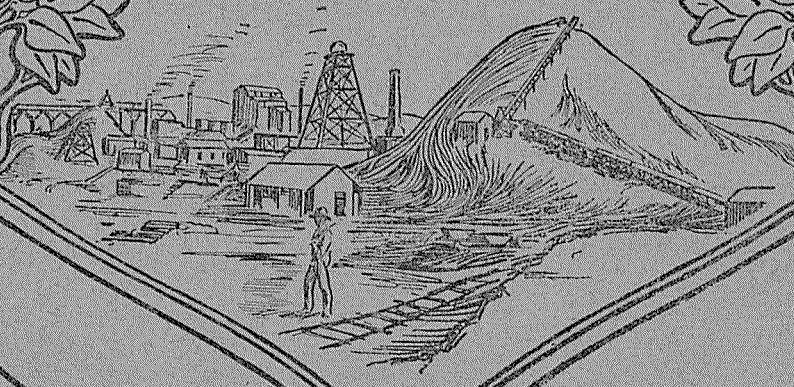




REPORT
OF THE
DEPARTMENT OF MINES
FOR THE YEAR
WESTERN · 1930 · AUSTRALIA



PRESENTED TO BOTH HOUSES OF PARLIAMENT

BY HIS EXCELLENCYS COMMAND



1931.
—
WESTERN AUSTRALIA.

REPORT

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[FIRST SESSION OF THE FOURTEENTH PARLIAMENT.]

PERTH:
BY AUTHORITY: FRED. WM. SIMPSON, GOVERNMENT PRINTER.

1931.

STATE OF WESTERN AUSTRALIA.

Report of the Department of Mines for the State
of Western Australia for the Year 1930.

To the Hon. the Minister for Mines.

Sir,

I have the honour to submit the Annual Report of the Department for the year 1930, together with reports from the officers controlling the various sub-departments, and comparative tables furnishing statistics relative to the Mining Industry of the State.

I have, etc.,

Department of Mines,
Perth, 31st March, 1931.

M. J. CALANCHINI,
Under Secretary for Mines.

DIVISION I.

The Hon. the Minister for Mines.

I have the honour to submit for your information a report on the Mining Industry for the year 1930.

The value of the mineral output of the State for the year was £2,191,393, being £103,500 greater than that for the previous year. All minerals, excepting gold, showed decreases.

The value of the Gold Yield was £1,768,623, being 80.70 per cent. of the total output.

The value of the Coal output was £394,758; Tin, £10,608; Lead, £5,582; Asbestos, £4,728; Silver, £3,748; Gypsum, £1,990; and Tantalite, £1,254.

The dividends paid by mining companies amounted to £31,250, and in the preceding year £65,607.

The total dividends paid to the end of 1930 amounted to £28,826,537.

To the same date, the total mineral production was £175,288,607, and the total gold production £162,704,268.

GOLD.

The gold yield shows an increase, being 39.193 fine ounces greater than in 1929, which was 16,232 fine ounces less than in 1928.

The average value per ton of ore treated in the State as a whole has risen from 50 shillings in 1929 to 54.95 shillings in 1930; and in the East Coolgardie Goldfield, which produced over 78 per cent. of the State's reported yield, it rose from 52.48 shillings to 60.75 shillings.

Comparing the tonnage of ore treated in 1929 and 1930, there was an increase of 16,944 tons in the latter year, during which 645,344 tons were treated.

There were increases in East Coolgardie, North Coolgardie, Yilgarn, Coolgardie, East Murchison and from the State generally of 21,744, 8,188, 5,579, 599, 147 and 22 tons respectively. All the others treated less tonnage, the largest decreases being in Broad Arrow, Murchison, Yalgoo and Mount Margaret, of 10,900, 4,173, 1,451 and 1,402 tons respectively.

There were increases in the production from Coolgardie, Dundas, East Coolgardie, Mount Margaret, North Coolgardie and Yilgarn; the others reported decreases.

The acreage held under Mining Lease for all minerals is 53,105 acres, being a decrease of 551 acres when compared with 1929.

The area leased for Gold Mining is lesser by 31 acres, and for other minerals by 520 acres.

The area held under Prospecting Areas is 35,618 acres, including 19,440 acres for Coal. This is a decrease of 1,547 acres on the area held in 1929, the area held for Coal being lesser by 8,890 acres, and for other minerals greater by 7,433 acres.

The number of men engaged in all classes of mining was 5,442; an increase of 283 on the number employed in 1929. The number of men engaged in mining for minerals other than gold showed a decrease

of 61, principally due to smaller numbers being employed in mining for Tin, Lead, Tantalite and Gypsum. Coal mining showed an increase. In gold mining there was an increase of 344.

The average value of gold produced per man employed on gold mines was £392.58 in 1929, and £414.85 in 1930.

The average tonnage raised per man was 150.64 tons, and in the previous year 157.02 tons. Examinations under the provisions of the Miner's Phthisis Act of persons employed in mines were carried out at Kalgoorlie and outlying centres.

In the East Murchison Field there was a decrease of 1,313 fine ounces.

In the Black Range District a few prospectors were operating in the various centres, but nothing of importance was reported.

In the Lawlers District there was a small increase. Apart from one or two crushings the production came from treatment of accumulated sands and slimes.

In the Wiluna District there was a decrease, but with the commencement of ore treatment by the Wiluna Gold Mines, Ltd., early in the New Year it is anticipated that the gold output will run into big figures.

In the outlying centres there was not much change.

The Murchison Field had a decrease of 2,301 fine ounces.

In the Meekatharra District there was a decrease, and the bulk of the production was from the Meekatharra centre. From the outlying centres, although prospecting was active, nothing noteworthy was reported.

In the Cue District there was an increase.

The greatest improvement was in the Cue centre, where several good crushings were recorded. In the various other centres prospecting was active, and the outlook is promising.

In the Day Dawn District there was a small decrease.

At Day Dawn there were several crushings from various prospecting areas and also from the "Mountain View." At Mainland the owners of the "Mainland Consols" treated some ore and then closed down, after which they acquired the "Eureka," to which they have removed their plant. At Lake Austin only a little fossicking is in evidence.

In the Mount Magnet District there was also a small decrease.

As hitherto, most of the production was from the neighbourhood of Mt. Magnet itself.

At Lennonville prospects had not improved. At Moyagee only two prospectors were working, but at Paynesville there were several parties operating with, so far, very poor results.

The Peak Hill Field had a small decrease of 11 fine ounces.

More than half of the output came from the vicinity of Peak Hill, and the centre known as Murphy's Well contributed a large proportion of the balance. At the other centre there was very little activity, excepting at Jimble Bar, where ore treatment was begun in December.

No work was done on the Manganese deposits at Horseshoe during the year.

The Yalgoo Field had a decrease of 420 fine ounces.

At Goodingnow the Lake View Mine, which has been a regular producer for many years, showed a considerable reduction in output.

At Noongal a rich discovery was reported in June, and the prospectors who, in addition to a rich crushing, recovered a large quantity of gold by dollying, were granted a Reward Lease.

In the various other centres, as well as in the neighbourhood of Yalgoo, a great many prospectors are at work.

The Mount Margaret Field had an increase of 6,686 fine ounces.

In both the Mount Margaret and Mount Morgans Districts there were reduced outputs, and practically no change indicating any improvement, although a good many prospectors were out.

In the Mount Malcolm District there was a substantial increase entirely due to the Sons of Gwalia Mine, which is once again a most promising proposition, well managed and being actively developed. A fair amount of prospecting was in evidence throughout the district.

