co. Ltd.	....	....	....	....	....	....	2·12	....	39·54	....
		Voided leases	....	....	....	....	....	16·65	....	2,255·00	403·60	....
		Sundry claims	....	....	....	....	....	161·08	45·64	483·60	150·15	....
Sharks	G.M.L., 1082, 1085, etc.	Table Top Leases	....	....	....	....	....	....	....	1,082·75	594·97	17·28
		Voided leases	....	....	....	....	....	1·43	....	1,739·50	1,969·65	1·16
		Sundry claims	....	....	....	....	....	163·14	47·93	1,159·50	1,675·34	·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	1,603·50	1,886·22	....
		Sundry claims	....	....	....	....	....	89·52	294·75	3,742·25	2,689·78	....
Warrawoona	1193	Trump	....	....	123·00	7·64	....	....	....	123·00	7·64	....
		Voided leases	....	....	....	....	....	....	16·99	17,749·30	19,645·44	23·70
		Sundry claims	....	....	....	....	....	70·98	623·67	6,632·79	4,247·38	·08
Western Shaw	....	Voided leases	....	....	....	....	....	....	....	1,222·50	957·80	....
		Sundry claims	....	....	....	....	....	22·34	67·47	71·50	81·49	....
Wodgina	....	Sundry claims	....	....	....	....	....	....	43·37	·50	....	3·25
Wymans Well	1084	New Copenhagen	....	....	76·50	8·82	....	....	....	691·05	158·93	1·35
		Voided leases	....	....	....	....	....	....	42·86	2,977·29	1,258·44	....
		Sundry claims	....	....	25·25	2·36	....	4·47	51·52	2,732·71	1,324·64	1·47
Yandicoogina	....	Voided leases	....	....	....	....	....	....	140·76	3,159·20	6,218·83	....
		Sundry claims	....	....	....	....	....	4·32	239·89	574·50	642·82	40·96
	From District generally :—											
	Sundry Parcels treated at :											
	State Battery, Bamboo Creek		....	....	....	....	*71·74	....	....	40·00	*11,511·65	262·69
	State Battery, Marble Bar		....	....	....	*435·95	11·54	....	....	12·00	*11,617·86	12·69
	Various Works		....	....	....	....	....	....	....	286·95	1,919·97	5·54
	Reported by Banks and Gold Dealers		·45	....	....	....	....	14,497·23	456·67	....	15·41	†2,223·98
	Total		**·45**	**3·53**	**1,582·75**	**888·07**	**83·28**	**15,253·27**	**4,568·60**	**334,538·72**	**326,771·18**	**32,496·54**

NULLAGINE DISTRICT.

Eastern Creek	....	Voided leases	....	....	....	....	....	8·96	8·19	5,594·00	9,854·21	14·76
		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	G.M.L. 229L	Barton	....	....	422·00	146·97	....	1·22	....	7,832·00	4,240·62	35·28
	231L, etc.	Blue Spec Mining Co. N.L.	....	....	....	....	....	....	....	53,391·41	32,004·76	10·99
		Voided leases	....	....	....	....	....	....	1·02	18,459·65	11,718·61	8·37
		Sundry claims	....	....	....	....	....	....	18·69	6,047·85	2,426·72	....
Mosquito Creek	331L	Ard Patrick	....	....	....	....	....	10·80	....	78·00	10·21	....
		Voided leases	....	....	....	....	....	1·07	30·12	8,392·30	12,839·13	....
		Sundry claims	....	....	....	....	....	....	181·64	3,707·44	3,789·21	....
Nullagine	292L	Alice	....	....	....	....	....	3·85	1,159·85	138·85	331·29	63·45
		Voided leases	....	....	....	....	....	....	599·59	9,192·75	13,376·46	36·92
		Sundry claims	....	3·58	4·50	4·32	....	315·53	684·67	6,566·55	10,520·25	15·22
Spinaway Well	314L	Copper Hills Copper Mine	....	....	....	....	....	....	....	....	‡15·44	‡483·78
Twenty Mile Sandy	M.C. 112L	J. C. and G. M. Baker	....	....	....	....	....	....	....	....	†·93	†51·20
		Voided leases	....	....	....	....	....	....	16·97	7,243·70	9,007·72	320·50
		Sundry claims	....	....	....	....	....	33·10	30·50	7,793·85	6,283·29	2·76
	From District generally :—											
	Sundry Parcels treated at :											
	Barton Battery (T.A. 9L)	....	....	....	....	....	....	....	....	....	*45·19	....
	McKinnon's Sluicing Plant (D.C. 10L, 14L, 15L)	....	....	....	....	....	3·89	2·23	....	7·20	....
	Various Works	....	....	....	....	....	....	....	124·50	8,110·35	1·37
	Reported by Banks and Gold Dealers	23·75	....	....	....	....	10,028·22	130·64	....	29·81	5·80
	Total	**23·75**	**3·58**	**426·50**	**151·29**	....	**10,406·64**	**2,885·13**	**136,863·20**	**128,411·11**	**1,067·30**

West Pilbara Goldfield.

Croydon	....	Voided leases	....	....	....	....	....	....	....	8·00	5·44	....
Hong Kong	....	Voided leases	....	....	....	....	....	....	....	331·00	442·45	....
		Sundry claims	....	....	....	....	....	21·40	·02	9·00	3·15	....
Lower Nicol	....	Voided leases	....	....	....	....	....	....	1·10	653·20	402·22	....
		Sundry claims	....	....	28·00	11·08	....	10·44	2·71	79·00	31·71	·05
Mallina	....	Voided leases	....	....	....	....	....	....	....	141·60	128·44	....

Table I.—*Production of Gold and Silver from all sources*—continued.

Mining Centre	Number of Lease	Registered Name of Company or Lease	Total for 1959					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.												
Nicol	....	Voided leases	....	....	....	....	....	....	....	30·00	11·47	....
Pilbara	....	Voided leases	....	....	....	....	....	9·90	48·12	267·00	432·84	....
		Sundry claims	....	....	....	....	....	1·11	86·24	163·00	255·42	....
Roebourne	....	Voided leases	....	....	....	....	....	....	....	2,396·86	1,424·04	385·15
		Sundry claims	....	....	....	....	....	15·47	3·29	1,934·85	811·86	130·21
Station Peak	....	Voided leases	....	....	....	....	....	177·74	41·37	11,016·00	11,388·18	·08
		Sundry claims	....	....	....	....	....	·69	....	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 Goldfield generally :											
	Sundry Parcels treated at :											
	Various Works	....	....	....	....	....	....	....	....	....	*102·39	4·90
	Sundry claims and leases	....	....	....	....	....	....	....	11·77	....	....	†503·36
	Reported by Banks and Gold Dealers	....	....	....	....	....	6,100·71	177·50	103·50	231·54	·87
	Total	....	....	**28·00**	**11·08**	....	**6,337·46**	**374·74**	**24,749·96**	**24,300·52**	**1,909·71**
Ashburton Goldfield.												
Belvedere	....	Voided leases	....	....	....	....	....	....	9·88	1,560·00	435·86	176·48
Dead Finish	....	Voided leases	....	....	....	....	....	....	....	1,699·00	874·60	·03
		Sundry claims	....	....	....	....	....	....	11·89	104·25	245·08	....
Linden Station	....	Sundry claims	....	....	....	....	....	....	....	128·35	203·51	....

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 (Silver Lead)		....	....	....	....	415·10	....	....	....	....	†33,787·67
	Banks and Gold Dealers		....	....	....	....	....	8,889·78	123·17	....	7·12	....
	Total		....	....	....	....	**415·10**	**9,266·82**	**482·46**	**6,807·10**	**2,913·43**	**41,971·38**

Gascoyne Goldfield.

Bangemall	....	Voided leases	....	....	....	....	....	....	....	6·22	350·70	313·82	....
		Sundry claims	....	....	....	....	....	88·97	33·55	36·30	203·47	....
Carnarvon	M.C. 4....	Allen McDonald	....	43·33	....	....	....	....	49·09	....	....	....
	From Goldfield Generally :—											
	Banks and Gold Dealers		·17	....	....	....	....	604·64	23·20	....	....	....
	Total		**·17**	**43·33**	....	....	....	**693·61**	**112·06**	**387·00**	**517·29**	....

Peak Hill Goldfield.

Bulloo Downs	....	Voided leases	....	....	....	....	....	....	....	....	....	....	†50·09
Egerton	....	Voided leases	....	....	....	....	....	62·31	224·68	7,292·25	6,604·91	....	
		Sundry claims	....	....	....	....	....	235·35	23·51	1,501·77	791·34	....	
Horseshoe	G.M.L. 568P	Horseshoe Lights	....	....	2,221·00	291·75	....	....	....	5,998·00	793·86	....	
	568P, etc.	Anglo-Westralian Mining Pty. Ltd.	....	....	....	....	....	....	....	135,872·00	22,870·80	1,407·05	
		Prior to Transfer	....	....	....	....	....	....	....	3,914·00	894·44	....	
	575P	Labourchere Main Lode	....	....	....	....	....	....	....	1,022·00	103·08	....	
		Voided leases	....	....	....	....	....	15·57	1,975·37	4,371·38	2,684·27	2·00	
		Sundry claims	....	....	....	....	....	20·12	829·58	2,191·35	790·99	....	
Jimbelbar	....	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	480·75	460·12	....	
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 1959					Total Production				
			Alluvial	Dollied and Specimens	Ore treated	Gold therefrom	Silver	Alluvial	Dollied and Specimens	Ore treated	Gold therefrom	Silver
			Fine ozs.	Fine ozs.	Tons (2,240 lb.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.)	Fine ozs.	Fine ozs.
PEAK HILL GOLDFIELD—continued.												
Peak Hill	512P	Atlantic	....	....	....	....	....	1·69	2·87	4,703·75	589·15	....
	599P	Bobby Dazzler	....	....	420·00	25·29	....	....	....	420·00	25·29	....
	511P	Commercial	....	....	....	....	....	....	....	3,745·25	591·05	....
	584P	Dazzle Star	....	....	....	....	....	....	....	303·00	80·98	....
	567P	Miner Bird	....	....	43·00	45·29	....	....	....	2,043·00	932·20	....
	553P	Morning Star	....	....	....	....	....	....	4·43	2,804·25	410·09	....
	587P	Murray Heath	....	....	....	....	....	....	....	41·00	6·17	....
	506P	No. 1 North	....	....	7·00	4·60	....	....	86·47	7,209·70	1,664·49	....
	492P	North Star	....	....	....	....	....	23·20	69·63	13,186·50	2,079·21	....
		Voided leases	....	....	....	....	....	7·39	920·21	521,841·33	247,054·04	2,285·63
		Sundry claims	....	....	....	....	....	61·51	306·63	34,406·35	8,955·54	....
Ravelstone	....	Voided leases	....	....	....	....	....	....	101·64	4,219·85	3,117·68	....
		Sundry claims	....	....	....	....	....	....	....	553·60	283·17	....
Wilgeena	....	Voided leases	....	....	....	....	....	....	23·54	230·50	156·25	....
Wilthorpe	....	Voided leases	....	....	....	....	....	....	....	47·00	20·93	....
		Sundry claims	....	....	....	....	....	....	....	89·00	25·71	....
Yowereena	....	Voided leases	....	....	....	....	....	....	....	19·50	36·46	....
		Sundry claims	....	....	....	....	....	....	....	117·25	203·16	....
		From Goldfields Generally :—										
		Sundry Parcels Treated at :—										
		Australian Machinery & Investment Co.	....	....	....	....	....	....	....	....	*1,686·20	....
		F. J. Edwards (L.T.T. 2/58)	....	....	1,302·00	62·44	....	....	....	1,302·00	62·44	....
		State Battery, Peak Hill	....	....	....	....	....	....	3·05	15·00	*7,171·41	....
		Various Works	....	....	....	....	....	....	....	30·00	*5,661·37	23·12
		Banks and Gold Dealers	5·19	....	....	1·81	....	2,852·84	444·36	....	14·32	....
		Total	**5·19**	....	**8,998·00**	**431·18**	....	**3,382·05**	**5,300·33**	**770,644·73**	**321,509·57**	**3,768·47**

East Murchison Goldfield.

LAWLERS DISTRICT.

Kathleen Valley	G.M.L. 1365	Beth Heno	....	....	60·00	8·33	....	....	....	60·00	8·33	....
		Voided leases	....	....	....	....	....	....	144·85	80,503·66	49,020·54	....
		Sundry claims	....	....	....	....	....	14·37	526·03	5,693·75	2,642·98	‡893·45

Lawlers	1236	Waroonga	....	....	....	....	....	....	....	....	*99·40	·50
		Voided leases	....	....	....	....	....	25·51	692·45	1,622,917·40	575,150·65	14,803·08
		Sundry claims	....	....	....	....	....	400·21	451·61	17,347·48	9,568·69	268·34
Sir Samuel	....	Voided leases	....	....	....	....	....	....	359·03	275,417·55	141,829·52	10,234·80
		Sundry claims	....	....	83·00	3·53	....	57·64	64·96	7,811·00	4,575·01	·02
Wildara Station	....	Sundry claims	19·35	....	....	....	....	122·86	....	....	....	....
		From District Generally :—										
		Sundry Parcels treated at :—										
		State Battery, Sir Samuel	....	....	....	....	....	....	....	53·50	*2,356·81	....
		Vanguard Cyanide Plant	....	....	....	....	....	....	....	4·00	*1,014·04	3·18
		Western Mining Co. Pty. Ltd.	....	....	....	....	....	....	....	5·00	*4,291·25	29·00
		Prior to transfer to present holders	....	....	....	....	....	....	....	....	*1,371·33	15·64
		Various Works	....	....	....	....	....	2·12	2·35	1,711·53	*30,788·76	936·21
		Reported by Banks and Gold Dealers	1·52	....	....	....	....	6,424·53	101·91	·05	10·00	....
		Total	**20·87**	....	**143·00**	**11·86**	....	**7,047·24**	**2,343·19**	**2,011,524·92**	**822,727·31**	**27,184·22**

WILUNA DISTRICT.

Coles	....	Voided leases	....	....	....	....	....	....	....	2,765·50	1,240·40	....
		Sundry claims	....	....	....	....	....	....	21·03	3,844·50	1,507·23	....
Corboys	....	Voided leases	....	....	....	....	....	5·24	1·25	14,946·29	11,036·71	5·00
		Sundry claims	....	....	....	....	....	21·58	....	9,082·35	5,210·79	....
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	G.M.L. 280J	Lake Violet Consols Deeps	....	....	....	....	....	....	....	....	226·96	4·50
		Voided leases	....	....	....	....	....	....	574·76	8,777,986·65	1,788,900·16	10,044·63
		Sundry claims	....	....	23·25	11·98	....	105·39	225·82	27,442·65	10,897·38	·33
		From District Generally :—										
		Sundry Parcels treated at :										
		State Battery, Wiluna	....	....	....	....	....	....	....	637·00	*23,679·00	219·70
		Various Works	....	....	....	....	....	....	....	139·00	*5,322·12	12·72
		Reported by Banks and Gold Dealers	7·78	....	....	....	....	59·81	56·58	....	155·97	11·75
		Total	**7·78**	....	**23·25**	**11·98**	....	**232·63**	**1,254·11**	**8,873,578·19**	**1,872,182·40**	**10,298·63**

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 1959					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.												
BLACK RANGE DISTRICT.												
Barrambie	G.M.L. 1116B	Dingo	....	....	....	....	....	....	....	1·00	201·93	....
	1120B	Iron Duke	....	....	110·75	8·66	....	....	....	110·75	8·66	....
	1117B	Scheelite Leases	....	....	303·50	174·91	....	....	....	480·25	318·73	....
		Voided leases	....	....	....	....	....	....	22·49	18,443·92	17,355·15	125·60
		Sundry claims	....	....	....	....	....	5·07	170·20	978·55	1,062·22	216·73
Bellchambers	....	Voided leases	....	....	....	....	....	....	111·80	4,349·27	3,130·56	....
		Sundry claims	....	....	....	....	....	....	....	1,182·80	557·95	....
Birrigrin	....	Voided leases	....	....	....	....	....	....	820·68	12,042·93	15,086·09	....
		Sundry claims	....	....	....	....	....	....	179·92	2,487·55	1,238·22	....
Currans	....	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	....
Hancocks	....	Voided leases	....	....	....	....	....	....	6,968·16	33,726·00	36,664·76	55·72
		Sundry claims	....	....	....	....	....	4·21	142·89	8,608·10	3,228·18	....
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	....	Voided leases	....	....	....	....	....	....	100·17	79,550·60	23,444·82	....
		Sundry claims	....	....	....	....	....	....	71·09	5,041·35	3,171·19	....
Nunngarra	....	Voided leases	....	....	....	....	....	25·94	952·34	9,509·00	3,655·49	....
		Sundry claims	....	....	46·00	6·58	....	50·27	1,458·98	7,682·40	2,960·27	....
Sandstone	G.M.L. 1114B	Black Range Gold Mine	....	86·04	133·75	391·82	....	....	86·04	169·75	595·29	....
	1118B	Lady Jennifer	....	....	23·50	5·45	....	....	....	23·50	5·45	....
	958B	Lady Mary	....	....	....	....	....	....	383·35	7,165·75	7,119·35	2·35
		Voided leases	....	....	....	....	....	4·75	4,363·69	696,431·82	447,563·94	11,754·22
		Sundry claims	....	....	23·00	5·45	....	44·95	1,421·07	15,933·70	6,917·94	....
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	*23,575·34	61·02
State Battery, Youanmi	....	....	....	....	....	....	....	....	....	....	40·00	*5,504·08	....
Various Works	....	....	....	....	....	....	....	....	....	....	104·50	*11,496·73	....
Reported by Banks and Gold Dealers	....	....	·14	....	....	....	....	1,494·98	52·23	....	20·38	....	....
Total	....	....	**·14**	**86·04**	**640·50**	**592·87**	....	**1,670·54**	**18,607·84**	**1,730,569·47**	**954,713·14**	**22,712·29**	

Murchison Goldfield.

CUE DISTRICT.

Big Bell	G.M.L. 2282	Orange Bell	....	....	....	....	....	....	....	....	373·25	84·41	2·34
	2274	Silver City	....	....	....	....	58·00	18·76	....	....	138·25	48·89	....
		Voided leases	....	....	....	....	....	....	....	4·49	5,539,857·75	730,970·13	251,813·67
		Sundry claims	....	....	....	....	....	....	....	·39	6·32	553·25	479·76	6·61
Cuddingwarra	....	Voided leases	....	....	....	....	....	....	....	10·59	132·46	102,115·91	56,152·11	100·71
		Sundry claims	....	....	....	....	28·00	26·63	....	18·46	384·38	10,335·89	5,743·75	16·85
Cue	2279	New Light	....	....	....	....	....	....	....	....	....	8·00	3·95	....
	2247	Victory	....	....	....	....	....	....	....	....	....	226·75	125·38	....
		Voided leases	....	....	....	....	....	....	....	202·71	911·60	292,134·49	222,197·86	73·03
		Sundry claims	....	....	....	....	133·25	25·19	....	252·92	894·70	46,873·74	20,496·32	4·24
Eelya	2241	Eagle Hawk	....	....	....	....	....	....	....	....	....	1,408·75	417·30	....
		Voided leases	....	....	....	....	....	....	....	....	8·78	1,069·00	1,811·26	....
		Sundry claims	....	....	....	....	....	....	....	6·20	143·81	2,309·90	1,099·24	1·31
Mindoolah	....	Voided leases	....	....	....	....	....	....	....	3·07	2·54	9,380·28	5,672·31	42·97
		Sundry claims	....	....	....	....	....	....	....	....	29·30	3,299·60	2,345·43	....
Reedy	2253	Rand No. 3	....	....	....	....	....	....	....	....	....	4,152·25	1,356·56	....
	2261	West Rand	....	....	....	....	....	....	....	1·36	2·98	53·75	67·95	....
		Voided leases	....	....	....	....	....	....	....	1·46	216·72	725,487·43	238,924·59	20,467·28
		Sundry claims	....	....	....	....	....	....	....	170·71	137·16	7,229·00	2,680·84	·62
Tuckabianna	2237	Gidgie	....	....	....	....	....	....	....	....	297·73	2,789·90	2,108·79	33·57
	2244	Winston	....	....	....	....	....	....	....	....	671·45	791·00	362·49	4·05
		Voided leases	....	....	....	....	....	....	....	649·70	324·77	13,152·23	7,465·12	....
		Sundry claims	....	....	....	....	6·00	12·06	....	154·26	489·40	5,321·35	2,772·87	·20
Tuckanarra	....	Voided leases	....	....	....	....	....	....	....	85·37	3,511·10	19,490·00	22,828·99	172·77
		Sundry claims	....	....	....	5·82	....	....	....	115·23	797·89	10,190·80	10,307·86	....
Weld Range	....	Voided leases	....	....	....	....	....	....	....	....	23·64	2,169·75	1,137·11	....
		Sundry claims	....	....	....	....	....	....	....	....	3·90	1,438·50	1,136·41	....

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 1959					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.*												
		From District Generally :—										
		Sundry Parcels treated at :—										
		J. Hamilton (L.T.T. 1413H)	....	....	....	10·55	....	....	....	....	*10·55	....
		State Battery, Cue	....	....	....	373·85	....	....	....	76·25	*26,792·60	123·99
		State Battery, Tuckanarra	....	....	....	....	....	....	....	518·50	*5,535·57	....
		Various Works	....	....	....	....	....	....	....	8,097·02	*30,167·24	1,206·50
		Reported by Banks and Gold Dealers	2·66	....	....	....	....	3,424·23	109·87	....	22·62	·07
		Total	**2·66**	**5·82**	**225·25**	**467·04**	....	**5,096·66**	**9,104·99**	**6,811,042·54**	**1,401,326·26**	**274,070·78**
MEEKATHARRA DISTRICT.												
Abbotts	....	Voided leases	....	....	....	....	....	....	26·45	36,841·35	38,775·28	....
		Sundry claims	....	....	....	....	....	....	5·29	3,951·57	2,357·54	....
Burnakura	G.M.L. 1980N	Burnakura Lady	....	....	214·75	30·60	....	....	....	214·75	30·60	....
		Voided leases	....	....	....	....	....	....	3,247·59	39,172·70	30,890·16	26·90
		Sundry claims	....	....	....	....	....	17·03	129·24	2,486·55	1,310·84	1·54
Chesterfield	1942N, 1946N	Margueritta Leases	....	....	720·00	126·33	....	....	....	2,950·00	704·49	6·65
	1942N	Margueritta	....	....	....	....	....	....	....	732·00	197·73	7·74
	1946N	Margueritta, East	....	....	....	....	....	....	....	1,420·00	250·09	10·65
		Voided leases	....	....	....	....	....	29·02	420·32	6,875·26	7,500·57	·80
		Sundry claims	....	....	....	....	....	....	42·19	960·55	740·97	....
Gabanintha	1973N	Mais No. 6	....	....	4·00	15·91	....	....	....	4·00	15·91	....
	1990N	Tumbulgum	....	....	123·00	33·48	4·72	....	....	123·00	33·48	4·72
	1986N	Tumbulgum, North	....	....	7·00	5·39	....	....	....	7·00	5·39	....
		Voided leases	....	....	....	....	....	11·79	38·14	32,991·35	22,188·88	815·57
		Sundry claims	....	....	....	....	....	16·78	159·05	5,184·50	2,954·40	....
Garden Gully	....	Voided leases	....	....	....	....	....	26·36	74·91	30,272·07	21,864·74	1,102·59
		Sundry claims	....	....	....	....	....	....	18·74	2,914·69	1,719·14	....
Gum Creek	....	Voided leases	....	....	....	....	....	25·27	91·96	3,893·08	3,819·91	....
		Sundry claims	....	....	2·05	4·70	....	4·37	84·86	729·30	641·55	....