The Coolgardie Field had an increase of 258 fine ounces.

In the immediate vicinity of Coolgardie prospecting was very active, and many old shows were being again tested.

At Gibraltar crushings were reported from the "Lloyd George" and "Carlton" Mines.

At Burbanks a small amount of work was going on, but crushing results were hardly payable.

At St. Ives a number of old mines were being further tested, and tributers were working on the "Clifton" and "Ives Reward," but their returns were not too promising.

At Logan's Find a good deal of attention was being concentrated on the Reward Lease, which was to be equipped with plant; and mining at this centre was brighter.

A few miles from Widgiemooltha an important discovery of alluvial gold was made, and up to the end of the year over 500 ounces had been reported. Several slugs up to 68 ounces had been found, but not much fine gold. A great number of men from all parts of the State were flocking to the locality, which is now known as Larkinsville, named after Mr. Larkin, one of the original prospectors.

At Higginsville very little was being done.

The Kunanalling centre was also very quiet.

The North Coolgardie Field had an increase of 3,278 fine ounces. This is principally attributable to a resumption of operations on the Sand Queen-Gladsome Mine at Comet Vale. At this centre little work was going on other than on this mine.

In the Menzies centre a good deal of attention was concentrated on various old holdings. Several small discoveries were made and a number of payable crushings reported. The Goongarrie and Mount Ida centres remained very quiet.

In the Ularring district there were a few prospectors working in the vicinity of Davyhurst, and practically the only production was from the treatment of sands on the "Golden Pole" and at the Mulline State Battery.

At Riverina work ceased on the "Riverina South," and there is little likelihood of a resumption at present.

In the Yerilla District a discovery at a locality about 12 miles South-Easterly from Edjudina, since named Patricia, was reported in April.

Many Leases and Prospecting Areas were taken up and there was considerable mining activity. Apart from the original find not much gold was reported. Elsewhere in the district a good deal of prospecting was going on.

In the Niagara District mining was very quiet, and nothing of any note was recorded.

The North-East Coolgardie Goldfield recorded a decrease of 150 fine ounces.

In the Kanowna District there was no change from the previous year. A few prospectors were operating, but very few payable crushings were reported.

In the Kurnalpi District mining was almost at a standstill, only a few men being at work.

The Board Arrow Field had a decrease of 6,291 fine ounces. This was solely owing to the cessation of operations on the Associated Northern Blocks Mine at Ora Banda. The number of prospectors was maintained and some good returns recorded.

In July a discovery was reported from a locality about 4 miles N.W. of Broad Arrow, subsequently named Fenbark. Several leases and prospecting areas were taken up and good crushings reported. The outlook is promising. From Grant's Patch, Dark Horse, Ora Banda, Cashmans, Lady Bountiful and the immediate vicinity of Broad Arrow good returns were reported. A few men still remained at Waverley, Bardoc, and Paddington, but there was nothing of note to report.

In the East Coolgardie Goldfield the number of men engaged in mining was 2,065, and in 1929, 2,072, a decrease of seven. This goldfield gave employment to over 46 per cent. of the number of men employed in gold mining, and the reported production during the year was 328,626 fine ounces, over 78 per cent. of the total reported yield.

The tonnage treated was 459,105 tons, being 21,744 tons greater than in 1929. The yield showed an increase of 46,076 fine ounces on the preceding year.

The average grade of the ore per ton rose from 52.48 shillings in 1929 to 60.75 shillings in 1930.

The large mines maintained their production, the biggest contributor being the Lake View and Star.

Many tributers were still operating and were responsible for a considerable portion of the output. At the North End of the field prospecting was very active.

At Feysville and Golden Ridge several parties were working and good returns were reported.

In the Bulong District mining was very quiet. Only a few men were at work in the various centres and very little gold was won.

The Yilgarn Field had an increase of 1,672 fine ounces.

In the Bullfinch Centre mining was very active and several crushings were reported. At Holleton a privately-owned plant commenced operations and prospectors were able to get their accumulated crushings treated. Some were very low grade, but others gave good returns.

At Manxman the Radio and Radio Deeps maintained their production and exceptionally high values were reported. Some discoveries reported from this centre are very promising. At Westonia mining was not active and the production showed a falling off. In the immediate vicinity of Southern Cross a good many prospectors were at work, as also in the various outlying centres not specially mentioned.

In the Dundas Field there was an increase of 363 fine ounces.

The principal producer was the O.K. at Norseman. The Mararoa, Golden Butterfly and a prospecting area 7 miles south of Norseman also had good outputs.

Although an increase is recorded no new discoveries were reported.

The Phillips River Field had a decrease of 49 fine ounces.

Very little mining was being done, although a few prospectors were working at various places.

In the Pilbara Field there was a decrease of 41 fine ounces.

There were no new finds reported but the position was well maintained and prospecting was active.

The West Pilbara Field was cancelled during the year and all records transferred to Head Office.

There was no production reported from the West Kimberley Goldfield.

In the Ashburton, Gascoyne and Kimberley Fields there were reduced outputs and no developments were reported.

TIN.

The quantity of Tin exported was 62 tons, valued at £10,608, a decrease in tonnage of 15 tons, and in value of £2,824. The Greenbushes Tinfield produced .65 of a ton, valued at £63; a decrease in tonnage of 37.65 tons, and in value of £4,016. The Yilgarn Goldfield produced .60 of a ton, valued at £46, but none in the preceding year, and the Pilbara Goldfield 11.80 tons, valued at £1,328; a decrease in tonnage of 6.60 tons, and in value of £1,203.

TANTALITE.

No production of Tantalite was reported.

COPPER.

No production of Copper was reported.

COAL.

The output of Coal was 501,425 tons, being 43,294 tons less than in 1929.

All the production was from Collie, where six collieries were working.

The deposits at Wilga remained unworked. The number of men employed, 896, is greater by 38 than in 1929, and the output per man was in 1929, 635 tons, and in 1930, 560 tons.

OIL.

Boring was continued on the area held by the Freney Kimberley Oil Company at Poole Range in the West Kimberley Goldfield. An inflow of water was encountered but eventually shut off. Drilling was recommenced when unfortunately the tools were lost and found to be impossible of recovery. Promising indications had been encountered in this bore and it is the Company's intention to put down another one as early as possible.

ASBESTOS.

The reported production was 65.30 tons, valued at £4,228 from the Pilbara Field; an increase in tonnage of 1.60 tons, but decrease in value of £4,885 on the previous year; also from the West Pilbara Goldfield 17 tons, valued at £500; a decrease in tonnage of 174.25 tons, and in value of £8,068.

OTHER MINERALS.

The quantity of Silver obtained as a by-product and exported was 46,348 ounces, valued at £3,748, a decrease on the preceding year of 3,486 ounces, and in value of £1,761. Lead and Silver Lead amounting to 391 tons, valued at £5,582; a decrease in tonnage of 53 tons, and in value of £1,434 was exported.

In addition, the production was reported of 1,581 tons of Gypsum, valued at £1,990; a decrease in tonnage of 3,708 tons, and in value of £5,686.

MINING GENERALLY.

The West Australian production was 70.39 per cent. of the total for Australasia and in the preceding year 69.71 per cent.

Owing to the urgent necessity for the reduction of expenditure wherever possible the Government has been compelled to reduce assistance to a very great extent. In spite of this, a good deal has been done.

The special relief accorded mine owners by the payment of their premiums to cover liability for occupational diseases under the Third Schedule of the Workers' Compensation Act was continued until the end of March: the expenditure on this account amounted to £11,816 10s. 10d.

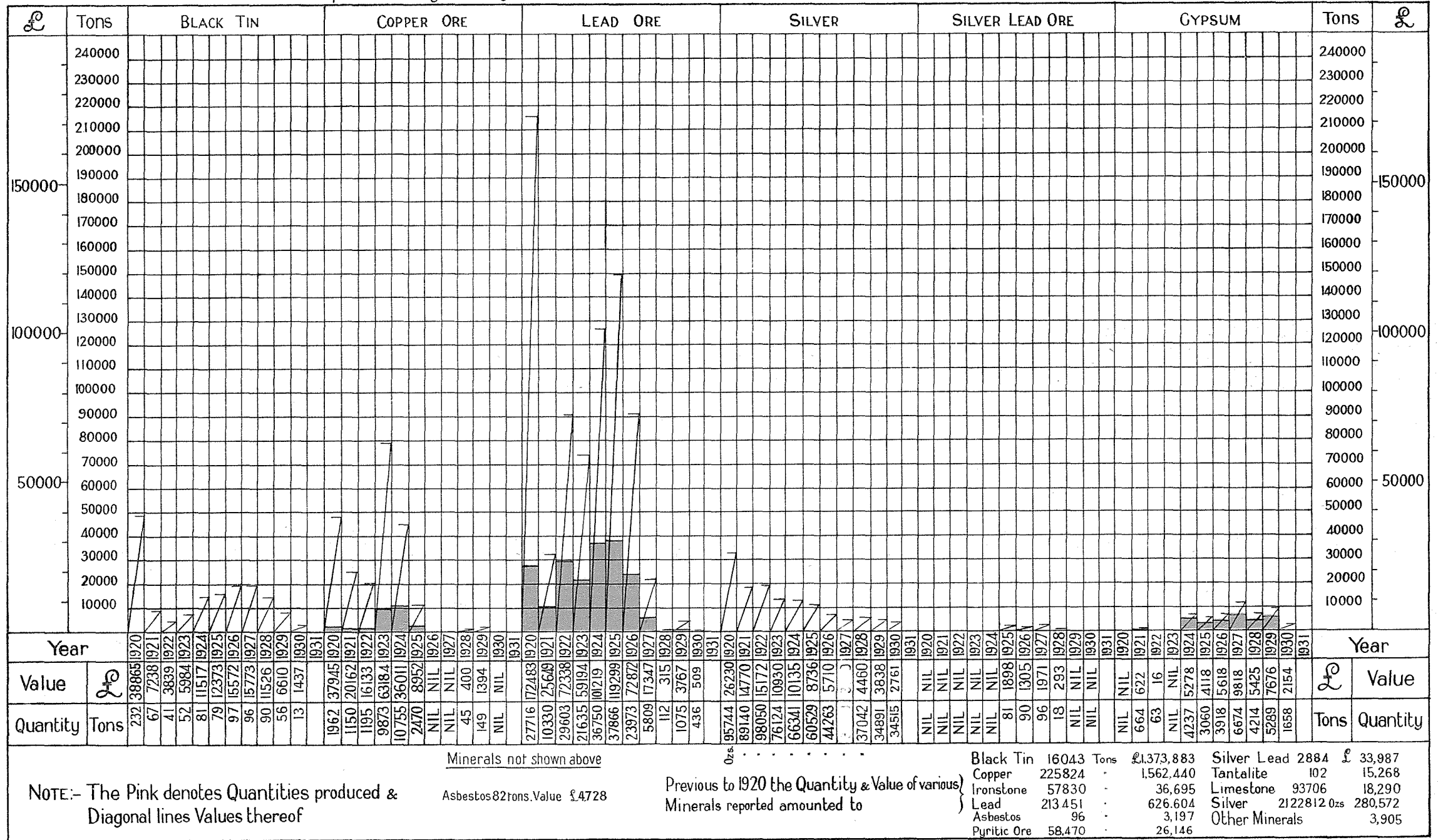
The concessions in regard to reduced charges for water and for treatment of ore at State Batteries were also continued.

In mining for base metals there was not any improvement, the low market prices ruling preventing any revival.

In gold mining there was a marked increase in activity which is reflected in the improved output, and prospecting has been active throughout the State.

D I A G R A M

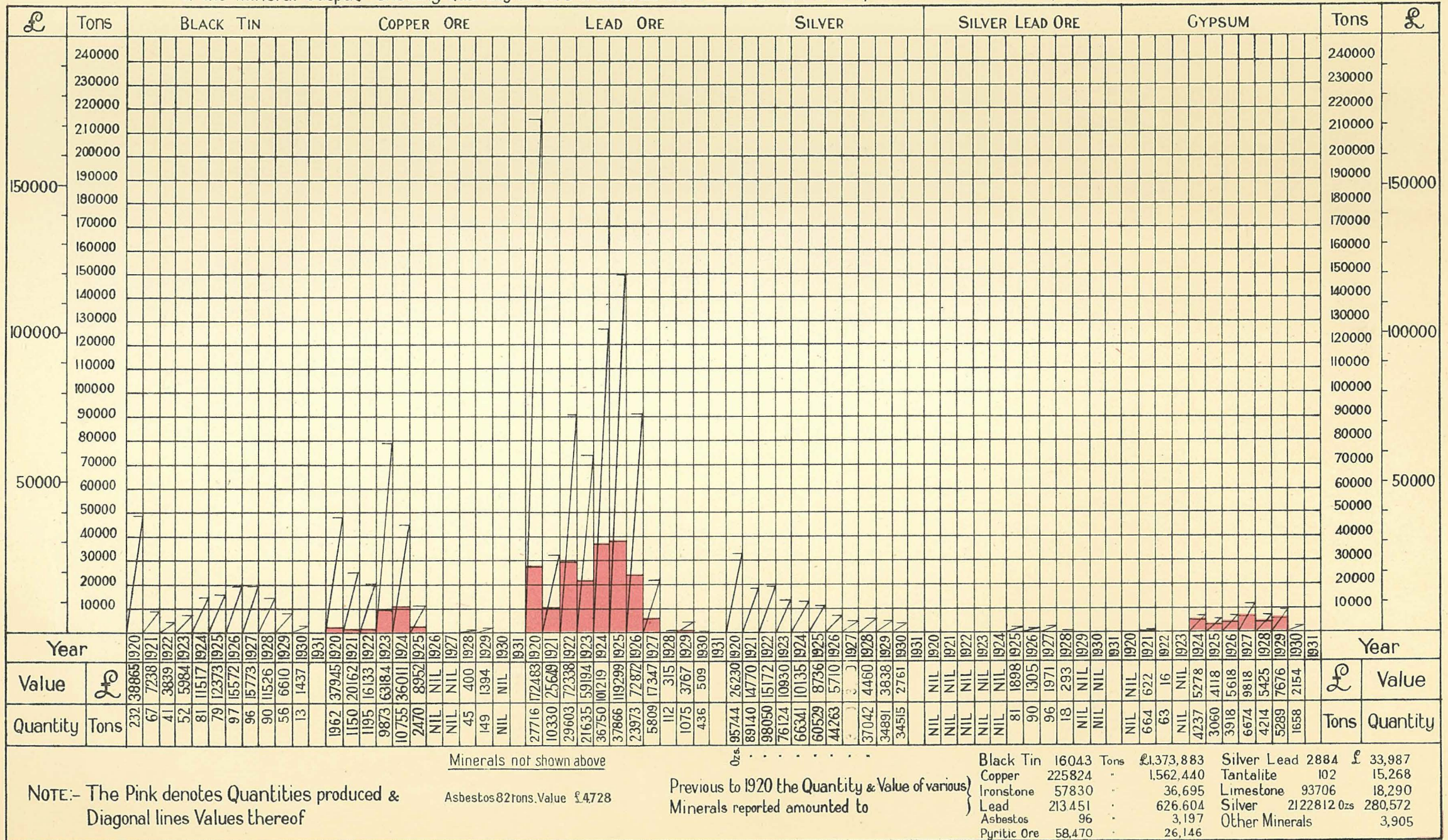
of the Mineral Output - shewing Quantity & Value of Minerals other than Gold & Coal reported to the Mines Dep^t from the Year 1920 onwards