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	....	Voided leases	....	....	....	....	....	....	1,263·53	1,999·80	3,565·40	....
		Sundry claims	....	....	3·00	1·63	....	173·02	150·04	443·75	404·77	....
Meeka Pools	....	Voided leases	....	....	....	....	....	....	....	111·58	82·27	....
		Sundry claims	....	....	....	....	....	....	2·84	233·57	205·38	....
Meekatharra	1922N	Albury Heath	....	....	....	....	....	....	13·16	1,406·75	1,927·19	....
	1976N	Dusty Galah	....	....	....	....	....	....	....	56·25	14·44	....
	1975N	Fortune Teller	....	....	....	....	....	....	....	38·00	4·84	....
	1977N	Haveluck	....	....	275·60	34·94	....	....	....	642·60	70·58	....
	1559N	Ingliston	....	....	361·00	22·72	....	....	498·32	3,167·85	1,885·91	....
	1985N	Lady Central	....	....	327·75	28·00	....	....	....	327·75	28·00	....
	1577N	Mopoke	....	....	....	....	....	....	12·47	1,361·50	827·50	....
	1989N	Pharlap	....	....	109·50	20·86	....	....	....	109·50	20·86	....
	1529N	Prohibition	....	....	420·00	16·21	....	....	....	4,620·25	1,976·10	4·25
	1529N, etc.	Prohibition Gold Mining Co., N.L.	....	....	....	....	....	....	....	24,844·25	4,978·31	11·83
	1529N	Prior to transfer to present holders	....	....	....	....	....	....	....	29,422·00	4,971·30	....
	R.C. 75N	C. V. S. White and W. E. Fisher	....	....	....	....	....	173·82	43·80	372·50	131·88	....
		Voided leases	....	....	....	....	....	7·57	1,627·93	1,710,912·62	925,911·74	2,455·04
		Sundry claims	....	....	786·60	144·73	....	279·84	1,009·74	29,877·95	11,397·18	....
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	....
Munaro Gully	....	Voided leases	....	....	....	....	....	....	....	13,283·50	6,559·93	....
		Sundry claims	....	....	....	....	....	....	34·23	1,009·75	373·74	....
Nannine	G.M.L. 1992N....	Queen of the Lake	....	....	3·00	1·90	....	....	....	3·00	1·90	....
		Voided leases	....	....	....	....	....	47·31	844·02	129,489·88	76,480·88	167·45
		Sundry claims	....	18·42	371·00	27·09	....	138·95	1,301·28	6,748·68	4,726·36	....
Quinns	....	Voided leases	....	....	....	....	....	7·30	1,186·50	33,356·91	13,464·37	90·70
		Sundry claims	....	....	....	....	....	15·07	1,289·65	3,841·67	2,718·33	....
Ruby Well	....	Voided leases	....	....	....	....	....	....	43·46	7,461·00	4,046·70	....
		Sundry claims	....	....	....	....	....	1,015·87	409·39	520·25	629·60	....
Stake Well	....	Voided leases	....	....	....	....	....	....	200·12	21,362·00	9,566·18	....
		Sundry claims	....	....	....	....	....	31·91	34·73	1,003·60	584·54	....
Star of the East	....	Voided leases	....	....	....	....	....	....	....	27,244·00	20,305·40	....
		Sundry claims	....	....	....	....	....	....	....	127·62	94·97	....
Yaloginda	1853N	Bluebird	....	....	434·00	103·48	....	....	....	9,447·50	2,939·23	....
		Voided leases	....	....	....	....	....	19·03	1,972·23	281,175·54	14,609·36	8·68
		Sundry claims	....	....	147·50	13·48	....	61·89	647·51	11,247·92	5,045·18	....

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 1959					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*.										
		From District Generally :—										
		Sundry Parcels treated at :—										
		R. Biggs (L.T.T. 3N/58)	....	....	126·00	6·34	....	....	....	126·00	6·34	....
		G. H. Sparrowhawk (L.T.T. 3N/57)	....	....	....	....	....	....	....	206·05	10·45	....
		P. Polletti (L.T.T. 2N/59)	....	....	13·50	4·82	....	....	....	13·50	4·82	....
		State Battery, Meekatharra	....	....	....	*104·87	....	....	....	130·00	*27,799·05	24·34
		Various Works	....	....	....	....	....	....	....	3,367·75	*13,931·67	391·20
		Reported by Banks and Gold Dealers	11·28	....	438·00	32·40	....	12,236·39	179·70	451·50	97·71	·60
		Total	**11·28**	**18·42**	**4,887·25**	**779·88**	**4·72**	**14,626·83**	**18,243·54**	**2,299,721·46**	**1,306,810·91**	**5,131·25**
		DAY DAWN DISTRICT.										
Day Dawn	G.M.L. 573D, etc.	Mountain View Gold, N.L.	....	....	....	....	....	....	....	13,612·10	17,376·85	217·60
		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	....	....	....	....	....	96·42	523·56	13,641·26	6,746·69	1·55
Lake Austin		Voided leases	....	....	....	....	....	613·00	3,079·62	36,872·20	51,050·49	....
		Sundry claims	....	....	24·75	3·67	....	59·07	965·49	3,490·94	1,336·48	4·60
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	664D	Eclipse	....	....	....	....	....	....	....	282·75	29·73	....
	676D	Eclipse Amalgamated North	....	....	....	....	....	....	....	187·50	17·68	....
	670D	Eclipse North	....	....	14·00	·40	....	....	....	840·00	47·62	....
		Voided leases	....	....	....	....	....	4·90	1,213·68	18,280·00	9,915·71	....
		Sundry claims	....	....	....	....	....	62·93	509·50	4,678·17	1,801·29	....
		From District Generally :—										
		Sundry Parcels treated at :—										
		F. W. Turner (LT.T. 1D/58)	....	....	....	*7·13	....	....	....	....	*7·13	....
		Various Works	....	....	....	....	....	....	16·61	988·00	*1,988·33	....
		Reported by Banks and Gold Dealers	....	....	....	....	....	2,220·42	37·30	....	12·57	·01
		Total	....	....	**38·75**	**11·20**	....	**3,241·76**	**11,341·63**	**2,037,165·63**	**1,375,507·68**	**169,434·20**

MOUNT MAGNET DISTRICT.

Jumbulyer	G.M.L. 1410M	Gold Bug	....	....	....	....	....	....	2·20	927·35	277·15	....
		Voided leases	....	....	....	....	....	....	13·37	680·10	361·74	....
		Sundry claims	....	....	....	....	....	20·32	116·27	1,216·70	886·47	....
Lennonville	1566M	Empress	....	....	....	....	....	....	....	....	*9·51	....
	1596M	Wheel of Fortune South	....	....	....	....	....	....	....	18·00	51·37	....
		Voided leases	....	....	....	....	....	....	3,226·91	151,502·55	128,568·28	459·62
		Sundry claims	....	....	120·75	39·77	....	25·86	108·82	14,701·62	5,655·17	....
Mt. Magnet	1527M	Eclipse	....	....	....	....	....	....	....	272·10	141·41	1·34
	1527M	Eclipse Goldmine, N.L.	....	....	7,514·00	12,047·81	446·66	....	....	10,354·00	14,990·11	455·14
	1255M, etc.	Edward Carson Leases	....	....	....	....	....	1·82	....	18,042·75	12,895·28	7·76
	1455M	Evening Star	....	....	115·50	13·68	....	....	....	1,083·25	124·35	....
	1581M	Exchange	....	....	22·00	29·36	....	....	....	22·00	29·36	....
	1287M	Havelock	....	....	....	....	....	....	11·05	4,332·50	840·14	....
	1479M	Hill 50 Consolidated, N.L.	....	....	....	....	....	....	....	68·00	5·10	....
	1282M, etc.	Hill 50 Gold Mine, N.L.	....	....	155,471·00	81,907·09	5,476·87	....	....	1,377,785·40	690,911·03	19,383·63
	1246M	(Neptune)	....	....	....	....	....	....	829·41	8,787·65	4,122·61	·21
	1361M	Jupiter	....	....	....	....	....	....	·83	658·05	261·71	....
	1444M	Late Comer	....	....	....	....	....	....	2·53	511·00	391·31	....
	1597M	Mayflower	....	....	....	....	....	....	....	37·00	6·43	....
	1447M	Morning Star	....	....	....	....	....	....	....	2,092·65	458·61	....
	1536M	Pat Omeara	....	....	....	....	....	....	....	34·00	·68	....
	1505M	Perseverance	....	....	....	....	....	....	....	107·25	11·40	....
	1588M	Three Boys	....	....	....	....	....	....	....	48·00	2·47	....
		Voided leases	....	....	....	....	....	29·26	9,811·54	834,324·06	312,772·17	851·39
		Sundry claims	....	....	24·75	19·84	....	123·08	2,626·24	60,912·40	29,902·96	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	1538M	Moyagee	....	....	....	....	....	....	....	33·75	34·88	....
		Voided leases	....	....	....	....	....	....	23·59	12,439·10	18,299·16	757·77
		Sundry claims	....	....	34·50	5·97	....	14·44	176·21	1,550·75	1,752·39	....
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	....	....	....	....	....	....	....	348·26	*35,102·45	15·62
		Various Works	....	....	....	....	....	....	....	56·06	*18,949·24	10·04
		Reported by Banks and Gold Dealers	·89	....	....	....	....	2,293·37	114·69	8·00	113·15	·22
		Total	**·89**	....	**163,302·50**	**94,063·52**	**5,923·53**	**2,575·79**	**20,434·16**	**2,510,536·70**	**1,283,797·84**	**21,947·23**

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 1959					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.												
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	G.ML. 1207	Rose Marie	....	....	....	....	....	....	....	418·67	254·46	1·59
		Voided leases	....	....	....	....	....	....	226·72	50,316·71	33,692·51	58·08
		Sundry claims	....	....	....	....	....	5·77	188·67	5,458·85	1,777·91	....
Goodingnow	1063	Ark	....	....	....	....	....	....	12·49	2,270·50	1,927·29	....
	1025	Carnation	....	....	....	....	....	....	....	19,096·05	14,016·94	....
	1236	Marigold	....	....	181·00	38·75	....	....	....	181·00	38·75	....
		Voided leases	....	....	....	....	....	146·70	299·28	62,415·66	52,294·32	....
		Sundry claims	....	....	87·75	10·56	....	152·96	169·70	10,370·05	5,125·26	....
Gullewa	....	Voided leases	....	....	....	....	....	....	19·05	39,913·60	20,966·51	113·70
		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	....
Messengers 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	2·29	....	....	....	....	3·95	44·72	1,152·60	502·15	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	....	....	....	....	....	....	....	30·88	955·00	223·90	....
Pinyalling	....	Voided leases	....	....	....	....	....	....	....	313·79	2,318·90	1,146·19	....
		Sundry claims	....	....	....	....	....	3·13	134·09	1,500·00	959·31	....
Retaliation	....	Voided leases	....	....	....	....	....	....	....	5,089·25	1,872·98	....
		Sundry claims	....	....	....	....	....	....	....	913·25	321·52	....
Rothsay	....	Voided leases	....	....	....	....	....	....	24·06	40,680·75	10,777·98	....
		Sundry claims	....	....	....	....	....	....	·73	6,469·50	2,562·03	....
Wadgingarra	....	Voided leases	....	....	....	....	....	....	....	691·11	650·63	....
		Sundry claims	....	....	....	....	....	....	....	2,131·30	559·83	....
Wardawarra	....	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 Goldfield generally :—												
Sundry Parcels treated at :												
State Battery, Paynes Find	....	....	....	....	....	....	....	....	....	156·50	*4,548·42	....
State Battery, Warriedar	....	....	....	....	....	....	....	....	....	....	*6,545·96	·90
State Battery, Yalgoo	....	....	....	....	....	....	....	....	....	....	*1,200·51	....
Various Works	....	....	....	....	....	....	....	9·42	....	865·00	*3,337·19	99·84
Reported by Banks and Gold Dealers	8·96	....	....	....	....	957·09	58·32	....	48·90	·20
Total	**11·25**	....	**268·75**	**49·31**	....	**1,800·53**	**3,223·19**	**442,508·08**	**263,703·11**	**1,503·16**

Mt. Margaret Goldfield.

MOUNT MORGANS DISTRICT.

Australia United....	....	Voided leases	....	....	....	....	....	....	....	1,911·63	15,913·69	23,305·76	1·76
		Sundry claims	....	....	....	....	....	....	....	580·98	1,307·50	2,227·65	....
Eucalyptus	....	Voided leases	....	....	....	....	....	....	....	2,878·56	1,603·85	3,251·01	....
		Sundry claims	....	....	....	....	....	....	....	591·62	2,160·30	2,011·78	....
Linden	....	Voided leases	....	....	....	....	....	7·53	566·97	72,919·81	66,208·35	·68
		Sundry claims	....	....	197·00	48·84	....	132·11	244·96	19,469·35	13,817·80	....

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 1959					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 MORGANS DISTRICT—*continued.*												
Mt. Margaret	....	Voided leases	....	....	....	....	....	12·13	1·89	8,900·39	5,291·51	12·55
		Sundry claims	....	....	....	....	....	25·22	111·18	1,790·10	661·42	....
Mt. Mrogans	G.M.L. 399F, etc.	Morgans Gold Mines Ltd.	....	....	129·00	70·23	....	....	....	5,070·05	13,981·69	....
		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	5,104·07	3,396·77	....
Murrin Murrin	....	Voided leases	....	....	....	....	....	10·43	231·35	136,940·22	104,029·97	29·60
		Sundry claims	....	....	....	....	....	51·15	557·24	6,561·68	4,562·63	....
Redcastle	557F	Trixie	....	....	....	....	....	....	46·14	177·75	68·44	....
		Voided leases	....	....	....	....	....	4·49	436·54	4,107·20	4,043·41	....
		Sundry claims	....	....	150·00	22·45	....	....	113·84	1,183·57	642·45	....
Yundamindra	560F	Queen of the May	....	....	....	....	....	....	....	1,961·00	391·79	....
	560F	(Linden (W.A.) Gold N.L.)	....	....	....	....	....	....	....	4,077·00	1,756·80	30·68
		Voided leases	....	....	....	....	....	....	110·93	78,485·85	49,894·35	5·82
		Sundry claims	....	....	....	....	....	3·01	271·93	6,674·35	4,789·46	....
	From District Generally :—											
	Sundry Parcels treated at :—											
	Crocker Anniversary Battery (M.A. 14F)		....	....	....	....	....	....	....	10·00	26·96	....
	United Aborigines Mission (M.A. 12)		....	....	....	....	....	113·08	18·87	403·00	135·50	·09
	State Battery, Linden		....	....	....	....	....	....	9·16	299·54	*15,502·97	....
	Various Works		....	....	....	....	....	....	....	1,257·81	*8,561·39	99·97
	Reported by Banks and Gold Dealers		4·20	....	....	....	....	3,088·46	141·84	10·30	95·75	·68
		Total	**4·20**	....	**476·00**	**141·52**	....	**3,501·97**	**9,389·86**	**1,217,321·31**	**717,668·00**	**5,812·32**
MOUNT MALCOLM DISTRICT.												
Cardinia	G.M.L. 1795C....	Rangoon	....	....	....	10·59	....	....	6·49	330·00	*188·66	....
		Voided leases	....	....	....	....	....	13·87	1,591·66	5,201·74	4,049·91	....
		Sundry claims	....	....	....	....	....	4·25	121·91	1,865·25	575·01	·66

Diorite	....	Voided leases	....	....	....	....	....	....	945·65	38,879·03	35,144·28	33·18
		Sundry claims	....	....	18·00	34·15	....	11·21	332·13	4,644·85	4,505·31	....
Dodgers Well	....	Voided leases	....	....	....	....	....	....	57·90	1,373·30	1,936·52	....
		Sundry claims	....	....	....	....	....	·95	28·32	1,440·25	904·23	....
Lake Darlot	1845C	Monte Christo	....	....	737·00	63·31	....	....	....	737·00	63·31	....
		Voided leases	....	....	....	....	....	....	4,482·18	74,717·46	52,293·77	7·56
		Sundry claims	....	....	1,609·00	98·33	....	129·92	906·52	11,436·62	6,124·25	2·60
Leonora	1829C	Jessie Alma	....	....	13·00	2·56	....	....	578·11	727·25	1,920·53	....
	1579C, etc.	Sons of Gwalia Ltd.	....	....	135,932·00	33,468·91	3,111·58	....	....	6,474,703·53	2,457,186·36	177,239·26
		Prior to transfer to present holders	....	....	....	....	....	....	....	109,081·00	55,989·21	8·66
		Voided leases	....	....	....	....	....	....	1,866·86	176,575·00	91,197·84	94·57
		Sundry claims	....	....	855·00	169·09	....	37·73	369·22	19,849·45	12,165·13	·21
Malcolm	....	Voided leases	....	....	....	....	....	11·65	47·07	62,656·53	47,563·43	....
		Sundry claims	....	....	....	....	....	5·75	33·39	4,576·47	2,711·34	·12
Merton Dale	....	Voided leases	....	....	....	....	....	....	....	89,024·75	60,935·32	1,497·58
		Sundry claims	....	....	....	....	....	5·42	85·74	3,216·41	2,295·52	....
Mt. Clifford	....	Voided leases	....	....	....	....	....	....	1,786·51	9,588·96	16,640·81	....
		Sundry claims	....	....	11·00	3·69	....	53·98	1,860·00	5,580·70	3,489·16	....
Pig Well	....	Voided leases	....	....	....	....	....	....	....	13,587·32	14,676·58	63·68
		Sundry claims	....	....	....	....	....	....	34·61	2,896·65	1,225·46	....
Randwick	....	Voided leases	....	....	....	....	....	....	246·76	10,912·65	9,736·57	....
		Sundry claims	....	....	63·00	13·21	....	66·57	164·02	2,551·64	1,320·66	....
Webster Find	....	Voided leases	....	....	....	....	....	30·30	....	22,167·50	14,377·65	....
		Sundry claims	....	....	....	....	....	36·84	695·68	2,356·15	1,530·56	....
Wilsons Creek	....	Voided leases	....	....	....	....	....	....	....	333·50	168·27	....
		Sundry claims	....	....	....	....	....	·70	4·24	316·00	261·12	....
Wilsons Patch	....	Voided leases	....	....	....	....	....	....	99·38	28,863·35	13,050·19	1·05
		Sundry claims	....	....	....	....	....	4·68	54·46	1,612·16	1,416·41	....
	From District Generally :—											
	Sundry Parcels treated at :—											
	State Battery, Darlot	....	....	....	....	....	....	....	....	18·00	*786·34	....
	Reefer Cyanide Plant	....	....	....	....	....	....	....	....	20·00	3,125·37	22·38
	Various Works	....	....	....	....	....	....	....	....	789·50	22,175·93	135·97
	Reported by Banks and Gold Dealers	12·51	....	25·00	6·23	....	3,550·82	252·83	46·50	57·80	....
	Total	**12·51**	....	**139,263·00**	**33,870·07**	**3,111·58**	**3,964·64**	**16,651·64**	**7,182,676·47**	**2,941,778·81**	**179,107·48**

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 1959					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.												
Burtville	G.M.L. 2567T....	Boomerang	....	....	415·00	29·73	3·67	....	....	415·00	29·73	3·67
		Voided leases	....	....	....	....	....	4·89	419·10	74,268·45	122,454·22	948·27
		Sundry claims	....	....	1,161·50	101·32	....	2·65	208·27	8,677·66	5,673·60	....
Duketon	....	Voided leases	....	....	....	....	....	5·35	3,216·10	31,889·42	22,542·63	....
		Sundry claims	....	....	....	....	....	80·50	528·26	2,442·65	2,196·49	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	2500T	Westralia	....	....	·10	6·46	....	....	....	·10	128·96	....
		Voided leases	....	....	....	....	....	10·07	393·41	156,730·90	101,512·60	4,327·81
		Sundry claims	....	....	....	....	....	1,181·65	165·05	5,716·59	3,888·89	....
Euro	....	Voided leases	....	....	....	....	....	....	65·14	91,821·50	37,678·25	....
		Sundry claims	....	....	....	....	....	4·87	73·04	1,507·00	835·30	....
Laverton	2445T, etc.	Lancefield leases	....	....	60·50	3·94	....	....	....	49,350·75	5,137·53	22·62
	2445T	Lancefield Extended West	....	....	....	....	....	....	....	881·25	846·77	....
	2489T	Wedge	....	....	....	....	....	....	....	222·00	21·19	....
	2478T	Lancefield North	....	....	....	....	....	....	....	2,235·25	438·99	....
	2541T	Mary Mack	....	....	27·00	2·50	....	....	....	119·00	13·71	....
		Voided leases	....	....	....	....	....	28·59	2,028·85	2,078,312·87	813,661·87	56,923·16
		Sundry claims	....	....	5·00	6·20	....	215·58	1,492·90	17,552·50	9,256·80	....
Mt. Barnicoat	....	Voided leases	....	....	....	....	....	....	23·08	2,370·00	2,251·99	....
		Sundry claims	....	....	....	....	....	....	·68	1,309·75	1,087·77	....
Mt. Shenton	....	Voided leases	....	....	....	....	....	....	....	15·00	26·65	....
		Sundry claims	....	....	....	....	....	....		279·25	209·67	....
	From District Generally :—											
	Sundry Parcels treated at :—											
	State Battery, Laverton		....	....	....	....	....	....	....	97·50	*19,327·97	561·11
	United Gold Recoveries Pty. Ltd. (T.L. 2T, 5T)		....	....	....	....	....	....	....	·25	*3,786·44	3,374·06
	Various Works		....	....	....	....	....	....	....	214·75	*19,403·68	·24
	Reported by Banks and Gold Dealers		10·71	....	....	2·42	....	2,557·14	108·08	....	29·18	....
	Total		**10·71**	....	**1,669·10**	**152·57**	**3·67**	**4,115·36**	**9,354·35**	**2,528,010·24**	**1,174,039·21**	**66,190·70**

(12)—37498

North Coolgardie Goldfield.

MENZIES DISTRICT.

Comet Vale	G.M.L. 5766Z....	Coonega Extended	....	....	17·50	7·64	....	....	....	100·25	35·55	....
	5778Z	Meteor	....	....	113·50	8·94	....	....	....	165·75	14·29	....
		Voided leases	....	....	....	....	....	....	419·74	267,385·72	193,243·62	5,355·33
		Sundry claims	....	....	....	....	....	....	40·19	2,041·21	1,022·83	....
Goongarrie	5740Z	Gulls Blow	....	....	8·75	36·03	....	....	164·75	357·50	257·47	....
		Voided leases	....	....	....	....	....	·94	1,385·26	29,897·79	18,124·83	....
		Sundry claims	....	....	....	....	....	46·46	2,109·79	2,835·85	3,342·42	....
Menzies	5543Z	Black Swan	....	....	....	....	....	....	....	1,135·63	1,658·49	9·08
	5736Z	Bodington	....	....	....	....	....	....	134·83	150·50	181·15	....
	5511Z	First Hit	....	....	795·00	122·86	....	....	....	4,711·75	6,961·81	21·25
	5511Z, etc.	First Hit Gold Mines (1934) Ltd.	....	....	....	....	....	....	....	68,473·70	49,060·96	6,676·23
	5542Z	Good Block Lease	....	....	117·50	14·45	....	....	7·32	2,642·00	2,919·52	....
	5780Z	Good Enough	....	....	510·50	128·76	....	....	....	510·50	128·76	....
	5520Z	Mignonette	....	....	19·25	8·12	....	....	....	808·50	404·43	....
		Voided leases	....	....	....	....	....	45·42	1,125·41	937,698·50	727,099·60	13,586·39
		Sundry claims	7·37	....	892·00	322·75	36·37	56·87	623·61	35,793·94	25,728·52	812·86
Mt. Ida	5701Z, etc.	Moonlight Wiluna Gold Mines Ltd.	....	....	32,229·00	15,879·35	....	....	40·77	262,313·86	136,902·98	787·54
		Prior to transfer to present holders	....	....	....	....	....	....	....	31,833·25	16,021·98	891·37
		Voided leases	....	....	....	....	....	....	92·21	68,748·92	72,681·44	106·63
		Sundry claims	....	....	3·75	4·43	....	48·14	436·08	16,093·41	8,267·10	·12
Twin Hills	....	Voided leases	....	....	....	....	....	....	....	582·30	574·93	....
		Sundry calims	....	....	....	....	....	....	....	97·80	86·69	....
	From District generally :											
	Sundry Parcels treated at :											
	W. Bracegirdle and R. Bennetts (L.T.T. 1Z/57)	....	....	....	....	....	....	....	....	328·75	12·62	....
	R. H. Bennetts (L.T.T. 1423H)	....	....	31·25	11·52	....	....	....	....	31·25	11·52	....
	State Battery, Mt. Ida	....	....	....	*9·77	1·99	....	....	....	1,866·25	*7,553·62	2·04
	State Battery, Menzies	....	....	....	*889·43	....	....	....	....	....	*1,743·45	....
	Various Works	....	....	....	....	....	....	....	....	2,807·80	58,744·47	3,062·11
	Reported by Banks and Gold Dealers	1·38	....	....	....	....	1,487·17	403·04	100·00	48·49	....	
	Total	**8·75**	....	**34,738·00**	**17,444·05**	**38·36**	**1,685·00**	**6,983·00**	**1,739,512·68**	**1,332,833·54**	**31,310·95**	

ULARRING DISTRICT.

Daveyhurst	G.M.L. 1016U, etc.	New Coolgardie Gold Mines N.L.	....	....	80·00	13·67	....	....	....	132,278·00	67,738·19	15,808·01
	1016U, 1085U	(New Callion)	....	....	....	....	....	....	....	5,293·30	2,002·37	119·67
		Voided leases	....	....	....	....	....	2·93	152·64	166,783·32	126,011·36	5,408·47
		Sundry claims	....	....	....	....	....	....	208·48	13,773·19	5,719·76	....

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 1958					Total Production				
			Alluvial	Dollied and Specimens	Ore treated	Gold therefrom	Silver	Alluvial	Dollied and Specimens	Ore treated	Gold therefrom	Silver
			Fine ozs.	Fine ozs.	Tons (2,240 lb.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.)	Fine ozs.	Fine ozs.
NORTH COOLGARDIE GOLDFIELD—*continued.*												
ULARRING DISTRICT—*continued.*												
Morleys	1101U	Emerald	....	....	78·75	32·59	....	....	26·24	4,389·00	2,459·37	....
	1094U	First Hit	....	....	203·00	121·51	....	....	....	4,408·00	6,708·48	....
	1169U	First Hit North	....	....	....	....	....	....	....	3·50	5·79	....
	1168U	Hazel Dawn	....	....	....	....	....	....	....	51·25	104·97	....
	1081U	Mabel Gertrude	....	....	94·25	65·55	....	....	17·19	1,692·75	1,998·06	....
	1089U	Paramount	....	....	411·00	90·91	....	....	1·49	4,547·50	3,812·36	....
	1163U	Two Chinamen	....	....	....	....	....	....	....	9·25	15·28	....
		Voided leases	....	....	....	....	....	....	3,854·94	2,956·50	5,944·69	10·54
		Sundry claims	....	....	40·75	18·56	....	2·16	932·23	1,929·50	2,627·31	....
Mulline	1107U	Ajax West	....	....	571·75	375·97	....	....	1·37	8,339·50	6,638·26	....
	1172U	Dolly's Grave	....	....	....	....	....	....	....	46·00	5·79	....
	1170U	Golden Wonder	....	....	96·50	918·75	....	....	....	228·50	1,586·98	....
	1173U	Riverina	....	....	29·00	9·49	....	....	....	29·00	9·49	....
	1070U	(Riverina)	....	....	....	....	....	....	....	283·00	75·30	....
	1068U, etc.	(Riverina Gold Mines Pty. Ltd.)	....	....	....	....	....	....	....	32,085·50	11,669·45	·07
	1175U	The Problem	....	....	25·35	54·14	....	....	....	25·35	54·14	....
	1176U	Wildcat	....	....	27·00	22·07	....	....	....	27·00	22·07	....
		Voided leases	....	....	....	....	....	....	274·09	102,637·22	103,360·32	530·75
		Sundry claims	....	....	69·00	119·77	....	10·82	296·42	11,093·64	9,674·75	1·10
Mulwarrie	1153U	Fourmile	....	....	6·00	29·38	....	....	....	83·00	466·34	....
	1113U	Oakley	....	....	300·00	279·62	....	....	....	3,814·00	5,303·02	....
		Voided leases	....	....	....	....	....	....	165·29	19,480·68	26,369·21	38·47
		Sundry claims	....	....	....	....	....	·80	282·29	3,106·33	2,722·13	....
Uularring	....	Voided leases	....	....	....	....	....	....	563·34	9,771·60	13,907·76	....
		Sundry claims	....	....	....	....	....	....	....	671·50	309·48	....
	From District generally :—											
	Sundry Parcels treated at :											
	State Battery, Mulline		....	....	....	....	....	....	....	639·99	*16,459·89	....
	State Battery, Mulwarrie		....	....	....	....	....	....	....	613·18	*6,564·16	....
	A. Scott-Linnett and A. Norman-Hawkins (L.T.T. 1252H)		....	....	....	....	....	....	....	....	*162·19	....
	Riverina South Battery		....	....	....	....	....	....	....	....	*900·46	....
	Various Works		....	....	....	....	....	....	15·82	268·15	*9,639·15	11·15
	Reported by Banks and Gold Dealers		....	....	....	....	....	112·81	411·29	100·00	106·34	....
	Total		....	....	**2,032·35**	**2,151·98**	....	**129·52**	**7,203·12**	**531,458·20**	**441,154·67**	**21,928·23**

NIAGARA DISTRICT.

Desdemona	....	Voided leases	....	....	....	....	....	....	7·12	9,809·00	7,555·81	12·04
		Sundry claims	....	....	....	....	....	....	10·35	2,225·45	892·48	....
Kookynie	928G	Altona	....	....	1,204·00	261·27	....	....	....	10,262·00	6,423·87	·44
	911G	Cosmopolitan South	....	....	260·00	101·90	....	....	....	2,630·00	1,349·77	....
	933G	New Gladstone	....	....	....	....	....	....	....	898·25	323·72	....
	937G	Victory	....	....	71·25	31·93	....	....	....	81·25	45·47	....
		Voided Leases	....	....	....	....	....	3·35	347·30	744,917·21	394,601·81	5,375·97
		Sundry Claims	....	....	278·00	118·93	....	60·92	106·60	9,386·80	6,913·06	3·02
Niagara	....	Voided leases	....	....	....	....	....	....	104·54	85,876·50	52,365·05	....
		Sundry Claims	....	....	28·75	4·26	....	28·10	97·22	14,687·91	8,265·87	....
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 :—											
	Various Works		....	....	....	....	....	....	....	1,220·50	20,884·22	120·98
	Reported by Banks and Gold Dealers		....	....	....	....	....	1,593·39	823·66	....	63·53	....
	Total		....	....	**1,842·00**	**518·29**	....	**1,718·36**	**1,821·77**	**940,513·77**	**527,085·39**	**5,686·69**

YERILLA DISTRICT.

Edjudina	....	Voided leases	....	....	....	....	....	....	18·44	35,523·70	43,374·79	37·79
		Sundry claims	....	....	19·00	2·52	....	....	28·52	6,967·58	4,829·77	·69
Patricia	....	Voided leases	....	....	....	....	....	....	....	4,158·50	5,396·40	25·40
		Sundry claims	....	....	....	....	....	....	....	47·00	20·78	....
Pin Gin	....	Voided leases	....	....	....	....	....	....	48·34	17,463·30	10,742·77	....
		Sundry claims	....	....	....	....	....	....	154·86	5,642·59	3,475·75	....
Yarri	G.M.L. 1320R	Margaret	....	....	....	....	....	....	....	3,874·00	1,219·54	....
	1327R	Nil Desperandum	....	....	....	....	....	....	....	328·00	76·26	....
	1126R, etc.	Porphyry (1939) G.M., N.L.	....	....	....	....	....	....	....	66,939·00	9,893·51	261·95
	1126R, etc.	(Edjudina Gold Mining Co., N.L.)	....	....	....	....	....	....	....	30,220·00	5,409·93	507·51
		Prior to transfer to present holders	....	....	....	....	....	....	....	124·50	38·89	....
	1340R	Patricia	....	....	281·00	51·99	....	....	....	281·00	51·99	....
	1339R	Yilgangie	....	....	345·00	152·75	....	....	....	345·00	152·75	....
		Voided leases	....	....	....	....	....	6·30	87·08	44,584·75	21,248·26	2·00
		Sundry claims	....	....	178·50	48·74	....	·87	5·93	17,479·05	6,199·53	·98
Yerilla	....	Voided leases	....	....	....	....	....	....	3,107·25	16,481·43	12,925·74	13·93
		Sundry claims	....	....	....	....	....	19·30	97·63	2,752·83	1,590·03	....
Yilgangie	1176R, etc.	Western Mining Corporation	....	....	1,899·00	2,078·76	366·59	....	....	23,915·75	22,641·17	3,332·31
		Prior to transfer to present holders	....	....	....	....	....	....	·85	1,244·75	1,830·28	....
		Voided leases	....	....	....	....	....	....	9·94	2,432·75	1,500·80	....
		Sundry claims	....	....	....	....	....	121·67	98·20	3,316·30	2,040·88	·63

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 1959					Total Production				
			Alluvial	Dollied and Specimens	Ore treated	Gold therefrom	Silver	Alluvial	Dollied and Specimens	Ore treated	Gold therefrom	Silver
			Fine ozs.	Fine ozs.	Tons (2,240 lb.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.)	Fine ozs.	Fine ozs.
NORTH COOLGARDIE GOLDFIELD—continued.												
YERILLA DISTRICT—*(continued)*.												
From District Generally :—												
Sundry Parcels treated at :—												
State Battery, Yarri			....	....	....	....	....	....	....	276·50	*9,060·18	11·65
State Battery, Yerilla			....	....	....	....	....	....	....	....	*43·52	....
Various Works			....	....	....	....	....	2·17	....	642·25	*6,049·24	....
Reported by Banks and Gold Dealers			....	....	....	....	....	1,161·60	160·08	....	27·36	....
Total			....	....	**2,722·50**	**2,334·76**	**366·59**	**1,311·91**	**3,817·12**	**285,040·53**	**169,840·12**	**4,194·84**

Broad Arrow Goldfield.

Bardoc		Voided leases	....	....	....	....	....	....	2,335·41	85,370·59	55,699·50	203·60
		Sundry claims	....	....	155·00	20·53	....	54·95	1,218·09	17,717·28	8,324·60	....
Black Flag	2229W	Bellvue	....	....	311·73	102·07	·17	....	212·68	3,047·23	3,045·89	·17
		Voided leases	....	....	....	....	....	27·81	405·90	48,277·79	28,175·08	....
		Sundry claims	....	....	79·00	13·01	....	712·92	251·59	8,177·51	5,001·47	....
Broad Arrow		Voided leases	....	....	....	....	....	70·32	10,453·81	155,895·94	120,088·05	20·23
		Sundry claims	....	....	220·50	61·20	....	1,007·72	3,046·17	34,686·64	17,008·49	·11
Cane Grass		Voided leases	....	....	....	....	....	....	27·77	669·82	460·72	....
		Sundry claims	....	....	....	....	....	....	227·55	717·45	505·06	....
Carnage		Voided leases	....	....	....	....	....	176·04	659·31	2,402·00	2,170·67	....
		Sundry claims	....	....	....	....	....	....	6·61	2,340·33	921·90	....
Cashman		Voided leases	....	....	....	....	....	67·51	813·76	8,172·15	7,090·91	....
		Sundry claims	....	....	....	....	....	....	40·31	1,205·12	361·74	·05

Christmas Reef	2279W	New Mexico	....	....	13·50	8·35	....	....	....	370·50	251·55	....
	2253W	New Mexico South	....	....	482·25	178·13	....	....	....	2,914·75	3,364·13	....
		Voided leases	....	....	....	....	....	....	55·49	1,865·12	3,606·65	....
		Sundry claims	....	....	22·00	17·54	....	....	441·85	3,312·14	3,245·56	....
Fernbark	....	Voided leases	....	....	....	....	....	....	4·42	6,771·00	2,711·68	....
		Sundry claims	....	....	....	....	....	....	51·96	3,031·52	1,000·47	....
Grants Patch	2277W	Coronation	....	....	46·50	47·96	....	....	....	506·50	420·37	....
	2299W	Jeanie May	....	....	160·60	40·13	....	....	....	160·60	40·13	....
	2278W	Prince of Wales Syndicate	....	....	44·75	125·25	....	....	....	443·75	832·52	....
	2277W, 2278W	(Ora Banda Amalgamated Mines, N.L.)	....	....	....	....	....	....	....	961·00	1,146·17	....
		Voided leases	....	....	....	....	....	....	274·13	203,675·74	80,047·31	175·00
		Sundry claims	....	....	98·80	54·52	....	....	356·66	6,613·59	3,154·16	....
Ora Banda	T.A. 42, M.A. 41	Associated Northern Ora Banda, N.L.	....	....	....	....	....	....	....	2,786·50	464·53	21·07
		Prior to transfer to present holders	....	....	....	....	....	....	....	315,958·95	123,252·22	1,664·70
	2270W	Gimlet South	....	....	1,490·00	282·22	....	....	....	8,473·75	1,701·96	....
		Voided leases	....	....	....	....	....	....	846·13	104,719·32	27,471·80	....
		Sundry claims	....	....	549·00	139·36	....	....	467·18	14,975·30	4,798·93	....
Paddington	2298W	Rona Lucille	....	....	94·00	14·78	....	....	....	94·00	14·78	....
	2294W	Shirley Lorna	....	....	56·75	5·68	....	....	....	188·00	53·26	....
		Voided leases	....	....	....	....	....	5,566·30	463·31	196,298·56	86,432·73	32·15
		Sundry claims	....	....	97·25	11·61	....	1,714·16	291·43	17,237·98	9,270·47	....
Riches Find	....	Voided leases	....	....	....	....	....	....	21·64	7,643·09	6,095·69	71·36
		Sundry claims	....	....	....	....	....	....	296·26	1,943·75	2,289·23	·13
Siberia	....	Voided leases	....	....	....	....	....	1·07	2,649·28	28,995·47	31,776·06	....
		Sundry claims	....	....	....	....	....	289·06	1,261·72	21,308·29	12,887·07	....
Smithfield	2296W	Timewell	....	....	15·75	10·41	....	....	....	15·75	10·41	....
		Voided leases	....	....	....	....	....	....	19·19	11,717·71	2,068·58	....
		Sundry claims	....	....	459·25	72·99	....	....	124·29	3,824·34	1,368·76	....
	From Goldfield generally :—											
	Sundry Parcels treated at :											
	State Battery, Ora Banda	....	....	....	*456·36	....	....	....	....	128·05	*25,604·35	11·56
	Golden Arrow Battery	....	....	....	....	....	....	....	....	80·75	4,333·07	2·30
	Various Works	....	....	....	....	....	....	2,275·66	1·24	16,967·02	49,504·77	3,103·45
	Reported by Banks and Gold Dealers	·18	....	....	·77	....	10,018·18	150·16	61·68	91·82	....
	Total	**·18**	....	**4,396·63**	**1,662·87**	**·17**	**21,981·70**	**27,475·30**	**1,352,724·32**	**738,165·27**	**5,305·88**

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 1959					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.												
KANOWNA DISTRICT.												
Gindalbie	G.M.L. 1583X	S.H.E.	....	....	127·00	62·18	....	....	....	243·00	163·25	....
		Voided leases	....	....	....	....	....	....	1,151·99	46,180·53	41,748·13	38·31
		Sundry claims	....	....	73·25	22·86	....	....	716·52	5,693·27	3,236·41	....
Gordon	....	Voided leases	....	....	....	....	....	....	682·54	53,900·58	20,072·51	517·61
		Sundry claims	....	....	15·50	5·15	....	....	177·38	2,246·95	1,227·24	....
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	1584X	Atlas	....	....	68·50	7·51	....	....	....	68·50	7·51	....
	1572X	Kanowna Red Hill	....	....	288·75	146·93	....	....	2·38	2,803·00	931·39	....
		Voided leases	....	....	....	....	....	24·94	4,516·76	685,557·10	380,497·36	2,482·24
		Sundry claims	....	....	209·75	42·55	....	125·32	2,169·07	27,449·52	11,984·22	1·50
Mulgarrie	....	Voided leases	....	....	....	....	....	....	1,216·63	6,902·26	4,197·98	....
		Sundry claims	....	....	....	....	....	....	16·78	1,290·00	646·60	....
Six Mile	....	Voided leases	....	....	....	....	....	....	1,603·72	559·00	767·72	....
		Sundry claims	....	....	....	....	....	....	56·51	764·50	231·13	....
		From District generally :—										
		Sundry Parcels treated at :										
		G. B. Edwards (L.T.T. 1X/59)	....	....	....	*3·52	....	....	....	....	*3·52	....
		Various Works	....	....	....	....	....	330·42	867·52	158,935·05	*153,205·89	....
		Reported by Banks and Gold Dealers	4·37	....	....	....	....	106,025·29	40·42	·50	109·73	....
		Total	**4·37**	....	**782·75**	**290·70**	....	**106,530·67**	**13,526·67**	**1,007,629·76**	**626,810·74**	**3,039·73**
KURNALPI DISTRICT.												
Jubilee	....	Voided leases	....	....	....	....	....	....	145·13	2,122·50	1,465·16	....
		Sundry claims	....	....	12·25	2·06	....	25·57	13·52	1,246·25	522·21	....
Kurnalpi	G.M.L. 456K	Purple Patch	....	....	78·25	64·42	....	....	....	78·25	64·42	....
		Voided leases	....	....	....	....	....	371·18	3,166·80	4,052·51	3,957·71	6·27
		Sundry claims	....	....	59·25	23·46	....	324·12	727·39	4,512·11	2,341·18	....
Mulgabbie	....	Voided leases	....	....	....	....	....	....	1,402·66	226·75	7,845·87	4·95
		Sundry claims	....	....	....	....	....	8·06	2,772·71	1,327·45	2,241·18	....

From District generally :—													
Sundry Parcels treated at :													
Various Works	....	....	....	....	....	....	....	....	101·50	388·63	....
Reported by Banks and Gold Dealers	....	....	....	....	....	12,106·56	70·70	....	2·35	1·49
Total	....	....	**149·75**	**89·94**	....	**12,835·49**	**8,298·91**	**13,667·32**	**18,828·71**	**12·71**

East Coolgardie Goldfield.

EAST COOLGARDIE DISTRICT.

Binduli	G.M.L. 6582E....	Royal Standard	....	....	131·00	10·19	....	....	....	173·00	14·05	....
		Voided leases	....	....	....	....	....	....	....	1,640·35	475·81	....
		Sundry claims	....	....	111·75	13·22	....	....	13·01	5,485·77	1,704·42	....
Boorara	....	Voided leases	....	....	....	....	....	....	459·07	309,467·82	172,861·95	411·37
		Sundry claims	....	....	....	....	....	·49	145·56	4,186·34	1,562·62	·05
Boulder	6145E	Boomerang	....	....	....	....	....	....	....	77·00	8·00	....
	5531E	Cassidy's Hill	....	....	623·25	52·83	....	....	....	698·75	60·60	....
	5964E	Croesus Extended	....	....	....	....	....	....	....	192·75	16·57	....
	6537E	Golden Key	....	10·32	196·10	291·02	....	....	58·22	696·10	772·31	....
	5692E, etc.	Gold Mines of Kalgoorlie (Aust.) Ltd.	....	....	476,697·00	119,861·67	22,581·45	....	....	1,456,955·00	383,716·49	74,991·90
		Prior to transfer to present holders	....	....	....	....	....	....	791·73	15916155·97	6,415,881·49	819,123·27
	5696E	Great Boulder Pty. Gold Mines Ltd.	....	....	454,474·00	124,040·73	28,144·20	....	1·53	13225879·97	6,146,759·80	1,481,829·37
	5845E	Happy Returns	....	....	....	....	....	....	....	7,928·00	1,462·92	....
	5478E, etc.	Lake View and Star Ltd.	....	....	669,927·00	172,419·61	20,721·77	....	....	15133868·30	4,477,125·78	490,339·52
		Prior to transfer to present holders	....	....	....	....	....	....	8·49	15792500·38	9,149,223·80	1,348,055·28
	5431E, etc.	North Kalgurli (1912) Ltd.	....	....	361,344·00	89,006·65	22,332·88	....	127·55	5,345,895·24	1,473,724·67	308,776·13
	5405E, etc.	North Kalgurli (1912) Ltd. (Croesus Pty. Group)	....	....	....	....	....	....	51·20	90,159·00	19,261·22	....
	5891E	New Croesus	....	....	....	....	....	....	....	193·00	48·74	....
		Prior to transfer to present holders	....	....	....	....	....	43·99	....	4,018,436·01	2,815,911·21	97,625·03
		Voided leases	....	....	....	....	....	129·24	12,023·37	1,814,628·06	760,470·54	24,046·96
		Sundry claims	....	....	....	....	....	24·58	212·32	11,649·99	4,300·62	....
Cutters Luck	....	Voided leases	....	....	....	....	....	45·87	133·58	74·50	239·19	....
		Sundry claims	....	....	....	....	....	8·11	501·65	922·90	384·71	....
Feysville	....	Voided leases	....	....	....	....	....	....	110·93	863·30	425·16	....
		Sundry claims	....	....	....	....	....	....	199·00	1,237·10	645·88	....
Hampton Plains	P.P.L. 1, etc.....	Consolidated Gold Areas N.L.	....	....	....	....	....	....	....	142,565·73	37,249·15	5,835·85
	P.P.L. 86	Golden Hope N.L.	....	....	....	....	....	....	....	5,964·00	2,006·14	....
	P.P.L. 192	Golden Hope North	....	....	....	....	....	....	....	353·00	201·02	....
	P.P.L. 252	Hampton Properties Ltd.—Mt. Martin	....	....	....	....	....	....	....	14,953·75	5,574·11	....
	P.P.L. 471	D. Cullen and R. Renton	....	....	7·05	126·78	....	....	....	7·05	126·78	....
	P.P.L. 474	L. Rowell	....	....	20·75	3·96	....	....	....	20·75	3·96	....
	P.P.L. 460	Hampton Xmas Gift	....	....	....	....	....	6·72	37·57	107·00	89·44	....
	P.P.L. 476	Ivy Rose	....	....	24·05	31·88	....	....	....	24·05	31·88	....
	P.P.L. 12	Junction Extended	....	....	....	....	....	....	....	3,581·75	527·74	....
	P.P.L. 277	M. Africh	....	....	367·00	49·27	....	....	....	367·00	49·27	....