NOTE:- The Pink denotes Quantities produced & Diagonal lines Values thereof

D I A G R A M

of the Mineral Output - shewing Quantity & Value of Minerals other than Gold & Coal reported to the Mines Dep^t from the Year 1920 onwards

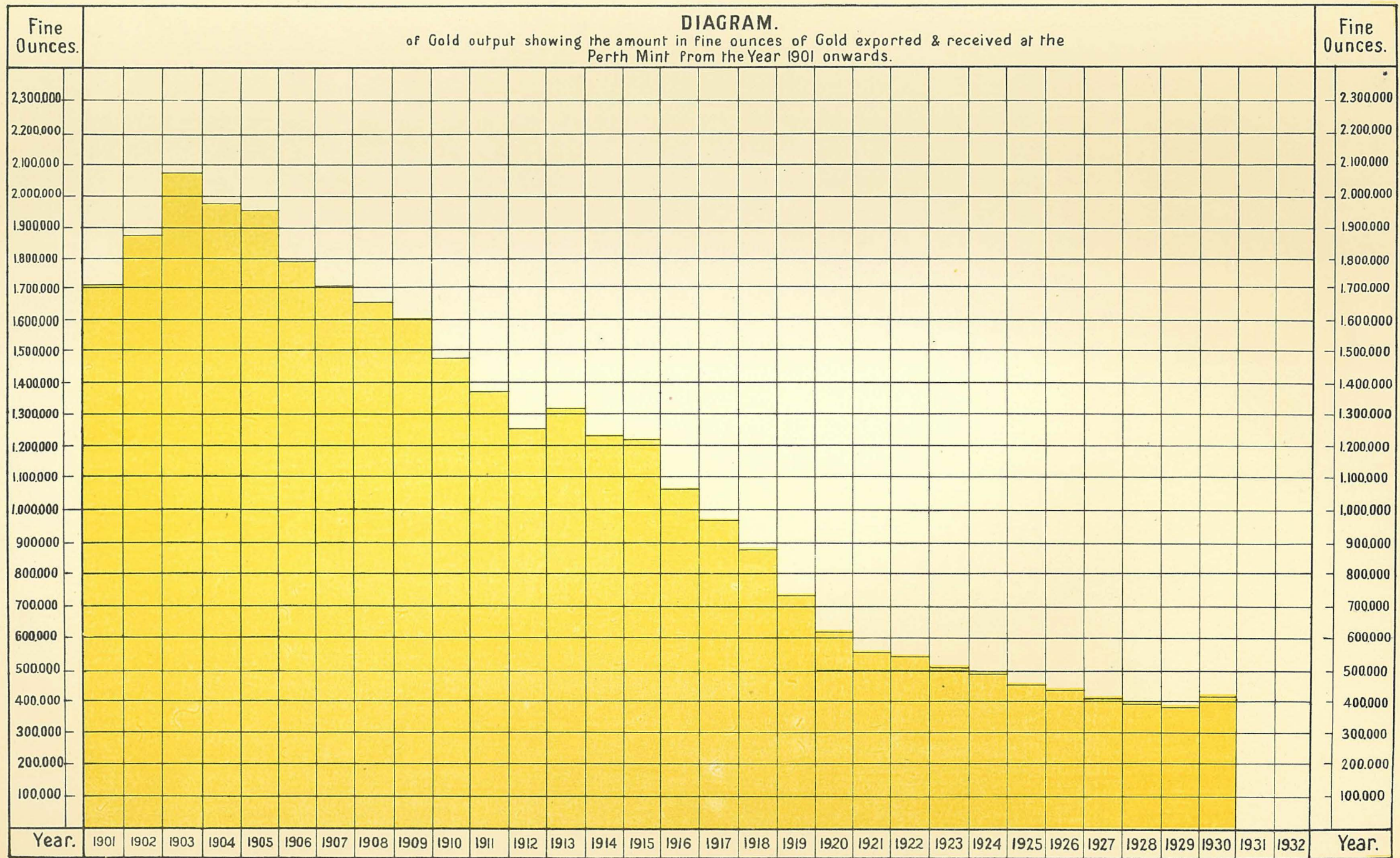


NOTE:- The Pink denotes Quantities produced & Diagonal lines Values thereof

Minerals not shown above
Asbestos 82 tons. Value £4728

Previous to 1920 the Quantity & Value of various Minerals reported amounted to

Black Tin	16043	Tons	£1,373,883	Silver Lead	2884	£	33,987
Copper	225824		1,562,440	Tantalite	102		15,268
Ironstone	57830		36,695	Limestone	93706		18,290
Lead	213451		626,604	Silver	2122812	ozs	280,572
Asbestos	96		3,197	Other Minerals			3,905
Pyritic Ore	58,470		26,146				



Note.— Previous to 1901 Gold Produced, 5,293,885·66 Fine Ozs.

COMPARATIVE STATISTICAL DIAGRAMS
 RELATING TO
OUTPUT AND VALUE OF GOLD AND OTHER MINERALS, LANDS LEASED FOR GOLD MINING
 IN WESTERN AUSTRALIA
 AND THE GOLD PRODUCTION OF AUSTRALASIA FOR THE YEAR 1930

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

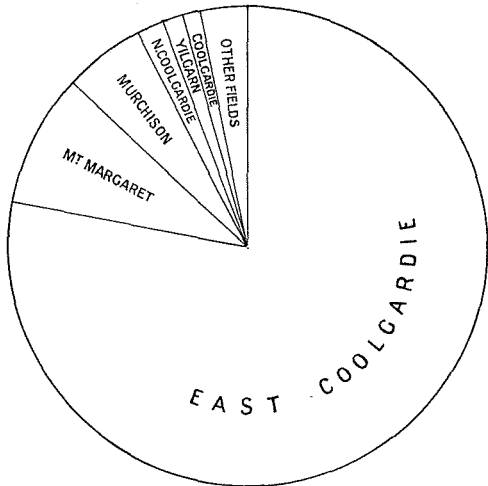


FIG. 2. Gold produced from various Goldfields as given by the Export and Mint Returns.

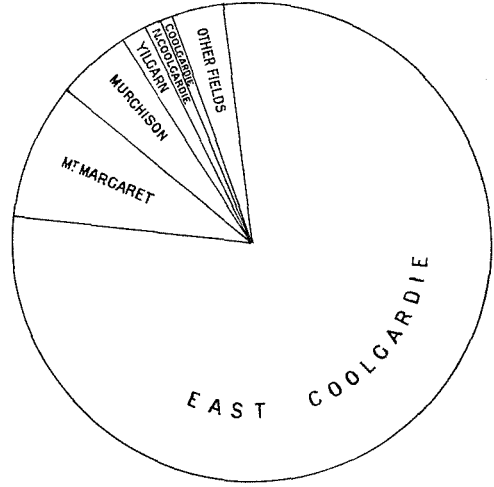


FIG. 3. Value of Gold and other Minerals.