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 1958					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. 277	Pernatty	....	....	....	....	....	....	....	7,247·75	866·88	·01
	P.P.L. 277	New Hope	....	....	....	....	....	....	17·23	61,468·55	11,175·94	....
	P.P.L. 50	A. McKay	....	....	80·25	5·46	....	....	....	80·25	5·46	....
	P.P.L. 23	Mutooroo (Scherini and Rowe)	....	....	....	....	....	....	....	1,747·50	134·82	....
	P.P.L. 10	F. C. Schoppe	....	....	....	....	....	....	....	888·75	37·82	....
	P.P.L. 175	Jubilee	....	....	....	....	....	....	....	6,708·00	906·81	....
		Cancelled leases	....	....	....	....	....	4,578·52	203·94	126,877·34	39,711·84	69·83
		Sundry claims and leases	....	....	....	....	....	2·68	70·85	46,439·41	8,509·67	....
Kalgoorlie	G.M.L. 6048E	Auld Acquaintance	....	....	....	....	....	....	....	7·50	2·36	....
	6562E	Bretvic	....	....	....	....	....	....	....	326·50	26·09	....
	6563E, 6564E	Champagne Syndicate N.L.	....	....	....	....	....	....	....	12,287·75	1,348·10	61·41
	4547E, etc.	Mount Charlotte (Kalgoorlie) Gold Mines Ltd.	....	....	....	....	....	....	....	25,143·25	2,888·32	110·15
		Prior to transfer to present holders	....	....	....	....	....	....	5·72	48,292·60	13,930·79	....
	6503E	Coronation	....	....	....	....	....	....	....	20·50	2·52	....
	5913E	Devon Consols	....	....	171·50	10·53	....	....	93·19	2,561·71	717·00	....
	5915E	Edna Derby	....	....	34·00	2·76	....	....	....	434·00	93·94	....
	5647E	Golden Cross	....	....	....	....	....	....	....	156·25	19·77	....
	5510E	Golden Dream	....	....	23·50	4·55	....	....	....	172·75	16·03	....
	5774E	Golden Goose	....	....	18·50	3·26	....	....	....	234·00	56·33	....
	5739E	Golden Star	....	....	....	....	....	....	....	918·50	85·96	....
	6502E	Western Mining Corporation (Hannans North)	....	....	....	....	....	....	....	256·00	65·07	4·28
	6504E	Historic	....	....	....	....	....	....	....	257·00	17·27	....
	5460E	Kalgoorlie Star	....	....	....	....	....	....	....	290·25	56·54	....
	5878E	Lady May	....	....	....	....	....	....	62·05	4,740·50	1,177·07	....
	6091E	Lesanben	....	....	40·05	41·46	....	....	193·96	862·55	458·20	....
	6485E	Maritana Hill	....	....	186·75	6·21	....	....	....	3,138·50	394·23	....
	6535E	Mary A	....	....	388·50	60·17	....	....	....	3,720·25	348·75	....
	6565E	Midas	....	....	8·00	11·41	....	....	....	8·00	11·41	....
	6321E	North End Extended	....	....	142·25	8·73	....	....	69·28	2,117·25	512·25	....
	5852E (6024E)	Pedestal Leases	....	....	....	....	....	....	....	1,828·50	490·37	....
	5852E	(Pedestal)	....	....	....	....	....	....	....	1,608·75	444·93	....
	(6024E)	Trident	....	....	....	....	....	....	....	58·75	36·67	....
	5468E	Phar Lap	....	....	....	....	....	....	....	2,083·25	750·82	2·50
	5415E, 5803E	Return Leases	....	....	....	....	....	....	5·64	3,831·75	656·15	....
		Voided leases	....	....	....	....	....	242·48	10,572·12	1,457,335·80	578,523·61	45,973·47
		Sundry claims	....	....	46·90	5·35	....	232·41	1,124·61	61,445·78	23,206·80	....

Wombola	6051E	Big Bull	....	....	74·25	48·90	....	....	....	669·75	481·76	....
	5688E (5967E)	Caledonian Leases	....	....	....	....	....	....	....	970·00	659·67	....
	5688E	(Caledonian)	....	....	....	....	....	....	....	4,275·00	3,632·98	....
	(5967E)	North Caledonian	....	....	....	....	....	....	1·27	22·25	8·15	....
	5497E, 5500E....	Daisy Leases	....	....	1,015·00	769·78	22·42	....	....	15,441·45	11,207·27	84·53
	5497E	(Daisy)	....	....	....	....	....	....	....	6,282·25	5,031·93	....
	5500E	(Happy-Go-Lucky)	....	....	....	....	....	....	....	2,075·25	1,675·85	....
	6032E	Dry Mount	....	....	101·50	11·95	....	....	....	1,366·25	1,161·55	·60
	6325E	Great Hope	....	....	246·75	89·16	....	....	26·66	582·00	204·93	....
	5689E, etc.	Mt. Monger Mining Syndicate	....	....	1,481·00	1,363·66	....	....	....	3,936·25	2,671·06	26·18
	5689E	(Haoma Gold Mines N.L.)	....	....	....	....	....	....	....	9,233·00	7,239·42	269·03
	5689E, etc.	(Haoma Leases)	....	....	....	....	....	....	....	27,396·50	25,445·40	79·15
	5689E	(Haoma)	....	....	....	....	....	....	....	2,168·00	1,948·36	·54
	5525E	(Xmas Flat)	....	....	....	....	....	....	....	330·25	264·74	....
	5798E	(Maranoa)	....	....	....	....	....	....	32·17	3,183·50	1,633·27	....
	5493E	(New Milano N.L.)	....	....	....	....	....	....	·25	17,390·75	11,622·24	479·00
	5493E	(Milano)	....	....	....	....	....	....	....	4,012·75	11,676·72	....
	(5616E)	(Leslie)	....	....	....	....	....	....	....	602·00	939·10	....
	6312E	Inverness	....	....	160·25	38·78	....	....	....	2,775·00	498·67	....
	6540E	Launa Doone	....	....	201·25	49·39	....	....	....	627·75	152·81	....
	6487E	Leslie	....	....	25·25	55·27	....	....	....	293·75	311·93	....
	6213E	Pauline	....	....	....	....	....	....	....	282·50	229·08	....
	6570E	Rock-and-Roll	....	....	....	....	....	....	....	851·00	64·22	....
	6533E	Rosemary	....	....	589·50	958·54	....	....	....	2,652·50	4,791·94	....
	6568E	Vanezia	....	....	....	....	....	....	....	72·75	30·40	....
		Voided leases	....	....	....	....	....	3·80	2,464·78	29,227·09	41,054·88	....
		Sundry claims	....	....	310·50	31·53	....	....	711·10	24,573·68	14,330·52	....
	From District Generally :—											
	Sundry Parcels treated at :—											
	Golden Horshoe (New) Ltd.	....	....	....	....	....	....	....	....	*350,028·15	354,192·20
	State Battery, Kalgoorlie	....	....	....	602·79	6·78	....	....	390·70	*34,193·36	73·46
	Sundry claims	....	....	....	....	....	11,014·57	465·61	5,440·46	2,541·10	....
	B. Bagworth and A. Parker (L.T.T. 1415H)	....	....	....	3·57	....	....	....	....	*3·57	....
	Northern Mineral Sands	....	....	491·75	78·11	....	....	....	532·25	*216·88	....
	Various Works	....	....	....	....	....	384·36	64·70	41,135·02	*270,756·33	14,114·46
	Reported by Banks and Gold Dealers	30·21	15·38	15·00	68·22	....	16,957·08	10,038·53	392·43	7,498·53	....
	Total	**30·21**	**25·70**	**1,969,775·15**	**510,237·35**	**93,809·50**	**33,674·90**	**41,098·44**	**75402688·50**	**33374811·40**	**5,066,575·53**

BULONG DISTRICT.

Balagundi	....	Voided leases	....	....	....	....	....	....	2,408·98	1,115·93	1,488·91	12·92
		Sundry claims	....	....	....	....	....	3·51	293·52	806·01	505·93	....
Bulong	G.M.L. 1311Y	Blue Quartz	....	....	....	....	....	....	....	2,031·25	701·61	....
	1337Y	Rainbow	....	....	148·50	25·61	....	....	....	148·50	25·61	....
	1336Y	Rosina	....	....	184·50	34·05	....	....	....	184·50	34·05	....
		Voided leases	....	....	....	....	....	107·54	8,526·12	108,330·55	85,785·57	....
		Sundry claims	....	....	142·00	29·55	....	1,655·86	1,611·58	17,625·73	17,933·71	....
Majestic	....	Voided leases	....	....	....	....	....	19·45	63·91	1,317·94	647·62	....
		Sundry claims	....	....	....	....	....	42·88	154·58	1,926·55	948·06	....

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre	Number of Lease	Registered Name of Company or Lease	Total for 1958					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.												
BULONG DISTRICT—*continued.*												
Morelands	....	Sundry claims	....	....	....	....	....	....	·13	308·75	81·84	....
Mount Monger	....	Voided leases	....	....	....	....	....	....	2,771·39	1,437·85	1,256·10	....
		Sundry claims	....	....	....	....	....	215·60	....	379·05	308·48	....
Randalls	....	Voided leases	....	....	....	....	....	....	60·04	33,180·35	11,100·46	....
		Sundry claims	....	....	....	....	....	20·70	9·79	4,842·56	1,216·07	....
Taurus	....	Voided leases	....	....	....	....	....	2·06	3·70	1,765·10	909·84	....
		Sundry claims	....	....	....	....	....	112·69	51·88	2,656·60	1,049·81	....
Hampton Plains .... (Trans Find)	P.P.L. 308A	Dawn of Hope	....	....	....	....	....	....	2·87	1,145·75	330·33	....
		Voided leases	....	....	....	....	....	....	....	1,098·42	876·22	....
		Sundry claims	....	....	....	....	....	....	5·93	808·25	335·33	....
		From District Generally :— Sundry Parcels treated at :— Various Works	....	....	....	....	....	....	....	6,102·15	*6,675·38	....
		Reported by Banks and Gold Dealers	....	....	....	....	....	25,224·93	70·15	·01	28·44	....
		Total	....	....	**475·00**	**89·21**	....	**27,405·22**	**16,034·57**	**187,211·80**	**132,239·37**	**12·92**
Coolgardie Goldfield												
COOLGARDIE DISTRICT												
Bonnievale	G.M.L. 5986	Jenny Wren	....	....	56·25	13·86	....	....	....	135·25	48·96	....
	5622	Lucky Hit	....	....	27·00	12·13	....	....	3·28	1,049·85	542·10	....
	4600	Melva Mae	....	....	91·50	6·71	....	....	....	3,876·65	3,854·37	2·35
		Prior to transfer to present holders	....	....	....	....	....	....	....	614·50	1,099·21	11·63
	5890	Rayjax	....	....	58·00	90·28	....	....	....	385·00	778·62	....
		Voided leases	....	....	....	....	....	....	212·48	358,205·72	191,459·32	5·88
		Sundry claims	....	....	74·50	28·25	....	....	163·19	8,191·63	5,392·98	·04
Bulla Bulling	5996	Pakaha's Son	....	....	160·00	99·74	....	....	....	432·50	218·57	....
		Voided leases	....	....	....	....	....	....	....	953·31	719·78	....
		Sundry claims	....	....	....	....	....	5·21	15·98	2,049·01	817·68	....
Burbanks	....	Voided leases	....	....	....	....	....	14·90	376·98	420,591·86	306,446·31	521·06
		Sundry claims	....	....	277·50	48·59	....	55·05	497·55	16,516·85	9,056·98	....

Cave Rocks	....	Voided leases	....	....	....	....	....	....	....	8,223·16	1,941·42	....
		Sundry claims	....	....	....	....	....	....	50·00	4,473·65	1,082·79	....
Coolgardie	G.M.L. 5679	Ada	....	....	....	....	....	....	....	1,834·95	167·23	....
	5935, etc.	Goldmines of Kalgoorlie (Aust.) Ltd.	....	....	19,637·00	13,854·60	....	....	....	96,645·00	46,737·09	907·43
	5876	(Bayleys West)	....	....	....	....	....	....	....	6·25	2·22	....
	5868	El Dorado	....	....	....	....	....	....	498·20	175·45	1,034·94	....
	5997	Ellen Jean	....	....	238·25	142·06	....	....	20·01	470·75	206·05	....
	5844	Jackpot	....	....	931·50	471·79	....	....	....	8,144·25	3,235·62	....
	5884	Lone Hand	....	....	....	....	....	....	19·85	475·25	77·30	....
	5992	Prejudice	....	....	78·00	6·15	....	....	....	610·25	66·57	....
		Voided leases	....	....	....	....	....	1,301·71	4,764·07	1,108,559·54	449,261·49	4,819·59
		Sundry claims	....	14·29	1,371·25	265·68	....	219·08	2,732·75	77,992·94	28,255·25	....
Eundynie	....	Voided leases	....	....	....	....	....	3·70	16·09	31,772·98	16,531·34	1·75
		Sundry claims	....	·34	....	....	....	....	229·66	698·12	521·20	....
Gibraltar	5723	Lloyd George	....	....	....	....	....	....	....	763·00	176·78	....
		Voided leases	....	....	....	....	....	....	33·97	38,762·63	20,114·27	....
		Sundry claims	....	....	10·50	2·54	....	1·39	50·76	3,280·60	1,393·01	....
Gnarlbine	....	Voided leases	....	....	....	....	....	....	13·95	2,731·75	1,341·60	....
		Sundry claims	....	....	....	....	....	....	4·90	1,186·10	504·18	....
Hampton Plains	P.P.L. 462	Bobby Dazzler	....	....	....	....	....	....	28·55	31·37	301·45	....
	419	Chtanooka	....	....	....	....	....	....	....	1,267·75	295·73	1·10
	335	C. & C. P. Clews	....	....	....	....	....	....	....	149·75	119·66	....
	338	Dry Hill	....	....	....	....	....	....	....	43·00	58·42	....
	465	G. Dugan & Party	....	....	....	....	....	....	....	53·75	17·54	....
	454	Golden Dollar	....	....	....	....	....	....	....	105·50	13·66	....
	319	Lady May	....	....	126·00	44·92	....	....	....	248·25	146·21	....
	319	(Lady May)	....	....	....	....	....	....	....	1,742·25	981·39	....
	334	Gold Mines of Kalgoorlie (Aust.) Ltd.	....	....	646·75	286·02	....	....	....	837·50	364·35	....
	468	J. P. Nichols & F. Hacket	....	....	....	....	....	....	....	24·25	5·30	....
	469	Cullen & Frank	....	....	....	....	....	....	6·46	3·75	2·34	....
	316, 330	Gold Mines of Kalgoorlie (Aust.) Ltd.	....	....	....	....	....	....	....	261,552·50	134,026·06	29,871·18
	316	(Surprise G.M.)	....	....	....	....	....	....	....	7,189·00	3,425·59	....
	330	(Barbara)	....	....	....	....	....	....	....	2,157·75	1,655·63	....
	471	A. J. Wells	....	....	45·00	1·40	....	....	....	45·00	1·40	....
	472	F. Clarke	....	....	13·50	1·85	....	....	....	13·50	1·85	....
	473	Austin & Haddow	2·56	....	30·00	28·38	....	2·56	....	30·00	28·38	....
	475	F. J. Wallace	....	....	16·00	5·22	....	....	....	16·00	5·22	....
	478	A. E. Smith	....	....	22·25	57·73	....	....	....	22·25	57·73	....
		Cancelled leases	....	....	....	....	....	....	451·32	13,950·84	11,118·69	....
		Sundry claims and leases	....	....	....	....	....	1·63	132·06	1,948·00	856·51	....
Higginsville	G.M.L. 5647	Fair Play Gold Mine	....	....	....	....	....	....	....	28,392·00	3,152·82	·02
	5293	Two Boys	....	....	....	....	....	....	....	402·00	1,265·18	·01
	5293	(Two Boys)	....	....	....	....	....	....	....	6,888·00	3,193·95	....
		Voided leases	....	....	....	....	....	....	482·47	38,296·60	17,571·08	160·71
		Sundry claims	....	....	....	....	....	....	187·25	3,664·76	1,957·50	....
Larkinville	....	Voided leases	....	....	....	....	....	22·77	54·44	2,335·16	3,256·49	....
		Sundry claims	....	....	....	....	....	....	147·20	490·53	1,033·19	....

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 1959					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*												
Logans	5324, etc.	Spargo's Reward Gold Mine (1935), N.L.	....	....	....	....	....	....	....	105,397·50	26,324·42	....
		Voided leases	....	....	....	....	....	....	....	1,263·31	607·26	....
		Sundry claims	....	....	14·00	10·50	....	6·88	128·95	2,035·85	925·28	....
Londonerry		Voided leases	....	....	....	....	....	....	95·04	34,155·35	22,238·37	·35
		Sundry claims	....	....	....	....	....	16·68	78·66	4,191·67	2,680·35	22·42
Mungari		Voided leases	....	....	....	....	....	....	17·71	1,872·50	458·43	....
		Sundry claims	....	....	....	....	....	1·77	153·24	2,828·94	752·60	....
Paris	5953	Northern Minerals Syndicate	....	....	2,827·00	873·16	61·73	....	....	2,827·00	873·16	61·73
	5873	Paris West	....	....	....	....	....	....	....	19·00	11·03	....
		Voided leases	....	....	....	....	....	·88	4·30	15,497·00	8,625·37	79·19
		Sundry claims	....	....	....	....	....	....	....	2,104·25	518·98	....
Red Hill		Voided leases	....	....	....	....	....	14·87	1,551·81	40,797·40	31,070·65	....
		Sundry claims	....	....	7·25	16·49	....	15·29	95·72	1,432·64	1,081·62	....
Ryan's Find	5999	Little Nipper	....	38·98	....	....	....	....	38·98	....	....	....
		Voided leases	....	....	....	....	....	....	....	54·16	151·69	....
		Sundry claims	....	477·56	....	....	....	....	478·00	116·44	355·83	....
St. Ives		Voided leases	....	....	....	....	....	63·34	146·87	39,318·46	16,208·86	....
		Sundry claims	....	....	....	....	....	211·25	950·23	4,177·56	1,459·39	....
Wannaway		Voided leases	....	....	....	....	....	....	28·61	1,831·95	1,465·70	....
		Sundry claims	....	....	....	....	....	....	193·79	1,336·12	1,310·57	....
Widgiemooltha	5663	Bobs	....	....	....	....	....	....	....	16·00	4·94	....
	5834	Harpers	....	....	....	....	....	....	9·54	40·00	93·06	....
	5451	Host Group	....	....	....	....	....	....	12·75	1,604·15	565·02	....
		Voided leases	....	....	....	....	....	17·95	1,252·70	22,727·81	11,965·35	·17
		Sundry claims	....	....	....	....	....	46·49	470·06	16,219·66	6,891·03	·07

	From District Generally :—											
	Sundry Parcels treated at :—											
	State Battery, Coolgardie	....	....	....	*415·73	....	....	....	771·01	*39,208·10	17·00
	Australian Machinery and Investment Co. Ltd., Cyanide Plant	....	....	....	....	....	....	....	....	*3,044·44	86·31
	T. A. James (T.A. 201)	....	....	....	....	....	....	....	361·00	*373·02	....
	Various Works	....	....	....	....	....	7·75	....	4,014·61	*29,780·07	223·06
	Reported by Banks and Gold Dealers	4·21	2·73	....	5·16	....	14,985·54	728·24	48·25	134·88	·65
	Total	**6·77**	**533·90**	**26,759·00**	**16,788·94**	**61·73**	**17,016·69**	**17,628·62**	**2,878,769·35**	**1,487,178·02**	**36,793·70**

KUNANALLING DISTRICT.

Carbine	1048S	Carbine	....	....	11·75	8·23	....	....	....	13,853·50	7,065·75	....
	33S, etc.	Carbine Leases	....	....	....	....	....	....	687·98	51,991·86	39,862·25	....
		Voided leases	....	....	....	....	....	....	....	20,116·00	5,470·81	....
		Sundry claims	....	....	....	....	....	136·08	96·96	6,430·13	2,270·71	....
Chadwin	....	Voided leases	....	....	....	....	....	....	....	4,837·80	5,298·69	2·50
		Sundry claims	....	....	....	....	....	14·28	82·36	5,972·55	2,945·14	·25
Dunnsville	....	Voided leases	....	....	....	....	....	....	828·58	17,548·85	8,657·45	....
		Sundry claims	....	....	13·75	5·92	....	21·00	1,034·08	3,004·46	2,090·62	....
Jourdie Hills	....	Voided leases	....	....	....	....	....	....	18·00	28,009·74	19,401·09	28·45
		Sundry claims	....	....	50·50	13·70	....	1·86	49·81	2,016·25	904·50	1·05
Kintore	....	Voided leases	....	....	....	....	....	18·70	169·33	56,822·89	40,044·61	677·88
		Sundry claims	....	....	....	....	....	111·91	102·70	4,709·53	2,548·75	....
Kunanalling	....	Voided leases	....	....	....	....	....	86·13	1,734·92	130,303·61	100,812·73	40·77
		Sundry claims	....	....	168·75	34·44	....	216·53	815·72	15,540·52	9,744·26	....
Kundana	....	Voided leases	....	....	....	....	....	....	....	465·00	68·12	....
		Sundry claims	....	....	....	....	....	....	....	475·25	60·38	....
	From District Generally :—											
	Sundry Parcels treated at :—											
	Goldfields Australian Development Plant	....	....	....	....	....	....	....	....	....	*548·07	....
	Various Works	....	....	....	....	....	42·23	....	1,782·26	*5,063·55	....
	Reported by Banks and Gold Dealers	1·23	....	....	....	....	871·79	17·93	....	5·85	·49
	Total	**1·23**	....	**244·75**	**62·29**	....	**1,520·51**	**5,638·37**	**363,790·20**	**252,863·33**	**751·39**

Yilgarn Goldfield.

Blackbournes	....	Voided leases	....	....	....	....	....	....	....	1,282·50	341·37	....
		Sundry claims	....	....	....	....	....	....	....	392·50	81·15	....

Table I.—*Production of Gold and Silver from all sources, etc.*—continued.

Mining Centre	Number of Lease	Registered Name of Company or Lease	Total for 1959					Total Production				
			Alluvial	Dollied and Specimens	Ore Treated	Gold Therefrom	Silver	Alluvial	Dollied and Specimens	Ore Treated	Gold Therefrom	Silver
			Fine ozs.	Fine ozs.	Tons (2,240 lb.)	Fine ozs.	Fine ozs.	Fine ozs.	Fine ozs.	Tons (2,240 lb.)	Fine ozs.	Fine ozs.
YILGARN GOLDFIELDS—continued.												
Bullfinch	G.M.L. 3350, etc.	Great Western Consolidated N.L. (Copperhead)	....	....	255,022·00	39,506·53	9,763·18	....	....	2,684,732·00	373,004·51	111,739·69
		Prior to transfer to present holders	....	....	....	....	....	....	64·80	78,404·34	24,644·88	....
	4287	Volcano	....	....	....	....	....	....	....	175·00	166·03	....
		Voided leases	....	....	....	....	....	....	10·14	490,361·07	185,489·03	27,958·41
		Sundry claims	....	8·45	6·64	2·82	....	8·47	45·49	7,507·39	4,076·42	1·25
Corinthian	3398, etc.	Great Western Consolidated N.L. (Corinthian)	....	....	20,983·00	2,578·75	656·62	....	....	91,349·00	13,182·06	3,261·18
		Prior to transfer to present holders	....	....	....	....	....	....	....	14,416·58	6,248·03	....
	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	....	Voided leases	....	....	....	....	....	....	196·74	10,208·06	10,660·65	·01
		Sundry claims	....	16·98	....	....	....	2·50	90·95	2,750·60	1,964·56	....
Evanston	....	Voided leases	....	....	....	....	....	....	79·27	64,533·06	33,191·88	10·14
		Sundry claims	....	....	....	....	....	4·98	....	638·35	159·55	....
Forrestonia	....	Voided leases	....	....	....	....	....	....	....	1,185·00	298·15	....
		Sundry claims	....	....	....	....	....	....	....	378·00	144·01	....
Golden Valley	4247	Lily of the Valley	....	....	....	....	....	....	....	709·00	177·73	....
	4220	Manzman South	....	....	....	....	....	....	....	19·00	4·42	....
	3266, etc.	Radio Leases	....	....	2,180·00	1,269·05	....	....	2·70	35,762·80	58,616·05	946·82
		Voided leases	....	....	....	....	....	....	36·34	36,835·92	28,969·41	10·99
		Sundry claims	....	....	27·00	22·17	·52	4·58	241·60	6,668·27	4,944·73	1·54
Greenmount	4433	Sydney	....	....	202·00	39·08	8·52	....	....	202·00	39·08	8·52
		Voided leases	....	....	....	....	....	45·99	21·62	125,127·64	31,585·45	944·50
		Sundry claims	....	....	53·00	15·93	5·28	·46	4·27	3,152·58	832·58	5·28
Holleton	4450 (37P.P.)	Brittania	....	....	....	....	....	....	....	2,200·00	1,726·15	....
		Voided leases	....	....	....	....	....	....	9·33	45,003·25	13,147·88	36·69
		Sundry claims	....	....	....	....	....	....	3·75	3,464·05	923·78	·20

Hopes Hill	3414	Great Western Consolidated N.L. (Pilot)	....	....	35,628·00	5,246·80	1,220·69	....	....	37,816·00	5,571·60	1,291·19
		Prior to transfer to present holders	....	....	....	....	....	....	....	19,446·12	2,948·68	....
		Voided leases	....	....	....	....	....	....	74·78	132,660·55	36,462·02	1·00
		Sundry claims	....	....	....	....	....	18·67	44·35	4,600·52	1,417·83	....
Kennyville	3875	Victoria	....	....	21·00	5·02	....	....	....	5,341·00	1,178·83	·63
		Voided leases	....	....	....	....	....	....	18·76	55,876·63	21,625·66	·59
		Sundry claims	....	....	....	....	....	....	5·06	8,700·50	2,337·49	....
Koolyanobbing	....	Voided leases	....	....	....	....	....	....	·99	1,768·05	972·77	....
		Sundry claims	....	....	10·50	1·35	....	·26	17·33	724·85	339·23	....
Marvel Loch	G.M.L. 4243	Christmas Gift	....	....	17·00	2·03	....	....	32·56	137·60	66·99	....
	4434	Cornwall	....	....	14,713·00	2,216·55	485·09	....	....	14,713·00	2,216·55	485·09
	4449 (13P.P.)	Cricket	....	....	....	....	....	....	....	1,671·00	932·04	....
	4039	Cromwell	....	....	....	....	....	....	....	995·50	159·91	....
	3942, etc.	Edwards Reward Leases	....	....	810·00	699·08	50·39	....	....	67,491·50	29,715·90	50·39
	3942	(Edwards Reward)	....	....	....	....	....	....	....	2,080·00	2,016·32	....
	3943	(Sunshine)	....	....	....	....	....	....	....	3,866·00	2,384·79	....
	4034	Firelight	....	....	....	....	....	....	2·68	6,653·75	940·03	....
	3724	Frances Furness	....	....	234·50	54·11	....	....	....	14,424·25	6,906·82	....
	4428	Great Victoria	....	....	486·00	40·58	8·28	....	....	486·00	40·58	8·28
	4375	Great Western Consolidated N.L. (Nevoria)	....	....	62,267·00	13,265·70	3,256·68	....	....	116,938·00	25,975·99	6,456·92
	4446	Great Western Consolidated N.L.	....	....	252·00	37·67	7·69	....	....	252·00	37·67	7·69
	4435	I.X.L.	....	....	106·00	13·94	....	....	....	106·00	13·94	....
	3718	Kurrajong	....	....	66·00	9·29	....	....	....	9,287·00	3,281·02	....
	3914	May	....	....	....	....	....	....	....	145·00	45·86	....
	4230	May Queen	....	....	....	....	....	....	....	286·00	43·42	....
	3970	Mountain Queen	....	....	....	....	....	....	....	1,231·00	455·65	....
	4432	Mountain Queen North	....	....	218·00	34·66	7·10	....	....	218·00	34·66	7·10
	4384	Newry	....	....	233·75	40·05	9·08	....	....	559·75	119·27	9·08
	4362	North Star	....	....	....	....	....	....	....	104·00	18·60	....
	4478 (107P.P.)	Patalena	....	....	19·00	3·36	....	....	....	19·00	3·36	....
	4035	Undaunted	....	....	....	....	....	....	....	865·00	113·59	....
		Voided leases	....	....	....	....	....	....	1,504·26	860,034·48	206,859·69	2,474·95
		Sundry claims	....	....	1,322·50	249·46	73·77	11·35	809·31	37,682·61	13,689·10	73·81
Mt. 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	4250	Palmerston	....	....	....	....	....	2·03	....	583·00	97·60	....
	4345	Speedie	....	....	33·25	2·27	....	....	....	123·25	40·30	....
	M.L. 4	Yellowdine Gold Development Pty. Ltd.	....	....	....	....	....	....	....	93·00	136·46	....
		Voided leases	....	....	....	....	....	....	....	306,408·40	158,486·81	....
		Sundry claims	....	....	....	....	....	1,643·48	18·19	450·25	387·14	....
Mt. Rankin	G.M.L. 4462 (81P.P.)	Golden View	....	....	....	....	....	....	72·16	50·00	87·03	....
	4469 (88P.P.)	Lynette	....	....	55·00	43·78	11·75	....	....	746·00	257·52	11·75
	4461 (76P.P.)	Marjorie Glen Reward	....	....	195·00	115·83	....	....	191·46	2,781·55	3,713·84	....
	3555	No Trumps	....	....	....	....	....	....	....	5,562·37	853·06	....
		Voided leases	....	....	....	....	....	3·84	5·20	496·00	122·17	....
		Sundry claims	....	....	....	....	....	....	1·85	771·00	956·57	....

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 1959					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												
Parkers Range	G.M.L. 4423	Spring Hill	....	....	....	....	....	....	....	76·50	27·36	....
		Voided leases	....	....	....	....	....	·42	270·76	63,642·10	32,711·48	26·46
		Sundry claims	....	....	286·25	39·71	....	6·59	303·93	12,899·30	5,493·57	·98
Southern Cross	4424	Excelsior	....	....	22·50	3·37	....	....	....	22·50	3·37	....
	4002, etc.	Great Western Consolidated N.L. (Frasers)	....	....	19,100·00	6,442·05	1,564·78	....	....	119,795·00	41,718·25	11,012·94
		Prior to transfer to present holders	....	....	....	....	....	....	....	13,720·50	1,876·00	1·26
	3444	(Three Boys)	....	....	....	....	....	....	....	4,180·00	727·75	....
	3934	(Three Boys North)	....	....	....	....	....	....	....	106·00	14·66	....
	3981	(Three Kings)	....	....	....	....	....	....	....	104·00	10·01	....
	3444, etc.	(Yellowdine Options N.L.)	....	....	....	....	....	....	....	8,074·25	2,000·29	....
		Voided leases	....	....	....	....	....	4·89	261·35	454,906·68	215,351·50	364·41
		Sundry claims	....	....	181·50	15·19	....	95·90	648·49	8,365·16	2,642·05	....
Westonia	....	Voided leases	....	....	....	....	....	....	4·06	597,118·14	381,435·37	5,104·07
		Sundry claims	....	....	....	....	....	9·51	64·96	4,310·76	2,823·33	·72
	From Goldfield generally :—											
	Sundry Parcels treated at :											
	W. B. Ridge Evanston Plant		....	....	....	*1,164·87	292·79	....	....	....	*3,138·85	785·59
	Great Western Consolidated N.L. (N.G.M. Dump)		....	....	....	....	....	....	....	....	*276·58	....
	T. Satterthwaite (L.T.T. 1401H)		....	....	....	....	....	....	....	13·50	2·77	....
	C. V. Davies (L.T.T. 1344H)		....	....	....	....	....	....	....	....	*15·19	....
	Great Western Consolidated (Fraser's Dump)		....	....	....	*22·12	6·65	....	....	....	*1,354·18	85·39
	Great Western Consolidated (Copperhead Dump)		....	....	....	....	....	....	....	....	*5,770·90	458·63
	Kurrajong Battery		....	....	....	....	....	....	....	....	*409·57	....
	Pilot Cyanide Plant		....	....	....	....	....	....	....	30·00	*3,753·59	....
	J. E. Read (L.T.T. 1375H)		....	....	....	....	....	....	....	....	*44·05	12·03
	R. R. Robinson (L.T.T. 1315H)		....	....	....	....	....	....	....	....	*1,408·40	....
	Three Boys Cyanide Plant		....	....	....	*23·84	....	....	....	7·00	*3,870·17	....
	State Battery, Marvel Loch		....	....	....	....	....	....	....	29·00	*1,283·32	....
	Various Works		....	....	....	....	....	....	....	351·48	99,188·34	107·98
	Reported by Banks and Gold Dealers		....	....	....	49·94	....	323·20	81·41	·60	170·54	....
	Total		....	**25·43**	**414,751·39**	**73,276·95**	**17,428·86**	**2,193·56**	**5,500·76**	**6,926,368·39**	**2,215,113·77**	**176,148·66**
Dundas Goldfield.												
Beete	G.M.L. 1907	Eldridge's Find	....	....	43·00	24·38	....	....	....	43·00	24·38	....
		Sundry claims	....	....	319·25	336·53	....	....	....	338·50	371·36	....

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	6,241·98	2,560·53	155·02
		Sundry claims	....	....	....	....	....	·76	413·85	2,158·25	1,115·96	19·64
Norseman	G.M.L. 1288 etc.	Central Norseman Gold Corporation N.L.	....	....	182,996·00	101,203·33	49,056·04	....	....	2,859,450·20	1,245,803·65	870,400·69
		Prior to transfer to present holders	....	....	....	....	....	....	1,663·32	69,819·83	47,892·08	16,508·85
	8159	Mt. Barker	....	....	....	....	....	....	....	30·50	4·51	·19
	1315, etc.	Norseman Gold Mines N.L.	....	....	....	....	....	....	....	964,099·00	241,009·50	353,206·54
		Prior to transfer to present holders	....	....	....	....	....	....	....	20,657·00	3,909·60	4,981·00
		Voided leases	....	....	....	....	....	14·27	10,601·15	915,759·17	601,761·91	39,001·04
		Sundry claims	....	48·56	206·00	30·58	1·61	1,052·09	3,451·55	48,029·45	22,424·91	209·67
Peninsular	....	Voided leases	....	....	....	....	....	....	24·29	9,603·39	6,102·61	12·20
		Sundry claims	....	....	....	....	....	....	....	217·25	119·32	·97
	From Goldfield generally :—											
	Sundry Parcels treated at :											
	State Battery, Norseman		....	....	....	....	....	....	....	417·89	25,351·51	1,051·13
	Various Works		....	....	....	....	....	....	54·52	780·89	15,110·71	2,588·35
	Reported by Banks and Gold Dealers		....	....	....	....	....	1,181·77	49·59	47·50	21·37	·70
	Total		....	**48·56**	**183,564·25**	**101,594·82**	**49,057·65**	**2,250·77**	**16,328·56**	**4,899,864·12**	**2,215,154·26**	**1,288,136·71**

Phillips River Goldfield.

Hatters Hill	....	Voided leases	....	....	....	....	....	....	4·38	1,599·55	1,222·72	....
		Sundry claims	....	....	1·00	*18·57	....	74·91	24·26	5,226·60	2,739·47	26·09
Kundip	G.M.L. 263	Hillsborough	....	....	....	....	....	....	....	258·00	65·75	19·33
		Voided leases	....	....	....	....	....	113·28	556·17	84,866·58	60,584·54	4,008·81
		Sundry claims	....	....	....	....	....	90·27	73·02	6,434·68	1,951·87	54·65
Mt. Desmond	....	Voided leases	....	....	....	....	....	....	1·40	9·00	3,905·46	6,891·59
		Sundry claims	....	....	....	....	....	....	....	80·00	41·96	51·01
Ravensthorpe	M.L. 411	Wehr Bros.	....	....	....	....	....	....	....	....	1·99	....
	M.C. 35 (50), M.L.	Ravensthorpe Copper Mines N.L.	....	....	....	‡1,344·68	8,596·93	....	....	....	‡2,512·79	12,348·26
	419 M.L. 421	Big Surprise	....	....	....	....	....	....	....	6·46	‡3·03	116·48
		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 :											
	F. C. Daw (T.A. 11)		....	....	....	....	....	....	....	....	*128·45	....
	Various Works		....	....	....	....	....	....	....	27·00	*4,118·73	515·43
	Reported by Banks and Gold Dealers		....	....	....	2·63	....	164·69	12·31	....	8·47	....
	Total		....	....	**1·00**	**1,365·88**	**8,596·93**	**607·11**	**821·02**	**130,492·99**	**106,568·78**	**28,491·34**

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 1959					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.
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	45P.P. (1P.P. Avon)	Hillsdale	....	....	....	....	....	....	....	1,261·75	308·00	....
Lake Grace	....	Sundry claims	....	....	....	....	....	....	....	19·00	5·71	....
Northampton	....	Sundry leases and claims	....	....	....	....	†699·99	....	....	....	....	†3,324·02
Ongerup	G.M.L. 103H....	Horneblende	....	....	....	....	....	....	....	24·50	2·85	....
		Sundry claims	....	....	....	....	....	....	1·58	·33	1·74	....
		From State generally :—										
		Miscellaneous voided leases and sundry claims	....	....	....	....	....	245·83	3·07	210·35	45·19	....
		Sundry specimens	....	....	....	....	....	4·24	56·85	....	....	....
		Various Works	....	....	....	....	....	....	....	27·00	9,009·75	31,521·73
		Reported by Banks and Gold Dealers	17·97	52·94	....	361·06	....	1,161·18	1,004·80	....	819·16	1,140·93
		Total	**17·97**	**52·94**	....	**361·06**	**699·99**	**1,478·50**	**1,110·31**	**4,359·33**	**11,944·69**	**36,001·86**

TABLE II

Production of Gold and Silver from all Sources, showing in fine ounces the output, as reported to the Mines Department during the year 1959.

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	....	....	....	....	....	....	....	15·76	16·67	....	5·62	38·05	....
West Kimberley	....	....	....	....	....	....	....	....	....	....	....	....	....
Pilbara	Marble Bar	·45	3·53	1,582·75	888·07	892·05	83·28	24·20	7·11	2,009·25	1,039·36	1,070·67	83·28
	Nullagine	23·75	3·58	426·50	151·29	178·62	....						
West Pilbara	....	....	....	....	....	....	....	....	....	28·00	11·08	11·08	....
Asburton	....	....	....	....	....	....	....	....	....	....	....	....	415·10
Gascoyne	....	....	....	....	....	....	....	·17	43·33	....	....	43·50	....
Peak Hill	....	....	....	....	....	....	....	5·19	....	3,993·00	431·18	436·37	....
East Murchison	Lawlers	20·87	....	143·00	11·86	32·73	....						
	Wiluna	7·78	....	23·25	11·98	19·76	....						
	Black Range	·14	86·04	640·50	592·87	679·05	....	28·79	86·04	806·75	616·71	731·54	....
Murchison	Cue	2·66	5·82	225·25	467·04	475·52	....						
	Meekatharra	11·28	18·42	4,887·25	779·88	809·58	4·72						
	Day Dawn	....	....	38·75	11·20	11·20	....	14·83	24·24	168,453·75	95,321·64	95,360·71	5,928·25
	Mt. Magnet	·89	....	163,302·50	94,063·52	94,064·41	5,923·53						
Yalgoo	....	....	....	....	....	....	....						
Mt. Margaret	Mt. Morgans	4·20	....	476·00	141·52	145·72	....	11·25	....	268·75	49·31	60·56	....
	Mt. Malcolm	12·51	....	139,263·00	33,870·07	33,882·58	3,111·58						
	Mt. Margaret	10·71	....	1,669·10	152·57	163·28	3·67	27·42	....	141,408·10	34,164·16	34,191·58	3,115·25
North Coolgardie	Menzies	8·75	....	34,738·00	17,444·05	17,452·80	38·36						
	Ularring	....	....	2,032·35	2,151·98	2,151·98	....						
	Niagara	....	....	1,842·00	518·29	518·29	....	8·75	....	41,334·85	22,449·08	22,457·83	404·95
	Yerilla	....	....	2,722·50	2,334·76	2,334·76	366·59						
Broad Arrow	....	....	....	....	....	....	....						
North-East Coolgardie	Kanowna	4·37	....	782·75	290·70	295·07	....	·18	....	4,396·63	1,662·87	1,663·05	·17
								4·37	....	932·50	380·64	385·01	....
	Kurnalpi	....	....	149·75	89·94	89·94	....						
East Coolgardie	East Coolgardie	30·21	25·70	1,969,775·15	510,237·35	510,293·26	93,809·50	30·21	25·70	1,970,250·15	510,326·56	510,382·47	93,809·50
	Bulong	....	....	475·00	89·21	89·21	....						
Coolgardie	Coolgardie	6·77	533·90	26,759·00	16,788·94	17,329·61	61·73	8·00	533·90	27,003·75	16,851·23	17,393·13	61·73
	Kunanalling	1·23	....	244·75	62·29	63·52	....						
Yilgarn	....	....	....	....	....	....	....	....	25·43	414,751·39	73,276·95	73,302·38	17,428·86
Dundas	....	....	....	....	....	....	....	....	48·56	183,564·25	101,594·82	101,643·38	49,057·65
Phillips River	....	....	....	....	....	....	....	....	....	1·00	1,365·88	1,365·88	8,596·93
Outside Proclaimed Goldfields		....	....	....	....	....	....	17·97	52·94	....	361·06	431·97	699·99
Total	....	....	....	....	....	....	....	197·09	863·92	2,959,202·12	859,908·15	860,969·16	179,601·66

TABLE III.

Return showing total production reported to the Mines Department, and respective Districts and Goldfields from whence derived, to 31st December, 1959.

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		....	....	....	....	....	....	8,996·47	2,900·64	22,751·90	17,240·32	29,137·43	128·76
West Kimberley		....	....	....	....	....	....	1·30	24·68	1·00	2·49	28·47	13,575·29
Pilbara	Marble Bar	15,253·27	4,568·60	334,538·72	326,771·18	346,593·05	32,496·54	25,659·91	7,453·73	471,401·92	455,182·29	488,295·93	33,563·84
	Nullagine	10,406·64	2,885·13	136,863·20	128,411·11	141,702·88	1,067·30						
West Pilbara		....	....	....	....	....	....	6,337·46	374·74	24,749·96	24,300·52	31,012·72	1,909·71
Ashburton		....	....	....	....	....	....	9,266·82	482·46	6,807·10	2,913·43	12,662·71	41,971·38
Gascoyne		....	....	....	....	....	....	693·61	112·06	387·00	517·29	1,322·96	....
Peak Hill		....	....	....	....	....	....	3,382·05	5,300·33	770,644·73	321,509·57	330,191·95	3,768·47
East Murchison	Lawlers	7,047·24	2,343·19	2,011,524·92	822,727·31	832,117·74	27,184·22	8,950·41	22,205·14	12,615,672·58	3,649,622·85	3,680,778·40	60,195·14
	Wiluna	232·63	1,254·11	8,873,578·19	1,872,182·40	1,873,669·14	10,298·63						
	Black Range	1,670·54	18,607·84	1,730,569·47	954,713·14	974,991·52	22,712·29						
Murchison	Cue	5,096·66	9,104·99	6,811,042·54	1,401,326·26	1,415,527·91	274,070·78	25,541·04	59,124·32	13,658,466·33	5,367,442·69	5,452,108·05	470,583·46
	Meekatharra	14,626·83	18,243·54	2,299,721·46	1,306,810·91	1,339,681·28	5,131·25						
	Day Dawn	3,241·76	11,341·63	2,037,165·63	1,375,507·68	1,390,091·07	169,434·20						
	Mt. Magnet	2,575·79	20,434·16	2,510,536·70	1,283,797·84	1,306,807·79	21,947·23						
Yalgoo		....	....	....	....	....	....	1,800·53	3,223·19	442,508·08	263,703·11	268,726·83	1,503·16
Mt. Margaret	Mt. Morgans	3,501·97	9,389·86	1,217,321·31	717,668·00	730,559·83	5,812·32	11,581·97	35,395·85	10,928,008·02	4,833,496·02	4,880,473·84	251,110·50
	Mt. Malcolm	3,964·64	16,651·64	7,182,676·47	2,941,788·81	2,962,405·09	179,107·48						
	Mt. Margaret	4,115·36	9,354·35	2,528,010·24	1,174,039·21	1,187,508·92	66,190·70						
North Coolgardie	Menzies	1,685·00	6,983·00	1,739,512·68	1,332,833·54	1,341,501·54	31,310·95	4,844·79	19,825·01	3,496,525·18	2,470,913·72	2,495,583·52	63,120·71
	Ularring	129·52	7,203·12	531,458·20	441,154·67	448,487·28	21,928·23						
	Niagara	1,718·36	1,821·77	940,513·77	527,085·39	530,625·52	5,686·69						
	Yerilla	1,311·91	3,817·12	285,040·53	169,840·12	174,969·15	4,194·84						
Broad Arrow		....	....	....	....	....	....	21,981·70	27,475·30	1,352,724·32	738,165·27	787,622·27	5,305·88
North-East Coolgardie	Kanowna	106,530·67	13,526·67	1,007,629·76	626,810·74	746,868·08	3,039·73	119,366·16	21,825·58	1,021,297·08	645,639·45	786,831·19	3,052·44
	Kurnalpi	12,835·49	8,298·91	13,667·32	18,828·71	39,963·11	12·71						
East Coolgardie	East Coolgardie	33,674·90	41,098·44	75,402,688·50	33,374,811·40	33,449,584·74	5,066,575·53	61,080·12	57,133·01	75,589,900·30	33,507,050·77	33,625,263·90	5,066,588·45
	Bulong	27,405·22	16,034·57	187,211·80	132,239·37	175,679·16	12·92						
Coolgardie	Coolgardie	17,016·69	17,628·62	2,878,769·35	1,487,178·02	1,521,823·33	36,793·70	18,537·20	23,266·99	3,242,559·55	1,740,041·35	1,781,845·54	37,545·09
	Kunanalling	1,521·51	5,638·37	363,790·20	252,863·33	260,022·21	751·39						
Yilgarn		....	....	....	....	....	....	2,193·56	5,500·76	6,926,368·39	2,215,113·77	2,222,808·09	176,148·66
Dundas		....	....	....	....	....	....	2,250·77	16,328·56	4,899,864·12	2,215,154·26	2,233,733·59	1,288,136·71
Phillips River		....	....	....	....	....	....	607·11	821·02	130,492·99	106,568·78	107,996·91	28,491·34
Outside Proclaimed Goldfield		....	....	....	....	....	....	1,478·50	1,110·31	4,359·33	11,944·69	14,533·50	36,001·86
Total		....	....	....	....	....	....	334,551·48	309,883·68	135605489·88	58,586,522·64	59,230,957·80	7,582,700·85

TABLE IV.