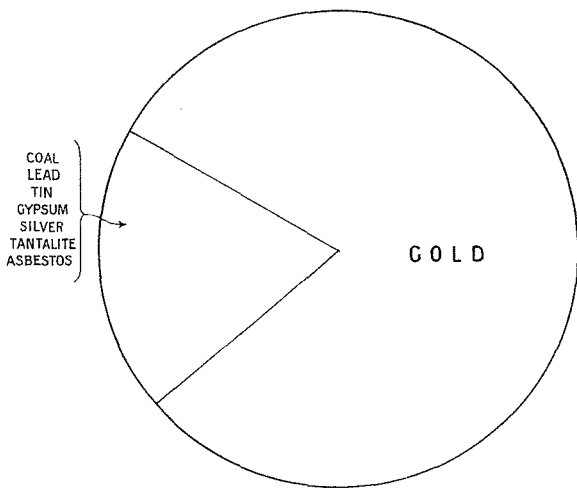


FIG. 4. Value of Minerals other than Gold.

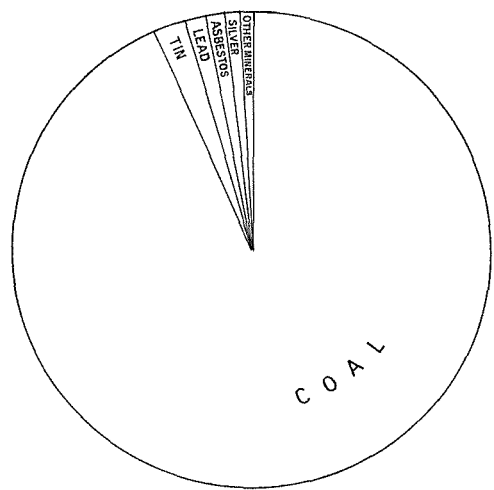


FIG. 5. Areas of Land leased for Goldmining on various Goldfields.

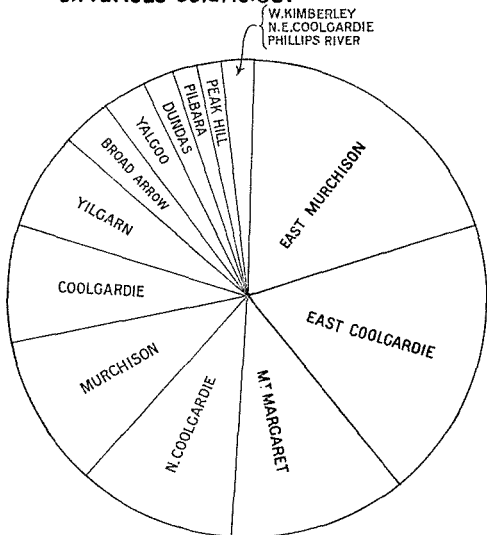
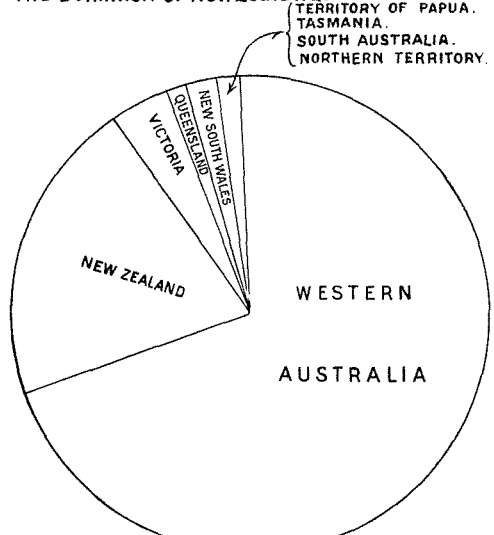


FIG. 6. Output of Gold in the States of Australia and the Dominion of New Zealand.



The rate of exchange has been a great help to producers, the amount paid to them by way of premium having risen from £2 17s. 6d. per cent. in March, to £7 15s. per cent. at the end of the year.

In December assent was given to an Act passed by the Commonwealth Parliament providing for the payment of a bounty on the production of gold. It provides that the bounty shall be payable in respect of gold produced during the period of 10 years commencing on 1st January, 1931, and shall be at the rate of £1 for each ounce of fine gold produced in each year in excess of the average number of fine ounces produced annually during the years 1928, 1929 and 1930. It is hoped that this will have the effect of giving a considerable fillip to the industry and offset some of the burdens under which it has been labouring for many years.

During the months of January, February, March, July and August, assistance to prospectors by way of sustenance, explosives, loans of equipment and transport facilities was granted as hitherto, but from April to June and after August it was found necessary to reduce the assistance to loans of equipment and turnout only, on account of the unduly large number of applicants and the consequent depletion of funds.

The Board dealing with this activity granted 274 applications representing 429 men and approved of 152 extensions of existing cases affecting 205 men. The expenditure involved was £7,244 15s. 3d., being

£1,217 19s. 1d. less than that for 1929, when the expenditure was greater than in any previous year.

From the 1st September, 1919, when the State Prospecting Board came into existence, 2,026 parties employing 3,160 men (including five specially selected State prospecting parties) have been assisted at a total cost of £70,478 6s. 3d.

The assisted prospectors' operations extended throughout the mineral-bearing portions of the State, and several new finds and a number of good crushings were reported.

Throughout the year the weather conditions were generally favourable, good rains being reported over most of the Goldfields, as early as February and March, extending as far as the Warburton Ranges, where one party instead of suffering from lack of water experienced a little difficulty with flood waters.

The area under prospecting areas, for gold and minerals, apart from Coal, viz., 16,178 acres, is 7,433 acres in excess of that held during the preceding year, and is indicative of the increasing interest and activity in mining.

The expenditure incurred in rendering assistance to mine owners and the industry generally under the provisions of the Mining Development Act totalled £59,137 17s. 3d., and in the preceding year £84,825 15s. 2d. In addition, guarantees to Banks on behalf of mine owners were in existence, the liability in this connection amounting to £51,500.

PART II.—MINERALS RAISED.

TABLE 1.

Quantity and Value of all the Minerals produced during 1929 and 1930.

Description of Minerals.	1929.		1930.		Increase or Decrease for Year compared with 1929.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
		£		£		£
1. Alunite (exported), statute tons	38	194	...	...	— 38	— 194
2. Asbestos (reported), statute tons	255	14,681	82	4,728	— 173	— 9,953
3. Barytes (exported), statute tons	2	8	...	...	— 2	— 8
4. Coal (raised), statute tons	544,719	426,706	501,425	394,758	— 43,294	— 31,948
5. Copper Ore (exported), statute tons	129	2,778	10	102	— 119	— 2,676
6. Emeralds (reported) ... ..	...	278	...	...	— ...	— 278
7. Felspar (exported), statute tons	21	96	...	...	— 21	— 96
8. Gold (exported and minted), fine ozs.	377,176	1,602,142	416,369	1,768,623	+ 39,193	+ 166,481
9. Gypsum (reported), statute tons	5,289	7,676	1,581	1,990	— 3,708	— 5,686
10. Lead and Silver Lead Ore (exported), statute tons	444	7,016	391	5,532	— 53	— 1,484
11. Manganese Ore (exported), statute tons	80	230	...	...	— 80	— 230
12. Pottery Clay (exported) cwts.	2	5	...	...	— 2	— 5
13. Sand (exported), statute tons	18	36	...	...	— 18	— 36
14. Silver (exported), fine ozs.	49,834	5,509	46,348	3,748	— 3,486	— 1,761
15. Tantalite (exported), statute tons	24	7,106	3	1,254	— 21	— 5,852
16. Tin (exported), statute tons	77	13,432	62	10,608	— 15	— 2,824
...	...	£2,087,893	...	£2,191,393	...	+ £103,500

TABLE 2.