Total output of Gold (Bullion and Concentrates entered for Export and Gold reviewed at the Perth Branch of the Royal Mint) from 1st January, 1886, to 31st December, 1959; Showing in Fine Ounces the quantity credited to 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 1956	22,422·06	16,853·76	39,275·82	174,791·15	387,098·46	561,889·61
1956	....	172·97	172·97	673·60	913·63	1,587·23
1957	....	69·13	69·13	13·28	787·95	801·23
1958	....	91·82	91·82	21·41	965·91	987·32
1959	....	35·87	35·87	....	1,080·25	1,080·25
Total	22,422·06	17,223·55	39,645·61	175,499·44	390,846·20	566,345·64
		(*a*) **West Pilbara**			**Ashburton**	
Prior to 1956	4,351·11	26,908·43	31,259·54	4,104·96	6,365·22	10,470·18
1956	....	7·59	7·59	....	1·01	1·01
1957	56·96	....	56·96	....	0·91	0·91
1958	....	15·71	15·71	....	....	....
1959	....	6·88	6·88	....	....	....
Total	4,408·07	26,938·61	31,346·68	4,104·96	6,367·14	10,472·10
		(*b*) **Gascoyne**			(*c*) **Peak Hill**	
Prior to 1956	304·55	1,089·57	1,394·12	41,102·76	229,120·74	270,223·50
1956	....	....	....	....	22·03	22·03
1957	....	0·60	0·60	....	272·50	272·50
1958	....	5·81	5·81	....	491·05	491·05
1959	....	18·68	18·68	....	448·61	448·61
Total	304·55	1,114·66	1,419·21	41,102·76	230,354·93	271,457·69
		East Murchison			**Murchison**	
Prior to 1956	259,456·25	3,024,582·07	3,284,038·32	1,577,344·02	3,784,787·32	5,362,131·34
1956	270·74	69·32	340·06	174·62	81,083·19	81,257·81
1957	13·40	228·44	241·84	25·02	89,012·11	89,037·13
1958	6·96	386·84	393·80	31·40	81,793·32	81,824·72
1959	4·85	635·57	640·42	46·30	95,327·82	95,374·12
Total	259,752·20	3,025,902·24	3,285,654·44	1,577,621·36	4,132,003·76	5,709,625·12
		(*d*) **Yalgoo**			(*e*) **Mt. Margaret**	
Prior to 1956	13,650·56	197,235·51	210,886·07	694,955·23	3,891,606·12	4,586,561·35
1956	....	0·48	0·48	64·85	25,986·30	26,051·15
1957	....	108·58	108·58	124·30	32,622·75	32,747·05
1958	....	9·89	9·89	63·50	30,487·16	30,550·66
1959	....	41·51	41·51	78·09	33,821·01	33,899·10
Total	13,650·56	197,395·97	211,046·53	695,285·97	4,014,523·34	4,709,809·31
		(*f*) **North Coolgardie**			(*g*) **Broad Arrow**	
Prior to 1956	263,653·17	2,100,311·73	2,363,964·90	122,916·00	445,651·61	568,567·61
1956	14·67	21,752·28	21,766·95	3·72	1,802·30	1,806·02
1957	....	24,178·72	24,178·72	....	2,548·36	2,548·36
1958	67·08	20,335·49	20,402·57	....	2,203·97	2,203·97
1959	....	21,728·32	21,728·32	....	1,513·24	1,513·24
Total	263,734·92	2,188,306·54	2,452,041·46	122,919·72	453,719·48	576,639·20
		(*f*) **North-East Coolgardie**			(*f*) **East Coolgardie**	
Prior to 1956	235,893·69	459,722·72	695,616·41	7,034,905·09	26,201,999·50	33,236,904·59
1956	....	128·27	128·27	946·39	491,466·14	492,412·53
1957	....	105·58	105·58	1,529·11	542,866·97	544,396·08
1958	....	143·84	143·84	688·12	522,852·26	523,540·38
1959	....	193·12	193·12	860·10	512,226·88	513,086·98
Total	235,893·69	460,293·53	696,187·22	7,038,928·81	28,271,411·75	35,310,340·56
		(*h*) **Coolgardie**			**Yilgarn**	
Prior to 1956	663,560·46	1,416,733·79	2,080,294·25	220,547·29	1,739,608·42	1,960,155·71
1956	22·72	10,828·17	10,850·89	70·98	86,353·75	86,424·73
1957	1·05	20,344·33	20,345·38	12·40	84,765·72	84,778·12
1958	21·36	14,512·28	14,533·64	8·63	81,832·96	81,841·59
1959	1·09	17,956· 3	17,957·32	....	76,246·91	76,246·91
Total	663,606·68	1,480,374·80	2,143,981·48	220,639·30	2,068,807·76	2,289,447·06
		(*i*) **Dundas**			(*j*) **Phillips River**	
Prior to 1956	170,787·39	1,730,730·54	1,901,517·93	40,650·82	64,373·65	105,024·47
1956	....	88,670·54	88,670·54	0·52	....	0·52
1957	....	95,726·05	95,726·05	266·75	92·49	359·24
1958	....	108,365·64	108,365·64	811·37	1·09	812·46
1959	....	101,623·28	101,623·28	1,331·56	29·90	1,361·46
Total	170,787·39	2,125,116·05	2,295,903·44	43,061·02	64,497·13	107,558·15
					Outside Proclaimed Goldfields	
Prior to 1956				23,051·33	43,426·76	66,478·09
1956				88·29	790·71	879·00
1947				....	907·52	907·52
1958				90·86	881·76	972·62
1959				....	1,352·79	1,352·79
Total				23,230·48	47,359·54	70,590·02

(*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.

(14)—37498

TABLE V.

Total Output of Gold Bullion, Concentrates, etc., entered for Export and Received at the Perth Branch of the Royal Mint from 1st January, 1886.

Year.	Export.	Mint.	Total.	Estimated Value
	Fine ozs.	Fine ozs.	Fine ozs.	£A.
1886	270·17	....	270·17	1,147
1887	4,359·37	....	4,359·37	18,518
1888	3,124·82	....	3,124·82	13,273
1889	13,859·52	....	13,859·52	58,871
1890	20,402·42	....	20,402·42	86,664
1891	27,116·14	....	27,116·14	115,182
1892	53,271·65	....	53,271·65	226,284
1893	99,202·50	....	99,202·50	421,385
1894	185,298·73	....	185,298·73	787,099
1895	207,110·20	....	207,110·20	879,749
1896	251,618·69	....	251,618·69	1,068,808
1897	603,846·44	....	603,846·44	2,564,977
1898	939,489·49	....	939,489·49	3,990,697
1899	1,283,360·25	187,244·41	1,470,604·66	6,246,732
1900	894,387·27	519,923·59	1,414,310·86	6,007,610
1901	923,698·96	779,729·56	1,703,416·52	7,235,654
1902	707,039·75	1,163,997·60	1,871,037·35	7,947,661
1903	833,685·78	1,231,115·62	2,064,801·40	8,770,719
1904	810,616·04	1,172,614·03	1,983,230·07	8,424,226
1905	655,089·88	1,300,226·00	1,955,315·88	8,305,654
1906	562,250·59	1,232,296·01	1,794,546·60	7,622,749
1907	431,803·14	1,265,750·45	1,697,553·59	7,210,750
1908	356,353·96	1,291,557·17	1,647,911·13	6,999,881
1909	386,370·58	1,208,898·83	1,595,269·41	6,776,274
1910	233,970·34	1,236,661·68	1,470,632·02	6,246,848
1911	160,422·28	1,210,445·24	1,370,867·52	5,823,075
1912	83,577·12	1,199,080·87	1,282,657·99	5,448,385
1913	86,255·13	1,227,788·15	1,314,043·28	5,581,701
1914	51,454·65	1,181,522·17	1,232,976·82	5,237,352
1915	17,340·47	1,192,771·23	1,210,111·70	5,140,228
1916	26,742·17	1,034,655·87	1,061,398·04	4,508,532
1917	9,022·49	961,294·67	970,317·16	4,121,646
1918	15,644·12	860,867·03	876,511·15	3,723,183
1919	6,445·89	727,619·90	734,065·79	3,618,509
1920	5,261·13	612,581·00	617,842·13	3,598,931
1921	7,170·74	546,559·92	553,730·66	2,942,526
1922	5,320·16	532,926·12	538,246·28	2,525,812
1923	5,933·82	498,577·59	504,511·41	2,232,186
1924	2,585·20	482,449·78	485,034·98	2,255,927
1925	3,910·59	437,341·56	441,252·15	1,874,920
1926	3,188·22	434,154·98	437,343·20	1,857,715
1927	3,359·10	404,993·41	408,352·51	1,734,572
1928	3,339·30	390,069·19	393,408·49	1,671,093
1929	3,037·12	374,138·96	377,176·08	1,602,142
1930	1,753·09	415,765·00	417,518·09	1,864,442
1931	1,726·66	508,845·36	510,572·02	2,998,137
1932	3,887·07	601,674·33	605,561·40	4,403,642
1933	2,446·97	634,760·40	637,207·37	4,886,254
1934	3,520·40	647,817·95	661,338·35	5,558,873
1935	9,868·71	639,180·38	649,049·09	5,702,149
1936	55,024·58	791,183·21	846,207·79	7,373,539
1937	71,646·91	928,999·84	1,000,646·75	8,743,755
1938	113,620·06	1,054,171·13	1,167,791·19	10,363,023
1939	98,739·88	1,115,497·76	1,214,237·64	11,842,964
1940	71,680·47	1,119,801·08	1,191,481·55	12,696,503
1941	65,925·94	1,043,391·96	1,109,317·90	11,851,445
1942	15,676·48	832,503·97	848,180·45	8,865,495
1943	6,408·34	540,057·08	546,475·42	5,710,669
1944	1,824·99	464,439·76	466,264·75	4,899,997
1945	5,029·38	463,521·34	468,550·72	5,010,541
1946	6,090·14	610,873·52	616,963·66	6,640,069
1947	5,220·09	698,666·29	703,886·38	7,575,574
1948	4,653·72	660,332·07	664,985·79	7,156,909
1949	4,173·14	644,252·48	648,425·62	7,962,808
1950	4,161·53	606,171·88	610,333·41	9,466,270
1951	5,589·45	622,189·64	627,779·09	9,725,343
1952	9,608·62	720,366·44	729,975·06	11,847,917
1953	5,396·30	818,515·65	823,911·95	13,299,092
1954	3,089·08	847,451·09	850,540·17	13,313,618
1955	4,091·55	837,913·72	842,005·23	13,175,559
1956	2,331·10	810,048·68	812,379·78	12,705,581
1957	2,042·27	894,638·71	896,680·98	14,038,185
1958	1,810·69	865,376·80	867,187·49	13,554,934
1959	2,321·99	864,286·87	866,608·86	13,541,929
Total	11,576,953·94	49,202,556·98	60,779,510·92	430,300,463

	1958 £A	1959 £A
Estimated total par value of above production	254,493,545	258,174,663
Overseas Gold Sales Premium distributed by Gold Producers Association, 1920-1924	2,589,602	2,589,602
Overseas Gold Sales Premium distributed by Gold Producers Association from 1952	1,202,606	1,203,773
Exchange Premium paid by Mint above par value, 1930-1959 (approximate)	158,482,781	172,332,425
Estimated Total	£A416,758,534	434,300,463
Bonus paid by Commonwealth Government under Commonwealth Bounty Act, 1930	161,448	161,448
Subsidy paid by Commonwealth Government under Gold Mining Industry Assistance Act, 1954 from 1955	1,803,713	2,455,981
Gross estimated value of gold won	£A418,723,695	436,917,892

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 1959 and previous years.

Period.	Abrasive Silica Stone. Murchison Goldfield. (Mt. Magnet District.) Quantity.	Value.	Alunite (Crude Potash). Yilgarn Goldfield. Quantity.	Value.	Arsenic.* East Murchison Goldfield. (Wiluna District.) Quantity.	Value.	Antimony.† East Murchison Goldfield. Conc.	Metal.	Value.
	tons	£	tons	£	tons	£	tons	tons	£
Prior to 1956	1·50	9	9,073·05	215,865	‡38,674·08	747,205	7,883·66	3,870·93	157,298
1956	....	....	....	....	....	....	....	....	....
1957	....	....	....	....	....	....	....	....	....
1958	....	....	....	....	....	....	....	....	....
1959	....	....	....	....	....	....	....	....	....
Total	1·50	9	9,073·05	215,865	38674·08	747,205	7,883·66	3,870·93	157,298

* By-product by Wiluna G.M.'s, Ltd. † By-product of Gold Mining. ‡ Includes 1·13 tons Arsenic valued at £24 from Yilgarn Goldfield.

Period	Antimony.* Pilbara Goldfield. Conc.	Metal.	Value.	Antimony.* Total. Conc.	Metal.	Value.	Asbestos. Ashburton Goldfield Quantity.	Value.
	tons	tons	£	tons	tons	£	tons	£
Prior to 1956	1,841·36	772·88	83,857	†9,751·25	4,657·37	241,755	10·10	959
1956	78·44	23·26	742	78·44	23·26	742	....	....
1957	....	....	....	....	....	....	....	....
1958	....	....	....	....	....	....	....	....
1959	....	....	....	....	....	....	....	....
Total	1,919·80	796·14	84,599	9,829·69	4,680·63	242,497	10·10	959

* By-product of Gold Mining. † Includes 26·23 tons. Conc. containing 13·56 tons metal valued at £600 from West Pilbara Goldfield.

Period.	Asbestos—*continued.* Pilbara Goldfield. Quantity.	Value.	West Pilbara Goldfield. Quantity.	Value.	Outside Proclaimed Goldfield. Quantity.	Value.	Total Quantity.	Value.
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	2,012·56	71,012	25,930·11	3,054,606	501·10	6,732	*28,462·12	3,133,350
1956	267·25	5,612	7,779·82	820,464	....	....	8,047·07	826,076
1957	360·52	8,031	12,133·66	1,229,670	....	....	12,494·18	1,237,701
1958	170·02	3,743	13,094·89	1,339,633	....	....	13,264·91	1,343,376
1959	34·35	721	15,277·48	1,627,821	....	....	15,311·83	1,628,542
Total	2,844·70	89,119	74,215·96	8,072,194	501·10	6,732	77,580·11	8,169,045

* Includes 8·25 tons valued at £41 from East Coolgardie Goldfield.

Period.	Barytes. Murchison Goldfield. Quantity.	Value.	North-East Coolgardie Goldfield. Quantity.	Value.	Outside Proclaimed Goldfield. Quantity.	Value.	Total. Quantity.	Value.
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	120·74	664	52·22	430	1,132·65	8,570	1,305·61	9,664
1956	426·10	2,031	....	....	501·00	3,156	927·10	5,187
1957	....	....	....	....	140·00	910	140·00	910
1958	....	....	....	....	....	....	....	....
1959	....	....	....	....	....	....	....	....
Total	546·84	2,695	52·22	430	1,773·65	12,636	2,372·71	15,761

Period.	Bentonite Outside Proclaimed Goldfield. Quantity.	Value.	Beryl Ore. Pilbara Goldfield. Quantity.	Value.	Ashburton Goldfield. Quantity.	Value.	Gascoyne Goldfield. Quantity.	Value.
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	4,407·37	14,567	1,371·31	112,512	0·14	25	141·46	10,325
1956	1,403·54	5,658	239·27	43,753	....	....	50·11	9,603
1957	741·79	2,982	284·05	52,129	....	....	22·73	4,399
1958	37·00	153	130·40	23,942	....	....	18·34	3,827
1959	133·00	532	199·09	35,636	5·24	964	45·51	8,470
Total	6,722·70	23,892	2,224·12	267,972	5·38	989	278·15	36,624

Table VI.—*Minerals other than Gold*—continued.

Period.	Beryl Ore—*continued.*						Bismuth.	
	Yalgoo Goldfield.		Coolgardie Goldfield.		Total.		Gascoyne Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons	£	tons	£	tons	£	lb.	£
Prior to 1956	13·81	2,376	144·32	13,612	1,709·68	140,266	7,982	1,884
1956	....	....	20·81	3,757	310·19	57,113	....	....
1957	·58	109	42·40	7,469	350·37	64,233	....	....
1958	1·06	197	20·23	3,834	170·03	31,801	3,310	1,475
1959	2·60	488	14·04	2,454	266·71	48,052	....	....
Total	**18·05**	**3,170**	**241·80**	**31,126**	***2,806·98**	**341,465**	**11,292**	**3,359**

* Includes 3·50 tons valued at £297 from West Kimberley Goldfield, 25·14 tons valued at £1,027 from Murchison Goldfield and 10·84 tons valued at £259 from Outside Proclaimed Goldfield.

Period.	Calcite.		Chromite.		Clays (Various)			
	Mt. Margaret Goldfield.		Peak Hill Goldfield.		Murchison Goldfield.		Outside Proclaimed Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Tons	£	Tons	£	Tons	£	Tons	£
Prior to 1956	5·00	25	7,010·55	89,774	41·75	207	204,277·50	154,343
1956	....	....	6,096·20	97,526	....	....	29,841·00	33,507
1957	....	....	1,312·30	20,996	....	....	29,400·70	34,171
1958	....	....	....	....	....	....	33,796·96	39,269
1959	....	....	....	....	....	....	52,011·10	61,950
Total	**5·00**	**25**	**14,419·05**	**208,296**	**41·75**	**207**	**349,327·26**	**323,240**

Period.	Clays (Various) *continued.*		Coal.		Copper Ore.			
	Total.		Collie Coalfield.		Pilbara Goldfield.		West Pilbara Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	*205,370·05	155,288	25903164·91	31,002,379	109·14	4,595	82,758·77	749,156
1956	29,841·00	33,507	830,006·65	2,723,981	22·71	1,058	....	....
1957	29,400·70	34,171	838,660·53	2,552,657	459·10	21,013	381·75	8,967
1958	33,796·96	39,269	870,882·45	2,280,649	....	....	6·75	210
1959	52,011·10	61,950	911,434·52	2,356,534	....	....	....	....
Total	**350,419·81**	**324,185**	**29354149·06**	**40,916,200**	**590·95**	**26,666**	**83,147·27**	**758,332**

* Includes 1,050·80 tons valued at £738 from Collie Mineral Field.

Period.	Copper Ore—*continued.*							
	Ashburton Goldfield.		Mt. Margaret Goldfield.		Phillips River Goldfield.		Outside Proclaimed Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	378·07	6,937	47,861·82	231,003	95,929·47	589,467	180·70	2,046
1956	....	....	....	....	6·46	770	3·39	340
1957	4·59	325	19·92	404	558·83	13,189	....	....
1958	....	....	....	....	1,726·71	53,265	....	....
1959	....	....	....	....	4,408·75	230,078	....	....
Total	**382·66**	**7,262**	**47,881·74**	**231,407**	**102,630·22**	**886,769**	**184·09**	**2,486**

Period.	Copper Ore—*continued.*		Corundum.		Cupreous Ore (Fertiliser).			
	Total.		East Murchison Goldfield.		West Pilbara Goldfield.		Pilbara Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	253,893·34	1,756,067	‡63·15	655	9,935·23	74,105	1,167·75	33,068
1956	212·23	12,742	....	....	2,331·23	18,418	1,853·12	42,972
1957	1,803·97	58,563	....	....	629·86	5,380	1,859·93	41,814
1958	* 1,801·95	54,424	....	....	225·25	4,985	1,713·98	37,892
1959	4,408·75	230,078	....	....	263·71	5,141	4,902·72	96,086
Total	**†262,119·71**	**2,111,741**	**63·15**	**655**	**13,385·28**	**108,029**	**11,497·50**	**251,832**

* Including 264·83 tons valued at £6,906 from East Murchison Goldfield, 68·49 tons valued at £949 from Peak Hill Goldfield, 9·35 tons valued at £193 from Yalgoo Goldfield, and 9·44 tons valued at £201 from Northampton Mineral Field. † Including 109·52 tons valued at £1,709 from West Kimberley Goldfield, 649·73 tons valued at £14,089 from East Murchison Goldfield, 91·70 tons valued at £1,004 from Yalgoo Goldfield, 6·12 tons valued at £51 from North Coolgardie Goldfield, 50·67 tons valued at £379 from East Coolgardie Goldfield, 16·00 tons valued at £77 from Yilgarn Goldfield, 1,295·27 tons valued at £49,888 from Peak Hill Goldfield, 24,035·69 tons valued at £119,698 from Northampton Mineral Field, 1,053·61 tons valued at £12,157 from Murchison Goldfield. ‡ Includes 9·15 tons valued at £275 from West Kimberley Goldfield.

Table VI.—*Minerals other than Gold*—continued.