Value and Percentage of Mineral Exports in relation to the Value of Total Exports from Western Australia.

Year.	Total Exports.	Mineral Exports (exclusive of Coal).	Percentage.
	£	£	
1901	8,515,623	6,920,118	81.27
1902	9,051,358	7,530,319	83.20
1903	10,324,732	8,727,060	84.53
1904	10,271,489	8,625,676	83.98
1905	9,871,019	7,731,954	78.33
1906	9,832,679	7,570,305	76.99
1907	9,904,860	7,544,992	76.17
1908	9,518,020	7,151,317	75.13
1909	8,860,494	5,906,673	66.66
1910	8,299,781	4,795,654	57.78
1911	10,606,863	7,171,638	67.61
1912	8,941,008	5,462,499	61.09
1913	9,128,607	4,608,188	50.48
1914	8,406,182	3,970,182	47.23
1915	6,291,934	2,969,502	47.19
1916	10,878,153	6,842,621	62.92
1917	9,323,229	5,022,694	53.87
1918	6,931,834	2,102,923	30.34
1919	14,279,240	6,236,585	43.67
1920	15,149,323	3,096,849	20.44
1921	10,331,405	1,373,810	13.30
1922	11,848,025	2,875,402	24.27
1923	11,999,500	3,259,476	27.16
1924	13,808,910	1,424,319	13.24
1925	13,642,852	173,126	1.27
1926	14,668,184	1,597,698	10.89
1927	15,805,120	472,041	2.99
1928	16,911,932	996,099	5.88
1929	16,660,742	1,802,709	10.82
1930	19,016,639	6,370,396	33.49
Total since 1901 ...	339,079,737	140,332,825	41.38

TABLE 3.

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

Goldfield.	Reported Yield.					
	1929.	1930.	Percentage for each Goldfield.		Average Value of Gold per ton of Ore treated.	
			1929.	1930.	1929.	1930.
	fine ozs.	fine ozs.			shillings.	shillings.
1. Kimberley	184	63	.05	.015	...	...
2. Pilbara	2,309	2,268	.62	.540	137.21	159.27
3. Ashburton	9	3	.01	.001	...	...
4. Gascoyne	78	11	.02	.003	...	...
5. Peak Hill	1,085	1,074	.29	.256	36.17	41.81
6. East Murchison... ..	3,766	2,453	1.01	.584	202.93	120.44
7. Murchison	23,427	21,126	6.30	5.033	43.34	43.18
8. Yalgoo	2,611	2,191	.70	.522	51.79	58.42
9. Mt. Margaret	32,779	39,465	8.81	9.401	25.92	31.75
10. North Coolgardie	3,750	7,028	1.01	1.675	112.62	53.67
11. Broad Arrow	8,756	2,465	2.35	.587	47.04	41.95
12. North-East Coolgardie	709	659	.19	.157	68.60	150.28
13. East Coolgardie	282,550	328,626	75.94	78.288	52.48	60.75
14. Coolgardie	3,449	3,707	.93	.883	66.51	53.97
15. Yilgarn	4,701	6,373	1.26	1.518	13.30	63.17
16. Dundas	1,651	2,014	.44	.480	44.49	64.42
17. Phillips River	190	141	.05	.033	118.52	62.79
State generally	60	100	.02	.024	...	131.22
Totals and averages	372,064	419,767	100.00	100.000	50.00	54.95

The total gold yield of the State is as shown in Table 1, being the amount of gold exported, and also that lodged at the Royal Mint, which total includes alluvial gold and gold not reported to the 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.

Averages of Gold Ore raised and treated, and Gold produced therefrom, per man employed on the several Goldfields of the State, during 1929 and 1930.

Goldfield.	1929.				1930.			
	Tons of Gold Ore raised and treated.		Fine ounces of Gold produced therefrom.		Tons of Gold Ore raised and treated.		Fine ounces of Gold produced therefrom.	
	Per man employed under ground.	Per man employed above and under ground.	Per man employed under ground.	Per man employed above and under ground.	Per man employed under ground.	Per man employed above and under ground.	Per man employed under ground.	Per man employed above and under ground.
	tons.	tons.	fine ozs.	fine ozs.	tons.	tons.	fine ozs.	fine ozs.
1. Kimberley ... ..	...	...	...	...	...	...	...	...
2. Pilbara	58.47	25.51	94.44	41.21	31.16	16.71	58.37	31.30
3. Ashburton ... ..	...	...	...	...	...	...	...	...
4. Gascayne ... ..	...	...	...	...	...	...	...	...
5. Peak Hill	175.23	81.35	74.60	34.64	114.15	66.91	56.18	32.93
6. East Murchison	9.88	4.14	23.62	9.88	10.00	3.05	14.17	4.33
7. Murchison	237.87	124.13	121.35	63.33	209.44	104.45	106.45	53.09
8. Yalgoo	107.00	54.18	65.23	33.03	55.47	27.46	38.14	18.88
9. Mt. Margaret	489.18	269.98	149.24	82.36	489.49	271.24	182.92	101.36
10. North Coolgardie	92.81	40.45	127.60	53.63	130.71	63.10	82.58	39.87
11. Broad Arrow	212.57	98.21	117.71	54.38	74.48	36.65	36.78	18.10
12. North-East Coolgardie	26.86	12.35	21.71	9.99	13.61	6.01	24.08	10.64
13. East Coolgardie	382.31	215.02	246.44	138.61	424.70	226.94	303.71	162.28
14. Coolgardie	64.93	28.52	50.82	22.32	69.85	31.50	44.38	20.01
15. Yilgarn	52.38	19.64	82.24	30.84	142.74	59.06	106.13	43.92
16. Dundas	92.12	46.77	48.21	24.48	90.90	44.68	68.94	33.88
17. Phillips River	62.25	13.11	47.43	9.98	46.25	18.50	34.18	13.67
Total Averages	302.99	157.02	178.34	92.42	307.45	150.64	198.86	97.43

The average value of gold produced per man above and under ground was £392.58 in 1929, and £414.85 in 1930. The average tonnage of ore raised shows a decrease from 157.02 tons to 150.64 tons. The average tonnage raised per man was highest in the Mount Margaret Goldfield, viz., 271.24 tons average value, £430.55, the next being East Coolgardie Goldfield with 226.94 tons, average value £689.32.

TABLE 5.

Output of Gold from the several States of Australia, the Northern Territory, Papua, and the Dominion of New Zealand during 1930.

State.	Output of Gold.	Value.	Percentage of total Output of Australasia.
	Fine ozs.	£	
1. Western Australia	416,369	1,768,623	70.39
2. Victoria	24,119	102,451	4.08
3. Queensland	7,821	33,224	1.32
4. New South Wales	12,493	53,066	2.11
5. Tasmania... ..	4,467	18,976	.75
6. South Australia	1,311	5,569	.22
7. Papua	4,012	17,042	.68
8. Northern Territory	402	1,708	.07
9. New Zealand	120,542	512,030	20.38
Total	591,536	2,512,689	100.00

TABLE 6.