Period.	Cupreous Ore (Fertiliser)—*continued.*							
	Ashburton Goldfield.		Peak Hill Goldfield.		East Murchison Goldfield.		Murchison Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	65·90	787	3,923·31	56,361	2,749·70	45,374	1,113·53	10,486
1956	2·00	53	2,443·12	37,839	411·42	7,261	524·93	4,589
1957	....	....	1,464·37	20,352	575·54	10,504	....	....
1958	....	....	4,624·54	51,875	737·79	9,161	85·80	1,768
1959	....	....	6,187·47	73,923	155·15	1,745	152·10	1,808
Total	**67·90**	**840**	**18,642·81**	**240,350**	**4,629·60**	**74,045**	**1,876·36**	**18,651**

Period.	Cupreous Ore (Fertiliser)—*continued.*							
	Yalgoo Goldfield.		Mt. Margaret Goldfield.		Broad Arrow Goldfield.		East Coolgardie Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	57·29	390	243·97	1,615	29·05	368	29·00	100
1956	....	....	81·67	807	5·54	11	....	....
1957	....	....	9·60	163	....	....	....	....
1958	43·09	636	....	....	....	....	....	....
1959	112·56	2,221	20·66	178	....	....	....	....
Total	**212·94**	**3,247**	**355·90**	**2,763**	**34·59**	**379**	**29·00**	**100**

Period.	Cupreous Ore (Fertiliser)—*continued.*							
	Dundas Goldfield.		Phillips River Goldfield.		Outside Proclaimed Goldfield.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	12·69	117	335·99	7,163	57·79	524	19,974·07	230,779
1956	....	....	32·48	1,259	1·19	22	7,713·31	113,442
1957	....	....	99·39	3,913	....	....	4,638·69	82,127
1958	....	....	211·17	8,337	....	....	7,643·72	114,670
1959	....	....	64·43	2,904	....	....	11,858·80	184,006
Total	**12·69**	**117**	**743·46**	**23,576**	**58·98**	**546**	***51,828·59**	**725,024**

* Includes 64·97 tons valued at £345 from Yilgarn Goldfield ; 21·79 tons valued at £186 from Northampton Mineral Field ; and 2·10 tons valued at £16 from Gascoyne Goldfield.

Period.	Diamonds.		Diatomaceous Earth.		Dolomite.		Emerald.	
	Pilbara Goldfield.		Outside Proclaimed Goldfield.		Murchison Goldfield.		Murchison Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	carats	£	tons	£	tons	£	carats (cut and rough)	£
Prior to 1956	*	24	411·00	5,861	1,655·90	7,470	22,123·00	1,609
1956	....	....	....	....	352·00	1,414	....	....
1957	....	....	....	....	60·00	239	....	....
1958	....	....	....	....	196·00	786	....	....
1959	....	....	....	....	....	....	....	....
Total	....	**24**	**411·00**	**5,861**	**2,263·90**	**9,909**	**22,123·00**	**1,609**

* Not recorded.

Period.	Emerald—*continued.*				Emery.		Felspar.	
	Pilbara Goldfield.		Total.		West Kimberley Goldfield.		Coolgardie Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	carats (cut and rough)	£	carats (cut and rough)	£	tons	£	tons	£
Prior to 1956	8·68	313	22,131·68	1,922	21·15	375	53,132·80	161,939
1956	....	....	....	....	....	....	2,773·00	17,686
1957	....	....	....	....	....	....	995·00	4,611
1958	....	....	....	....	....	....	673·00	3,062
1959	....	....	....	....	....	....	1,393·00	6,338
Total	**8·68**	**313**	**22,131·68**	**1,922**	**21·15**	**375**	**58,966·80**	**193,636**

Table VI.—*Minerals other than Gold*—continued.

Period	Felspar—*continued.*				Fergusonite.		Fuller's Earth	
	Outside Proclaimed Goldfield.		Total.		Pilbara Goldfield.		Outside Proclaimed Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	628·41	1,427	53,761·21	163,366	0·30	391	*81·51	344
1956	8·00	32	2,781·00	17,718	....	....	40·13	201
1957	....	....	995·00	4,611	....	....	....	....
1958	7·60	30	680·60	3,092	....	....	....	....
1959	2·80	14	1,395·80	6,352	....	....	....	....
Total	**646·81**	**1,503**	**59,613·61**	**195,139**	**0·30**	**391**	**121·64**	**545**

* Including 30 tons valued at £86 from Broad Arrow Goldfield.

Period.	Gadolinite.		Glass Sand.		Glauconite.		Graphite.	
	Pilbara Goldfield.		Outside Proclaimed Goldfield.		Outside Proclaimed Goldfield.		Outside Proclaimed Goldfield.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	1·00	112	43,325·19	31,932	5,902·00	124,581	148·10	1,267
1956	....	....	7,343·17	5,153	114·00	4,520	5·10	37
1957	....	....	5,692·86	3,914	126·00	5,040	....	....
1958	....	....	6,420·41	4,267	112·00	5,590	....	....
1959	....	....	6,827·54	4,555	102·00	5,103	....	....
Total	**1·00**	**112**	**69,609·17**	**49,821**	**6,356·00**	**144,834**	**153·20**	**1,304**

Period.	Gypsum.							
	Yilgarn Goldfield.		Dundas Goldfield.		Outside Proclaimed Goldfield.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	274,122·00	213,874	2,078·00	1,336	218,926·00	231,128	495,126·00	446,339
1956	23,622·00	17,838	....	....	3,499·00	3,090	27,121·00	20,928
1957	27,842·00	21,234	....	....	5,510·40	4,733	33,353·00	25,967
1958	21,953·00	16,544	4,984·00	14,894	8,578·00	8,696	35,515·00	40,134
1959	23,553·00	17,773	11,169·00	33,495	3,009·00	2,979	37,731·00	54,207
Total	**371,092·00**	**280,223**	**18,231·00**	**49,725**	**239,522·00**	**250,626**	**628,846·00**	**587,575**

Preiod	* Iron Ore (for Pig Iron)						Iron Ore (exported)	
	Yilgarn Goldfield		Outside Proclaimed Goldfield.		Total		West Kimberley Goldfield	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	76,411·65	936,980	47,508·57	296,734	123,920·22	1,233,717	2,034,620·00	2,017,763
1956	19,853·60	278,846	....	....	19,853·60	278,846	327,815·00	323,923
1957	21,838·50	324,646	....	....	21,838·50	324,646	389,686·00	386,440
1958	30,075·00	458,561	....	....	30,075·00	458,561	536,713·00	532,355
1959	57,206·00	808,644	....	....	57,206·00	808,644	672,239·00	666,601
Total	**205,384·75**	**2,807,677**	**47,508·57**	**296,734**	**252,893·32**	**3,104,411**	**3,961,073·00**	**3,927,082**

* Excludes Iron Ore used as Flux :—Yilgarn Goldfield, 84·35 tons valued at £128 ; West Pilbara Goldfield, 100·00 tons valued at £300 ; East Coolgardie Goldfield, 450·00 tons valued at £247 ; West Kimberley Goldfield, 10·50 tons valued at £12 ; Greenbushes Mineral Field, 7,481·00 tons valued at £4,629 ; and Outside Proclaimed Goldfields, 49,938·50 tons valued at £31,732.

Period	Jarosite		Kyanite		Lead Ore and Concentrates		Silver Lead Ore and Concentrates	
	Phillips River Goldfield		Outside Proclaimed Goldfield		Northampton Mineral Field		Ashburton Goldfield	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	9·45	37	4,215·69	21,781	*436,627·82	2,897,158	6,916·54	331,143
1956	....	....	....	....	6,330·75	552,564	156·60	12,215
1957	....	....	....	....	3,322·51	256,214	197·43	15,965
1958	....	....	....	....	2,312·92	131,612	109·45	7,553
1959	....	....	....	....	1,440·52	69,899	41·50	2,492
Total	**9·45**	**37**	**4,215·69**	**21,781**	**450,034·52**	**3,907,447**	**7,421·52**	**369,370**

* Includes 12·19 tons valued at £13 from State generally.

Table VI.—*Minerals other than Gold*—continued.

Period	Tanto/Columbite—*continued*						Tin	
	Coolgardie Goldfield		Phillips River Goldfield		Total		Greenbushes Mineral Field	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	6·56	9,625	0·50	1,947	366·76	280,044	11,675·40	1,175,344
1956	1·47	4,389	0·34	1,473	70·59	126,094	131·17	71,273
1957	....	....	0·23	622	22·28	11,830	49·09	29,749
1958	....	....	....	....	6·03	8,551	14·24	6,434
1959	....	....	....	....	8·46	9,832	22·95	12,818
Total	**8·03**	**14,014**	**1·07**	**4,042**	**474·12**	**436,351**	**11,892·85**	**1,295,618**

Period	Tin—*continued*							
	Kimberley Goldfield		West Kimberley Goldfield		Pilbara Goldfield		West Pilbara Goldfield	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	0·83	302	0·43	314	6,363·02	771,227	2·48	1,615
1956	....	....	....	....	227·12	136,965	....	....
1957	....	....	....	....	221·16	125,330	....	....
1958	....	....	....	....	123·96	70,886	....	....
1959	....	....	....	....	226·75	141,911	....	....
Total	**0·83**	**302**	**0·43**	**314**	**7,162·01**	**1,246,319**	**2·48**	**1,615**

Period	Tin—*continued*				Tungsten (Scheelite)			
	East Murchison Goldfield		Total		Pilbara Goldfield		East Murchison Goldfield	
	Quantity	Value	Quantity	Value	Conc.	Value	Conc.	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	0·69	225	18,048·32	1,949,449	1·68	1,867	0·06	52
1956	....	....	358·35	208,273	....	....	....	....
1957	....	....	270·25	155,079	0·19	138	....	....
1958	....	....	138·20	77,319	....	....	....	....
1959	....	....	249·70	154,229	....	....	....	....
Total	**0·69**	**225**	***19,064·82**	**2,544,849**	**1·87**	**2,005**	**0·06**	**52**

* Includes 4·78 tons values at £395, 0·15 tons valued at £15, and 0·60 tons valued at £46 from Murchison, Coolgardie and Yilgarn Goldfields, respectively.

Period	Tungsten (Scheelite)—*continued*							
	Yalgoo Goldfield		Mt. Margaret Goldfield		North Coolgardie Goldfield		Coolgardie Goldfield	
	Conc.	Value	Conc.	Value	Conc.	Value	Conc.	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	3·02	1,093	2·95	3,730	15·48	10,104	24·30	8,479
1956	....	....	....	....	....	....	....	....
1957	....	....	....	....	....	....	....	....
1958	....	....	....	....	....	....	....	....
1959	....	....	....	....	....	....	....	....
Total	**3·02**	**1,093**	**2·95**	**3,730**	**15·48**	**10,104**	**24·30**	**8,479**

Period	Tungsten (Scheelite)—*continued*				Tungsten (Wolfram)			
	Yilgarn Goldfield		Total		Pilbara Goldfield		Murchison Goldfield	
	Conc.	Value	Conc.	Value	Ore and Conc.	Value	Ore and Conc.	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	106·79	39,135	*155·51	64,702	24·61	45,078	248·82	14,740
1956	....	....	....	....	....	....	....	....
1957	....	....	0·19	138	....	....	....	....
1958	....	....	....	....	....	....	....	....
1959	....	....	....	....	....	....	....	....
Total	**106·79**	**39,125**	**155·70**	**64,840**	**24·61**	**45,078**	**248·82**	**14,740**

* Includes 0·16 tons valued at £59 from Murchison Goldfield, 1·01 tons valued at £175 from Broad Arrow Goldfield and 0·08 tons valued at £19 from Dundas Goldfield.

Table VI.—*Minerals other than Gold*—continued.

Period	Silver Lead Ore and Concentrates—*continued*							
	Kimberley Goldfield		Pilbara Goldfield		West Pilbara Goldfield		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	9·26	652	2,493·85	158,564	178·42	7,754	9,603·57	498,410
1956	....	....	1,117·94	81,433	....	....	1,282·14	94,306
1957	....	....	657·62	44,161	1·63	126	856·68	60,252
1958	....	....	70·06	734	....	....	179·51	8,287
1959	....	....	420·87	17,039	....	....	462·37	19,531
Total	**9·26**	**652**	**4,760·34**	**301,931**	**180·05**	**7,880**	***12,384·27**	**680,786**

* Includes 5·50 tons valued at £295 from Peak Hill Goldfield and 7·60 tons valued at £68 from Gascoyne Goldfield.

Period	Silver Lead Zinc Ore and Concentrates							
	West Kimberley Goldfield		Pilbara Goldfield		Northampton Mineral Field		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	1,844·14	46,734	94·42	5,488	105·36	3,983	2,043·92	56,205
1956	....	....	....	....	....	....	....	....
1957	....	....	....	....	....	....	....	....
1958	....	....	....	....	....	....	....	....
1959	....	....	....	....	....	....	....	....
Total	**1,844·14**	**46,734**	**94·42**	**5,488**	**105·36**	**3,983**	**2,043·92**	**56,205**

Period	Magnesite							
	East Coolgardie Goldfield		Coolgardie Goldfield		Outside Proclaimed Goldfield		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	1,452·96	2,413	2,329·67	6,308	4,269·82	9,718	8,052·45	18,439
1956	378·30	855	459·70	1,226	....	....	838·00	2,081
1957	....	....	....	....	....	....	....	....
1958	....	....	....	....	....	....	....	....
1959	....	....	....	....	....	....	*18·50	74
Total	**1,831·26**	**3,268**	**2,789·37**	**7,534**	**4,269·82**	**9,718**	**8,908·95**	**20,594**

* From Phillips River Goldfield.

Period	Manganese (Metallurgical and Battery Grades)						Mica	
	Pilbara Goldfield		Peak Hill Goldfield		Total		Outside Proclaimed Goldfield	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	tons	£	tons	£	tons	£	lbs	£
Prior to 1956	16,576·00	258,619	111,179·67	1,126,173	127,800·52	1,385,084	†32,930·00	3,984
1956	7,525·25	102,159	49,797·89	546,797	57,323·14	648,956	....	...
1957	13,496·14	227,329	50,440·92	702,491	63,937·06	929,820	....	....
1958	22,372·52	389,482	39,400·91	570,834	61,809·43	960,474	....	....
1959	39,266·84	662,219	30,705·80	358,573	69,980·24	1,020,824	....	....
Total	**99,236·75**	**1,639,803**	**281,525·19**	**3,304,868**	***380,850·39**	**4,945,158**	**32,930·00**	**3,984**

* Includes 20 tons valued at £180 from Mt. Margaret Goldfield and 24·85 tons valued at £112 from Outside Proclaimed Goldfield, and 43·60 tons valued at £190 from East Coolgardie Goldfield. † Includes 7,868 lb. Crude Mica. Also includes 31·25 lb. Mica valued at £5 from West Kimberley Goldfield.

Period	*Mineral Beach Sands—Outside Proclaimed Goldfield							
	Ilmenite Concentrates		Monazite Concentrates		Rutile Concentrates		Zircon Concentrates	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	tons	£	tons	Value	tons	Value	tons	Value
Prior to 1956	....	....	....	....	....	....	....	....
1956	3,293·40	15,150	....	....	....	....	....	....
1957	40,931·99	233,475	....	....	....	....	....	....
1958	82,926·27	448,218	....	....	....	....	....	....
1959	73,627·67	335,076	109·55	7,210	297·45	8,423	4,068·34	41,129
Total	**200,779·33**	**1,049,919**	**109·55**	**7,210**	**297·45**	**8,423**	**4,068·34**	**41,129**

* Excluding 155·95 tons of mixed concentrates valued at £776.

Table VI.—*Minerals other than Gold*—continued.

Period	Mineral Beach Sands—Outside Proclaimed Goldfield		Ochre					
	Leucoxene Concentrates		West Pilbara Goldfield		Murchison Goldfield		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	....	....	3,800·45	47,931	3,995·92	39,837	7,942·33	88,678
1956	....	....	....	....	444·38	4,349	444·38	4,349
1957	....	....	....	....	27·30	273	27·30	273
1958	....	....	....	....	189·30	1,893	189·30	1,893
1959	276·25	3,930	....	....	104·00	1,040	104·00	1,040
Total	**276·25**	**3,930**	**3,800·45**	**47,931**	**4,760·90**	**47,392**	**8,707·31**	**96,233**

Period	Petalite		Phosphatic Guano		Pyrites			
	Coolgardie Goldfield		Outside Proclaimed Goldfield		Dundas Goldfield		East Coolgardie Goldfield	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	20·19	121	10,799·73	59,174	519,373·00	2,986,260	....	....
1956	....	....	....	....	48,426·00	362,949	12,542·98	57,103
1957	....	....	586·89	8,974	45,342·00	327,761	12,575·72	54,806
1958	67·77	293	169·65	1,827	38,915·00	303,340	10,473·64	48,507
1959	....	....	....	....	38,909·00	302,719	14,121·39	69,270
Total	**87·96**	**414**	**11,556·27**	**69,975**	**690,965·00**	**4,283,029**	**49,713·73**	**229,686**

Period	Pyrites—*continued*		Quartz Grit		Sillimanite		Soapstone	
	Total		Collie Coalfield		Outside Proclaimed Goldfield		Geenbushes Mineral Field	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	†593,420·56	3,031,756	....	....	2·00	13	517·00	1,778
1956	60,968·98	420,052	....	....	....	....	....	....
1957	57,917·72	382,567	....	....	....	....	....	....
1958	49,388·64	351,847	90·00	75	....	....	....	....
1959	53,030·39	371,989	312·00	260	....	....	....	....
Total	**814,726·29**	**4,558,211**	**402·00**	**335**	**2·00**	**13**	**517·00**	**1,778**

† Includes 74,047·56 tons values at £45,496 from Mt. Margaret Goldfield.

Period	Soapstone—*continued*		Spodumene		Talc			
	Total		Phillips River Goldfield		East Coolgardie Goldfield		Outside Proclaimed Goldfield	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	*565·40	1,928	3·89	57	1,136·44	4,760	9,695·21	140,482
1956	....	....	....	....	77·12	388	4,378·45	54,050
1957	....	....	....	....	175·45	877	3,478·20	49,029
1958	....	....	....	....	....	....	2,500·67	35,304
1959	....	....	....	....	....	....	4,047·69	58,085
Total	**565·40**	**1,928**	**3·89**	**57**	**1,389·01**	**6,025**	**24,100·22**	**336,950**

* Including 48·40 tons valued at £150 from Outside Proclaimed Goldfields.

Period	Talc—*continued*		Tanto/Columbite					
	Total		Pilbara Goldfield		Greenbushes Mineral Field		Gascoyne Goldfield	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	10,831·65	145,242	323·40	230,641	35·50	36,793	·80	1,038
1956	4,455·57	54,438	38·58	86,565	30·20	33,667	....	....
1957	3,653·65	49,906	5·55	4,662	16·50	6,546	....	....
1958	2,500·67	35,304	4·03	6,923	2·00	1,628	....	....
1959	4,047·69	58,085	3·10	4,343	5·36	5,489	....	....
Total	**25,489·23**	**342,975**	**374·66**	**333,134**	**89·56**	**84,123**	**·80**	**1,038**

Table VI.—*Minerals other than Gold*—continued.

Period	Tungsten (Wolfram)—*continued*				Vermiculite		Zinc Ore (Fertiliser)	
	Yalgoo Goldfield		Total		Outside Proclaimed Goldfield		Pilbara Goldfield	
	Ore and Conc.	Value	Ore and Conc.	Value	Quantity	Value	Quantity	Value
	tons	£	tons	£	tons	£	tons	£
Prior to 1956	1·74	1,522	*303·93	61,759	1,831·92	11,822	20·00	100
1956	....	....	....	....	1·04	9	....	....
1957	....	....	....	....	....	....	....	....
1958	....	....	....	....	....	....	....	....
1959	....	....	....	....	....	....	....	....
Total	**1·74**	**1,522**	**303·93**	**61,759**	**†1,832·96**	**11,831**	**20·00**	**100**

* Includes 28·48 tons valued at £331 from West Kimberley Goldfield and 0·28 tons valued at £88 from Broad Arrow Goldfield. † Includes 127·16 tons valued at £882 from East Coolgardie Goldfield and 20 tons valued at £60 from Yilgarn Goldfield.

TABLE VII.

Quantity and Value of Minerals, other than Gold, reported during year 1959.

Number of Lease, Claim, or Area	Goldfield or Mineral Field	Registered Name of Producer.	Quantity.	Metallic Content.	Value.
		ASBESTOS (Chrysotile)	Tons		£A
M.C. 48, etc.	West Pilbara	Hancock, L. G.	597·31	....	16,527·40
L.T.T. 1226H	Pilbara	Hancock, L. G.	34·35	....	721·35
			631·66	....	(*b*) 17,248·75
		ASBESTOS (Crocidolite)			
M.C. 22, etc.	West Pilbara	Australian Blue Asbestos Ltd.	14,680·17	....	1,611,293·43 (*b*)
		BENTONITE			
M.L. 437H, etc.	O.P.G. (Marchagee)	Noonan, E. J.	133·00	....	(*a*) 532·00
		BERYL (*f*) (*g*)		BeO Units	
Crown Lands	Ashburton	Sundry Persons	5·24	61·05	964·10
Crown Lands	Gascoyne	Sundry Persons	33·08	387·53	6,060·35
P.A. 39	Gascoyne	Kempton Bros.	6·46	77·85	1,255·40
P.A. 36	Gascoyne	Poland, W. C.	5·97	71·57	1,154·10
P.A. 7330	Coolgardie	Bucktin, R.	0·79	9·43	152·05
M.L. 80, etc.	Coolgardie	Austn. Glass Manufacturers Co. Pty. Ltd.	11·33	122·95	1,961·70
Crown Lands	Coolgardie	Sundry Persons	1·92	21·10	340·30
P.A. 3645	Yalgoo	Little and Todd	2·60	30·24	487·60
M.C. 111H	O.P.G. (Balingup)	Oma, V. C.	0·23	2·62	40·45
Crown Lands	Pilbara	Sundry Persons	155·71	1,731·33	27,819·35
M.C. 614	Pilbara	Butterfield, D. J.	5·23	59·35	943·75
M.C. 512	Pilbara	Hall, W.	13·90	156·89	2,529·90
M.L. 370	Pilbara	Stein, L. and S. K.	9·42	110·25	1,774·90
M.C. 106	Pilbara	Strelley Mining Syndicate	1·78	14·93	22·10
M.C. 116	Pilbara	Tabba Tabba Mining Syndicate	11·05	129·84	1,988·65
P.A. 2575	Pilbara	Seigne, M.	2·00	22·75	356·95
			266·71	3,009·68	(*b*) 48,051·65
		CLAYS (Cement Clay)			
Freehold Land	O.P.G. (Maida Vale)	D. F. D. Rhodes Pty. Ltd.	8,821·00	....	4,960·00
M.C. 492H, etc.	O.P.G. (Gosnells)	Cockburn Cement Co.	13,500·00	....	18,094·75
			22,321·00	....	(*c*) 23,054·75
		CLAYS (Fireclay)			
M.C. 304H, etc.	O.P.G. (Clackline)	Clackline Refractories Ltd.	1,871·00	....	1,871·00
Loc. 84	O.P.G. (Glen Forrest)	Darling Range Firebrick Co. Pty. Ltd.	590·10	....	560·60
M.C. 522H, etc.	O.P.G. (Byford)	Bridge, J. S.	18,772·00	....	26,437·25
M.C. 504H, etc.	O.P.G. (Bedfordale)	Brisbane and Wunderlich Ltd.	1,000·00	....	1,500·00
M.C. 585H	O.P.G. (Glen Forrest)	Le Vaux, M. L.	3,969·00	....	2,976·75
			26,202·10	....	(*c*) 33,345·60
		CLAYS (White Clay—Ball Clay)			
M.C. 109H	O.P.G. (Goomalling)	Brisbane and Wunderlich Ltd.	1,005·00	....	(*c*) 4,020·00
		CLAYS (White Clay—Kaolin)			
M.C. 247H	O.P.G. (Mt. Kokeby)	Linton, J. B.	185·00	....	(*c*) 925·00
		CLAYS (*Brick, Pipe, and Tile Clay)			
M C. 584H	O.P.G. (Bickley)	Plunkett, T.S.	2,298·00	....	(*c*) 605·00

* Incomplete.—Figures relate only to production reported from holdings under the Mining Act.