Dividends paid by Western Australian Gold Mining Companies during 1930 and Total to date.

(Compiled from information supplied by the Government Statistician's Office.)

Goldfield.	Name of Company.	Capital.				Dividends.		
		Authorised	No. of Shares.	Par Value Shares.	Paid up to.	Paid in 1930.		Grand Total paid to end of 1930.
						No.	Total Amount.	
		£		£ s. d.	£ s. d.		£	£
Peak Hill ...	Various Companies ...	...	...	...	...	...	...	160,666
East Murchison...	Various Companies ...	...	...	...	...	...	...	437,968
Murchison ...	Various Companies ...	...	...	...	...	...	...	1,992,670
Mt. Margaret ...	Various Companies ...	...	...	...	...	...	...	1,504,701
North Coolgardie	Various Companies ...	...	...	...	...	...	...	575,032
North-East Coolgardie	Various Companies ...	...	...	...	...	...	...	89,854
East Coolgardie	South Kalgurli Consolidated, Ltd.	150,000	250,007	0 10 0	0 10 0	2	31,250	502,501
Do. ...	Other Companies ...	...	...	...	...	...	...	22,487,826
Coolgardie ...	Various Companies ...	...	...	...	...	...	...	339,495
Yilgarn ...	Various Companies ...	...	...	...	...	...	...	513,199
Dundas ...	Various Companies ...	...	...	...	...	...	...	222,625
							31,250	28,826,537

TABLE 7.

Quantity and Value of Minerals, other than Gold and Coal, reported to the Mines Department during 1930.

Goldfield, District, or Mineral Field.	1930.		Increase or Decrease for Year compared with 1929.	
	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£
BLACK TIN.				
Pilbara Goldfield (Marble Bar District)	11·80	1,328	— 6·06	— 1,203
Yilgarn Goldfield	·60	46	+ ·60	+ 46
Greenbushes Mineral Field	·65	63	— 37·65	— 4,016
Total	13·05	1,437	— 43·11	— 5,173
TANTALITE.				
Pilbara Goldfield (Marble Bar District) ... ..	...	...	— 11·27	— 3,598
Greenbushes Mineral Field ... ..	...	...	— ·30	— 70
Total ... ..	...	...	— 11·57	— 3,668
COPPER ORE.				
Northampton Mineral Field ... ..	...	...	— 116·00	— 974
Phillips River Goldfield ... ..	...	...	— 33·18	— 420
Total ... ..	...	...	— 149·18	— 1,394
LEAD ORE.				
Northampton Mineral Field ... ..	...	...	— 1,075	— 3,767
ASBESTOS.				
Pilbara Goldfield (Marble Bar District)	65·30	4,228	+ 1·60	— 1,885
West Pilbara Goldfield	17·00	500	— 174·25	— 8,068
Total	82·30	4,728	— 172·65	— 9,953
GYPSUM.				
Yilgarn Goldfield	606	606	— 155	— 155
State generally	975	1,384	— 3,553	— 5,531
Total	1,581	1,990	— 3,708	— 5,686
EMERALDS.				
Murchison Goldfield (Cue District)	Carats. 3,750	*	...	...

* Some 3,750 carats of emeralds were reported, but had not been sold at the end of the year and their value not ascertainable.

The output of black tin shows a net decrease in tonnage of 43.11 tons and in value £5,173. No production of tantalite, copper ore or lead ore was reported, and the production of asbestos declined to the extent of 172.65 tons and in value by £9,953. The quantity of gypsum decreased by 3,708 tons and the value by £5,686. A small parcel of tin was obtained from Holleton, in the Yilgarn Goldfield, and

the balance was obtained from Pilbara and Greenbushes Fields. Asbestos came from the Pilbara and West Pilbara Goldfields and gypsum from the Yilgarn Goldfield and the State generally. Emeralds were obtained from the Murchison Goldfield. The low prices ruling for base metals made the production of lead and copper ores unprofitable.

TABLE 8.

Quantity of Coal raised during 1929 and 1930, and estimated Value thereof, with Number of Men employed, and Output per Man.

Coalfield.	Year.	Quantity raised.	Estimated Value.	Men employed.		Quantity raised.	
				Above ground.	Under-ground.	Per Man employed under-ground.	Per Man employed above and under ground.
		tons.	£			tons.	tons.
Collie	1929	544,719	426,706	209	649	839	635
	1930	501,425	394,758	210	686	731	560

The number of men employed at collieries increased by 38, but the output decreased by 43,294 tons, valued at £31,948, which is accounted for by the men not working full time; in some cases only three shifts per week have been worked owing to lack of orders for coal.

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

TABLE 9.

Total Number and Acreage of Leases and Prospecting Areas held for Mining on 31st December, 1929 and 1930

Description of Leases.	1929.		1930.	
	No.	Acreage.	No.	Acreage.
Gold mining leases on Crown land	391	6,179	373	6,118
" " " private property	1	6	2	36
Mineral leases on Crown land	263	47,269	243	46,849
" " " private property	6	202	5	102
Prospecting Areas	517	37,165	908	35,618
	1,178	90,821	1,531	88,723

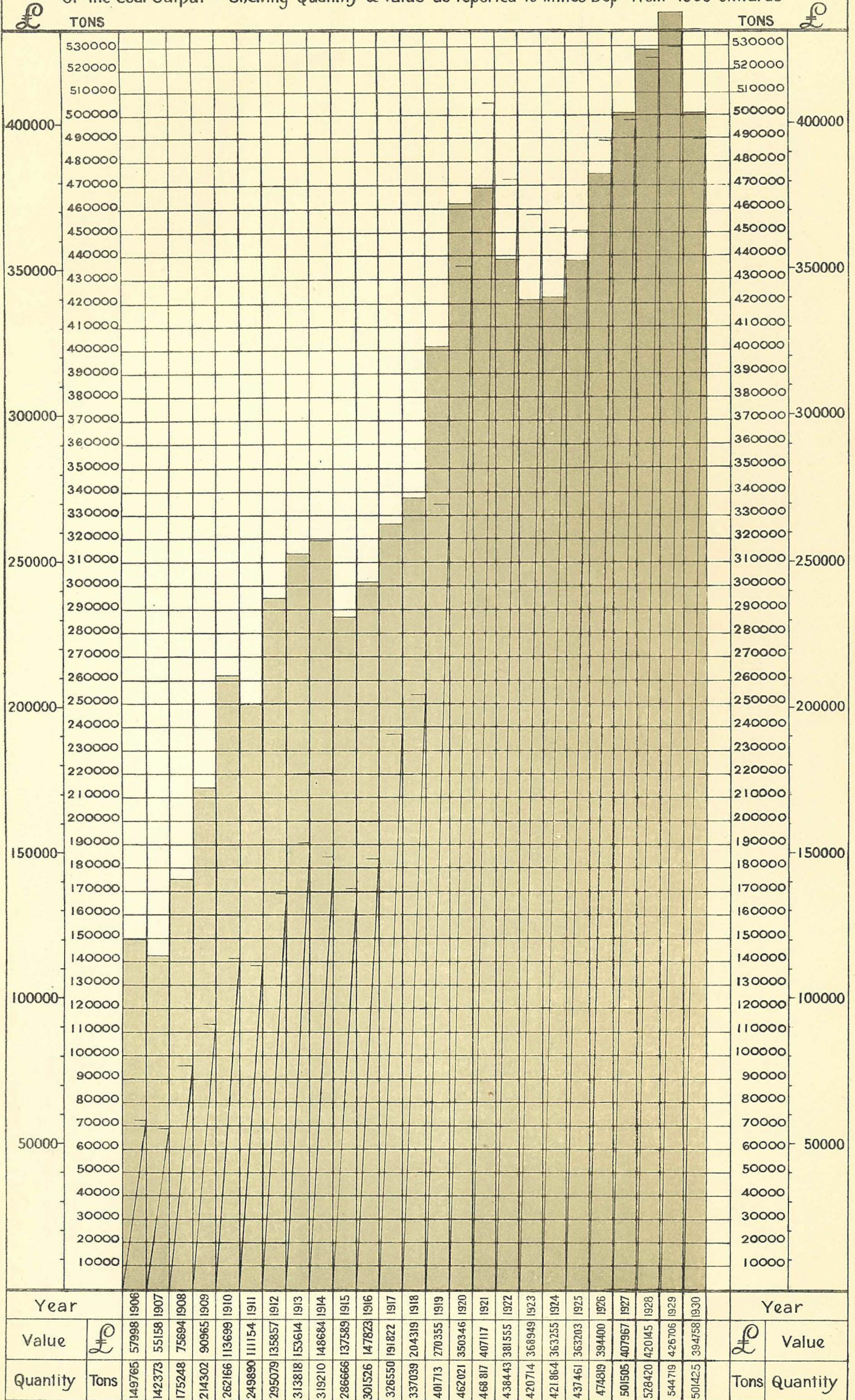
The total number of leases held for mining purposes decreased by 38 and the area by 551 acres, as compared with the year 1929. The number of leases for gold mining decreased by 17 and the area by 31 acres. The number of mineral leases decreased by 21 and the area by 520 acres.