Table VII.—*Minerals other than Gold*—continued.

Quantity and Value of Minerals, other than Gold, reported during year 1959.

Number of Lease, Claim, or Area	Goldfield or Mineral Field	Registered Name of Producer.	Quantity.	Metallic Content.	Value.
		COAL	Tons		£A
M.L. 250, etc.	Collie	Amalgamated Collieries of W.A. Ltd.	633,916·77	....	1,679,939·75
M.L. 314, etc.	Collie	Griffin Coal Mining Co.	130,445·05	....	289,724·60
M.L. 418, etc.	Collie	Western Collieries Ltd.	147,072·70	....	386,870·00
			911,434·52	....	2,356,534·35 (*e*)
		COPPER ORE AND CONCENTRATES (*f*) (*g*)			
				Copper Units	
M.C. 35, etc.	Phillips River	Ravensthorpe Copper Mines, N.L.	4,408·75	109,325·00	230,077·90 (*b*)
		Silver and Gold content transferred to respective items.			
		CUPREOUS ORE AND CONCENTRATES (Fertilizer)			
				Av. Assay Cu %	
M.C. 91P	Peak Hill	Copper Knob Pty. Ltd.	32·08	7·27	318·40
P.A. 872P	Peak Hill	Rumble, R. W.	9·42	15·72	312·00
P.A. 877P	Peak Hill	Rooney, J. P.	80·42	7·98	921·90
M.L. 68P	Peak Hill	Thaduna Copper Mining Co.	5,761·95	7·59	62,205·85
M.C. 65P	Peak Hill	Ricci, A.	102·18	9·32	1,542·15
L.T.T. 1/58	Peak Hill	Smith, R. J.	8·45	7·95	104·00
M.C. 63P	Peak Hill	Parkinson, L. T.	82·36	16·32	3,030·40
M.C. 43P	Peak Hill	Parkinson, L. T.	110·61	20·88	5,488·60
M.C. 14	Yalgoo	O'Callaghan and Howlett	112·56	10·94	2,220·95
P.A. 2585	Pilbara	Doughty, R. G. and Party	2·17	15·80	65·30
G.M.L. 314L	Pilbara	Copper Hills Copper Mine	4,900·55	10·88	96,020·64
P.A. 257	West Pilbara	Watkins, D. C.	5·86	8·56	68·85
M.L. 259	West Pilbara	Yannery Hill Copper Mine	57·12	8·66	739·65
M.L. 260	West Pilbara	Whundo Copper Syndicate	200·73	11·50	4,332·60
P.A. 3507N	Murchison	Grylls, West, Vicini and Facer	9·02	6·15	63·80
M.C. 15N	Murchison	Cawse and Rixon	9·17	13·96	254·15
P.A. 3485N	Murchison	Yaksich, A.	24·42	9·37	375·55
P.A. 3459N	Murchison	Alac, M.	34·18	9·25	517·20
G.M.L. 1990N	Murchison	Motter, Z.	75·31	6·02	596·90
M.C. 2B	East Murchison	Rinaldi, Motter, and Motter	155·15	7·89	1,745·10
M.L. 25F	Mt. Margaret	Anaconda Copper Mine	20·66	6·58	178·40
M.C. 35, etc.	Phillips River	Ravensthorpe Copper Mines, N.L.	13·00	24·86	969·45
M.L. 413, etc.	Phillips River	H. Wehr and Party	28·38	8·52	676·70
M.L. 410	Phillips River	New Surprise Copper Mine	23·05	18·22	1,257·90
			11,858·80	9·31	184,006·44 (*a*) (*b*)
		FELSPAR			
M.L. 80, etc.	Coolgardie	Australian Glass Manufacturers Co. Pty. Ltd.	1,393·00	....	6,338·15
M.C. 111H	O.P.G. (Balingup)	Oma, V. C.	2·80	....	14·00
			1,395·80	....	(*a*) 6,352·15
		GLASS SAND			
M.C. 417H, etc.	O.P.G. (Lake Gnangara)	Australian Glass Manufacturers Co. Pty. Ltd.	6,697·54	....	4,359·93
M.C. 365H	O.P.G. (Lake Gnangara)	Leach, R. J.	130·00	....	195·00
			6,827·54	....	(*c*) 4,554·93
		GLAUCONITE			
			Greensand Treated	Glauconite Recovered	
Private Property	O.P.G. (Gingin)	Brook, G. E.	510·00	102·00	(*b*)(*d*)5,103·00
		GYPSUM			
			Tons		
M.C. 58	Yilgarn	James, A. D.	19·00	....	23·75
M.C. 30, etc.	Yilgarn	Ajax Plaster Co. Pty. Ltd.	4,532·00	....	3,739·00
M.C. 51, etc.	Yilgarn	H. B. Brady & Co. Ltd.	7,766·00	....	5,824·50
M.C. 9, etc.	Yilgarn	Perth Modelling Works	11,236·00	....	8,146·11
M.C. 126H, etc.	O.P.G. (Baandee)	Perth Modelling Works	197·00	....	177·30
M.C. 12	Dundas	McDonald and Whitfield	5·00	....	1·50
M.C. 25, etc.	Dundas	Garrick Agnew Pty. Ltd.	11,163·70	....	33,493·48
M.C. 612H, etc.	O.P.G. (Lake Cowcowing)	Hewitt, B.	1,603·00	....	1,804·00
M.C. 485H	O.P.G. (Nukarni)	Fitzgerald, E. J.	1,208·85	....	997·50
			37,730·55	....	54,207·14 (*a*) (*b*)

Includes 11,163·70 tons for Export.

Plaster of Paris reported as manufactured during the year being 13,658·00 tons from 20,117·00 tons of Gypsum.

Table VII.—*Minerals other than Gold*—continued.

Quantity and Value of Minerals, other than Gold, reported during year 1959.

Number of Lease, Claim, or Area	Goldfield or Mineral Field	Registered Name of Producer.	Quantity.	Metallic Content.	Value.
		IRON ORE (for Pig)	Tons		£A
Temp. Res. 1258H	Yilgarn	Charcoal Iron and Steel Industry	57,206·00	Pig Iron Recovered 36,427·00	808,644·00 (*c*) (*d*)
		Average Assay of Ore used = 61·94% Fe.			
		IRON ORE (for Export)			
M.L. 10, etc.	West Kimberley	Australian Iron and Steel Ltd.	672,239·00	Av. Assay Fe% 66·47	(*b*)666,601·00

Number of Lease, Claim or Area	Goldfield or Mineral Field	Registered Name of Producer	Ore and Conc. Tons	Lead		Silver	
				Tons	Value £A	Fine oz.	Value £A
		LEAD ORE AND CONCENTRATES (*f*) (*g*)					
M.L. 268	Northampton	McGuires Lead Mine	158·34	117·78	6,792·90	....	....
M.L. 234	Northampton	Mary Springs Lead Mine	36·18	27·48	1,189·00	....	....
M.L. 256, etc.	Northampton	Gurkha Lead Mine	743·05	566·68	38,793·37	454·83	175·03
Vict. Loc. 436	Northampton	Wheel of Fortune Extended	404·67	293·96	18,583·92	227·73	87·78
M.L. 66P.P.	Northampton	Lucky Strike Lead Mine	81·71	62·65	3,499·00	....	....
M.L. 263	Northampton	Kathleen Hope Lead Mine	16·57	11·73	770·75	17·43	6·75
			1,440·52	1,080·28	(*b*)69,628·94	699·99	269·56
		Silver :—Quantity and Value transferred to Silver Item.					
		SILVER/LEAD ORE AND CONCENTRATES (*f*) (*g*)					
M.C. 189	Pilbara	Ragged Hills Lead Mine	420·87	273·23	17,039·00	....	....
M.L. 118	Ashburton	Bilrose Lead Mine	41·50	28·68	2,335·55	415·10	156·81
			462·37	301·91	(*b*)19,374·55	415·10	156·81
		Silver :—Quantity and Value transferred to Silver Item.					

Number of Lease, Claim, or Area	Goldfield or Mineral Field	Registered Name of Producer	Quantity	Metallic Content	Value
		MAGNESITE	Tons		£A
M.C. 76, etc.	Phillips River	Garrick Agnew Pty. Ltd.	18·50	....	74·00
		MANGANESE (METALLURGICAL GRADE)			
				Av. Assay Mn%	
M.C. 517, etc.	Pilbara	Pindan Pty. Ltd.	60·55	47·79	927·15
M.C. 332, etc.	Pilbara	D. F. D. Rhodes Pty. Ltd.	19,944·00	51·21	336,580·00
M.C. 244L, etc.	Pilbara	Westralian Ores Pty. Ltd.	10·00	44·00	200·00
M.C. 268, etc.	Pilbara	Northern Minerals Syndicate	19,252·29	51·76	324,511·95
M.C. 24P, etc.	Peak Hill	Westralian Ores Pty. Ltd.	30,362·03	42·81	353,352·90
			69,628·87	47·69	1,015,572·00 (*b*)
		MANGANESE (BATTERY GRADE)			
M.L. 61P	Peak Hill	Westralian Ores Pty. Ltd.	202·71	Assay MnO_2 78·00	(*b*) 4,256·90
		MANGANESE (LOW GRADE)			
				Av. Assay Mn%	
M.L. 61P	Peak Hill	Westralian Ores Pty. Ltd.	10·66	Not known	85·05
M.C. 24P, etc.	Peak Hill	Westralian Ores Pty. Ltd.	130·40	Not known	878·20
P.A. 5177	East Coolgardie	McCarthy, M. D.	7·60	32·00	32·00
			148·66	....	(*a*) 995·25

Table VII.—*Minerals other than Gold*—continued.

Quantity and Value of Minerals, other than Gold, reported during year 1959.

Number of Lease, Claim, or Area	Goldfield or Mineral Field	Registered Name of Producer.	Quantity.	Metallic Content.	Value.
MINERAL BEACH SANDS (ILMENITE) (*f*)			Tons		£A
				TiO_2 Assay	
D.C. 56H	O.P.G. (Bunbury)	Cable (1956) Ltd.	8,917·42	54·07	40,186·60
M.C. 619H, etc.	O.P.G. (Yoganup)	Westralian Oil Ltd.	286·20	61·02	3,922·00
D.C. 34H, etc.	O.P.G. (Wonnerup)	Ilmenite Pty. Ltd.	18,770·00	53·65	112,980·00
M.C. 516H, etc.	O.P.G. (Capel)	Western Titanium, N.L.	45,654·05	55·02	195,987·10
			73,627·67	54·58	(*b*)353,075·70
MINERAL BEACH SANDS (MONAZITE) (*f*) (*g*)					
				Units ThO_2	
M.C. 516H, etc.	O.P.G. (Capel) ...	Western Titanium, N.L.	109·55	744·88	(*b*) 7,210·25
MINERAL BEACH SANDS (RUTILE) (*f*) (*g*)					
				Tons TiO_2	
M.C. 516H, etc.	O.P.G. (Capel)	Western Titanium, N.L.	297·45	285·05	(*b*) 8,423·50
MINERAL BEACH SANDS (LEUCOZENE) (*f*) (*g*)					
M.C. 516H, etc.	O.P.G. (Capel)	Western Titanium, N.L.	276·25	222·03	(*b*) 3,930·30
MINERAL BEACH SANDS (ZIRCON) (*f*) (*g*)					
				Tons ZrO_2	
M.C. 516H, etc.	O.P.G. (Capel)	Western Titanium, N.L.	4,068·34	2,671·01	(*b*) 41,128·85
OCHRE—RED					
M.C. 26, etc.	Murchison	Zadow, J. C.	104·00	....	(*a*) 1,040·00
PYRITES ORE AND CONCENTRATES (*g*)					
				Sulphur Content Tons	
G.M.L. 5345E, etc.	East Coolgardie	Gold Mines of Kalgoorlie (Aust.) Ltd.	(*j*)14,121·39	5,540·92	69,270·11
G.M.L. 1460, etc.	Dundas	Norseman Gold Mines, N.L.	38,909·00	18,666·16	302,719·00
			53,030·39	24,207·08	(*a*)371,989·11
QUARTZ GRIT					
Q A. 2	Collie	Rowden, E.	312·00	....	(*c*) 260·00
SILVER					
			Fine oz.		
	By-product of Gold Mining		183,850·48	....	76,031·25
	By-product of Copper Mining		8,595·96	....	3,455·85
	By-product of Lead Mining		699·99	....	269·56
	By-product of Silver/Lead Mining		415·10	....	156·81
			193,561·53	....	79,913·47
TALC					
Loc. M839	O.P.G. (Three Springs)	Universal Milling Co. Pty. Ltd.	4,047·69	....	(*c*) 58,084·80
TANTO/COLUMBITE ORE AND CONCENTRATES (*f*) (*g*)					
				Assayed Ta_2O_5 Content—Units	
M.C. 116	Pilbara	Tabba Tabba Mining Syndicate	0·74	44·47	1,223·00
Crown Lands	Pilbara	Sundry Producers	2·36	92·09	3,120·00
M.C. 69, etc.	Greenbushes	Austin and Sweeney	(*k*) 4·09	189·18	4,103·35
Crown Lands	Greenbushes	Sundry Producers	(*k*) 0·52	19·16	460·30
L.T.T. 1399H	Greenbushes	Coghlan, R. J.	(*k*) 0·75	34·50	926·30
			8·46	379·40	(*b*) 9,832·95

Sold Variously on Assayed Ta and TaNb Basis.

Table VII.—*Minerals other than Gold*—continued.

Quantity and Value of Minerals, other than Gold, reported during year 1959.

Number of Lease, Claim, or Area	Goldfield or Mineral Field	Registered Name of Producer.	Quantity.	Metallic Content.	Value .
		TIN (*f*) (*g*)	Tons	Tons	£A
M.C. 69, etc.	Greenbushes	Austin and Sweeney	14·88	9·34	7,807·55
L.T.T. 1399H	Greenbushes	Coghlan, R. J.	5·75	4·04	3,607·00
Crown Lands	Greenbushes	Sundry Persons	2·32	1·67	1,403·25
D.C. 228, etc.	Pilbara	Leonard, H. V.	2·18	1·52	1,306·60
D.C. 201	Pilbara	Mineral Concentrates Pty. Ltd.	35·58	25·30	23,269·75
D.C. 43, etc.	Pilbara	Northern Minerals Syndicate	111·92	80·01	71,301·60
D.C. 32	Pilbara	Johnston, J. A.	27·74	18·90	16,629·35
D.C. 48, etc.	Pilbara	Pilbara Exploration, N.L.	36·35	24·38	21,482·90
Crown Lands	Pilbara	Sundry Persons	12·98	9·01	7,920·90
			249·70	174·17	(*b*)154,728·90

REFERENCES

O.P.G. Denotes Outside Proclaimed Goldfield.
(*a*) Value F.O.R.
(*b*) Value F.O.B.
(*c*) Value at Works.
(*d*) Value of Mineral Recovered.
(*e*) Value at Pit Head.
(*f*) Only results of shipments finalised during period under review.
(*g*) Metallic Content calculated on Assay Basis.
(*h*) Subject to Revision.
(*i*) Concentrates.
(*j*) By-product of Gold Mining.
(*k*) By-product of Tin Mining.

TABLE VIII.

SHOWING AVERAGE NUMBER OF MEN EMPLOYED ABOVE AND UNDER GROUND IN THE LARGER GOLDMINING COMPANIES OPERATING IN WESTERN AUSTRALIA DURING THE YEARS FROM 1950 to 1959 INCLUSIVE.

COMPANY.	1950.			1951.			1952.			1953.			1954.			1955.			1956.			1957.			1958.			1959.		
	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.	Above.	Under.	Total.
Anglo-Westralian Mng. Pty.	....	....	....	....	....	....	47	4	51	37	5	42	28	6	34	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
†Boulder Perseverance, Ltd.	173	138	311	115	119	274	151	115	266	155	112	267	152	114	266	171	114	285	181	113	294	....	....	....	....	....	....	....	....	....
Broken Hill Pty. Co., Ltd.	34	68	102	13	12	25	6	....	6	4	....	4	2	....	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Blue Spec Gold Mines, Ltd.	20	6	26	33	21	54	36	21	57	33	15	48	30	15	45	17	9	26	....	....	....	....	....	....	....	....	....	....	....	....
Big Bell Mines, Ltd.	219	246	465	230	240	470	203	205	408	200	215	415	179	167	346	44	16	60	....	....	....	....	....	....	....	....	....	....	....	....
Burbidge Gold Mines, N.L.	16	4	20	2	....	2	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Consolidated Gold Area, N.L.	1	....	1	3	1	4	1	....	1	1	1	2	1	2	3	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Comet Gold Mines, Ltd	11	12	23	13	11	24	10	8	18	10	6	16	4	2	6	3	....	3	....	....	....	....	....	....	....	....	....	....	....	....
Central Norseman Gold Corporation, N.L.	163	236	399	148	226	374	151	212	363	155	228	383	158	227	385	166	225	391	159	209	368	165	226	391	166	232	398	173	214	387
Dundas Gold Mines, N.L.	3	9	12	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Eclipse Gold Mines, N.L.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	27	8	35	17	10	27
Evanston Gold, N.L.	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
First Hit Gold Mine	1	1	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Golden Horseshoe (New), Ltd.	41	....	41	39	....	39	38	....	38	42	....	42	42	....	42	39	....	39	35	....	35	6	....	6	....	....	....	....	....	....
Gold Mines of Kalgoorlie, Ltd.	187	180	367	181	191	372	185	182	367	184	182	366	199	186	385	257	192	449	228	223	451	417	500	917	392	538	930	374	455	829
Great Boulder Pty., Ltd.	327	404	731	311	354	665	344	339	683	349	359	708	342	372	714	350	379	729	349	380	729	330	400	730	323	387	710	308	399	707
*Great Western Consolidated	....	....	....	125	72	197	148	60	208	186	113	299	191	150	341	224	271	441	232	270	502	220	223	443	220	241	461	207	218	425
Hill 50 Gold Mine, N.L.	74	66	140	62	41	103	59	48	107	68	63	131	73	63	136	82	73	155	98	85	183	108	94	202	103	103	206	95	88	183
†Kalgoorlie Enterprise, Ltd.	7	95	102	8	85	93	8	93	101	8	98	106	8	89	97	7	101	108	8	100	108	....	....	....	....	....	....	....	....	....
§Kalgurli Ore Treatment Co., Ltd.	74	....	74	77	....	77	81	....	81	77	....	77	78	....	78	65	....	65	40	....	40	33	....	33	28	....	28	....	....	....
Lake View and Star, Ltd.	471	476	947	492	517	1,009	486	529	1,015	494	519	1,013	488	498	986	482	487	969	471	523	994	460	517	977	433	525	958	451	535	986
Moonlight Wiluna Gold Mines, Ltd. (Timoni)	33	32	65	42	42	84	42	41	83	39	37	76	42	34	76	39	33	72	37	32	69	36	31	67	35	31	66	31	27	58
Mountain View Gold, N.L.	11	11	22	13	7	20	5	3	8	4	6	10	3	6	9	3	1	4	....	....	....	....	....	....	....	....	....	....	....	....
Mt. Charlotte (Kalgoorlie) Gold Mines, N.L.	10	8	18	2	....	2	2	3	5	3	6	9	3	2	5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
North Kalgurli (1912), Ltd.	90	316	406	133	348	481	112	293	405	76	207	283	83	193	276	95	236	331	156	239	395	158	250	408	163	263	426	181	251	432
Northern Minerals Syndicate Ltd. (Paris Mine).	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	6	4	10
Gold Mines of Kalg. (Aust.) Ltd. (Barbara and Bayleys Leases)	73	125	198	73	120	193	65	109	174	68	108	176	77	95	172	79	95	174	37	73	110	34	61	95	23	48	71	19	36	55
New Coolgardie Gold Mines, N.L. (Callion Leases)	....	...	....	6	21	27	6	29	35	7	34	41	9	42	51	8	35	43	3	11	14	....	....	....	....	....	....	....	....	....
Ora Banda Amalgamated, Ltd.	2	....	2	1	....	1	1	....	1	3	2	5	1	2	3	....	2	2	....	....	....	....	....	....	....	....	....	....	....	....
Paringa Mining and Exploration Co., Ltd.	92	138	230	47	46	93	10	6	16	2	2	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Porphyry (1939) Gold Mines, Ltd.	10	8	18	6 5	1	7	1	....	1	3	3	6	2	2	4	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Radio Gold Mines	....	....	....	....	3	8	4	4	8	5	5	10	5	5	10	6	6	12	6	6	12	7	7	14	6	6	12	6	6	12
†South Kalgurli Consolidated	120	107	227	124	110	234	67	102	169	67	107	174	64	106	170	53	99	152	13	84	97	....	....	....	....	....	....	....	....	....
Sons of Gwalia, Ltd.	104	151	255	121	129	250	121	118	239	102	157	259	102	138	240	102	146	248	105	156	261	107	146	253	109	142	251	99	137	236
Sunshine Reward Amalgamated Leases	10	9	19	10	7	17	9	7	16	8	7	15	8	7	15	7	4	11	8	7	15	2	....	2	8	3	11	5	2	7
Wiluna Gold Mines, Ltd.	29	....	29	20	....	20	13	....	13	2	1	3	1	1	2	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Yellowdine Gold Development, Ltd.	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
All other Operators	987	837	1,824	883	664	1,547	851	598	1,449	846	523	1,369	734	495	1,229	634	388	1,022	544	407	951	498	349	847	476	413	789	521	398	919
State Average (incl. Diggers)	3,404	3,676	7,080	3,378	3,388	6,766	3,265	3,129	6,394	3,238	3,121	6,359	3,109	3,019	6,128	2,933	2,912	5,845	2,710	2,918	5,628	2,581	2,804	5,385	2,512	2,840	5,352	2,493	2,780	5,273

* Including Copperhead, Frasers, Nevoria, Corinthian and Pilot Groups. † Absorbed by Gold Mines of Kalgoorlie (Aust.) Ltd. from 1957.
‡ Effective workers only and totally excluding non-workers for any reason whatsoever. § Absorbed by Gold Mines of Kalgoorlie (Aust.) Ltd. from 1959.

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