For the year 1929 the number of prospecting areas held was 517, the total acreage being 37,165, which included 11 areas of 28,420 acres for coal.

For the year 1930 the number held was 908, of a total acreage of 35,618, including 9 areas of 19,440 acres for coal.

D I A G R A M

Of the Coal Output - Shewing Quantity & Value as reported to Mines Dept from 1906 onwards



PART IV.—MEN EMPLOYED.

TABLE 10,

Average number of Men engaged in Mining during 1929 and 1930.

Goldfield.	District.	Reef or Lode.		Alluvial.		Total.	
		1929.	1930.	1929.	1930.	1929.	1930.
1. Kimberley ...	...	...	...	4	4	4	4
2. Pilbara ...	Marble Bar ...	35	65	6	8	41	73
	Nullagine ...	20	4	3	4	23	8
3. West Pilbara ...	...	...	...	2	2	2	2
4. Ashburton ...	...	...	2	2	...	2	2
5. Gascoyne ...	...	...	...	2	2	2	2
6. Peak Hill ...	...	28	29	3	4	31	33
	Lawlers ...	15	19	6	4	21	23
7. East Murchison ...	Wiluna ...	305	485	...	...	305	485
	Black Range ...	60	59	...	...	60	59
	Cue ...	83	91	...	...	83	91
8. Murchison ...	Meekatharra ...	177	182	10	8	187	190
	Day Dawn ...	23	37	...	...	23	37
	Mt. Magnet ...	83	85	2	...	85	85
9. Yalgoo ...	...	79	103	...	...	79	103
	Mt. Morgans ...	31	30	...	...	31	30
10. Mt. Margaret ...	Mt. Malcolm ...	333	330	2	1	335	331
	Mt. Margaret ...	31	28	...	...	31	28
	Menzies ...	34	30	1	3	35	33
11. North Coolgardie ...	Ularring ...	17	16	1	1	18	17
	Niagara ...	6	16	...	...	6	16
	Yerilla ...	12	62	...	...	12	62
12. Broad Arrow ...	...	158	126	10	7	168	133
13. North-East Coolgardie ...	Kanowna ...	34	27	3	3	37	30
	Kurnalpi ...	16	16	1	1	17	17
14. East Coolgardie ...	East Coolgardie ...	2,012	1,996	36	39	2,048	2,035
	Bulong ...	22	27	2	3	24	30
	Coolgardie ...	121	123	10	73	131	196
15. Coolgardie ...	Kunaneling ...	27	30	...	1	27	31
16. Yilgarn ...	...	152	145	...	...	152	145
17. Dundas ...	...	65	59	...	...	65	59
18. Phillips River ...	...	19	10	...	...	19	10
State generally	...	4	2	...	...	4	2
Total—Gold Mining		4,002	4,284	106	168	4,108	4,452
MINERALS OTHER THAN GOLD.							
Tantalite ...	Marble Bar ...	16	6	...	...	16	6
	Greenbushes ...	32	12	...	...	32	12
Tin ...	Marble Bar ...	5	2	12	12	17	14
	Yilgarn ...	...	4	...	...	...	4
Copper ...	Phillips River ...	7	3	...	...	7	3
	Northampton ...	2	...	...	...	2	...
Coal ...	Collie ...	858	896	...	...	858	896
	Marble Bar ...	20	17	...	...	20	17
Asbestos ...	Nullagine ...	4	2	...	...	4	2
	West Pilbara ...	23	13	...	...	23	13
Gypsum ...	Yilgarn ...	10	4	...	...	10	4
	State Generally ...	17	10	...	...	17	10
Silver-Lead Ore ...	Marble Bar ...	3	...	...	...	3	...
Emeralds ...	Cue ...	14	9	...	...	14	9
Lead Ore ...	Northampton ...	28	...	...	...	28	...
Total—Other Minerals		1,039	978	12	12	1,051	990
GRAND TOTAL		5,041	5,262	118	180	5,159	5,442

PART V.—ACCIDENTS.

TABLE No. 11.

MEN EMPLOYED IN MINES KILLED AND INJURED IN MINING ACCIDENTS DURING
1929 AND 1930.

A.—According to Locality of Accident.

Goldfield.	Killed.		Injured.		Total Killed and Injured.	
	1929.	1930.	1929.	1930.	1929.	1930.
1. Kimberley ... ..	...	...	...	...	...	...
2. West Kimberley ... ..	...	...	...	...	...	...
3. Pilbara ... ..	...	...	...	...	...	...
4. West Pilbara ... ..	...	...	...	...	...	...
5. Ashburton ... ..	...	...	...	...	...	...
6. Gascoyne ... ..	...	...	...	...	...	...
7. Peak Hill ... ..	...	...	...	...	...	...
8. East Murchison	1	...	24	53	25	53
9. Murchison	2	...	22	19	24	19
10. Yalgoo ... ..	...	1	2	...	2	1
11. Mt. Margaret	1	3	26	27	27	30
12. North Coolgardie ... ..	...	...	2	2	2	2
13. N.E. Coolgardie ... ..	...	1	...	...	...	1
14. Broad Arrow ... ..	...	...	...	...	...	...
15. East Coolgardie	3	9	136	115	139	124
16. Coolgardie ... ..	...	...	...	1	...	1
17. Yilgarn ... ..	...	...	2	1	2	1
18. Dundas ... ..	...	...	...	...	...	...
19. Phillips River ... ..	...	...	...	...	...	...
MINING DISTRICTS—						
Northampton ... ..	...	...	1	...	1	...
Greenbushes ... ..	...	...	...	...	...	...
Collie	4	...	111	114	115	114
Swan ... ..	...	...	32	16	32	16
Total	11	14	358	348	369	362

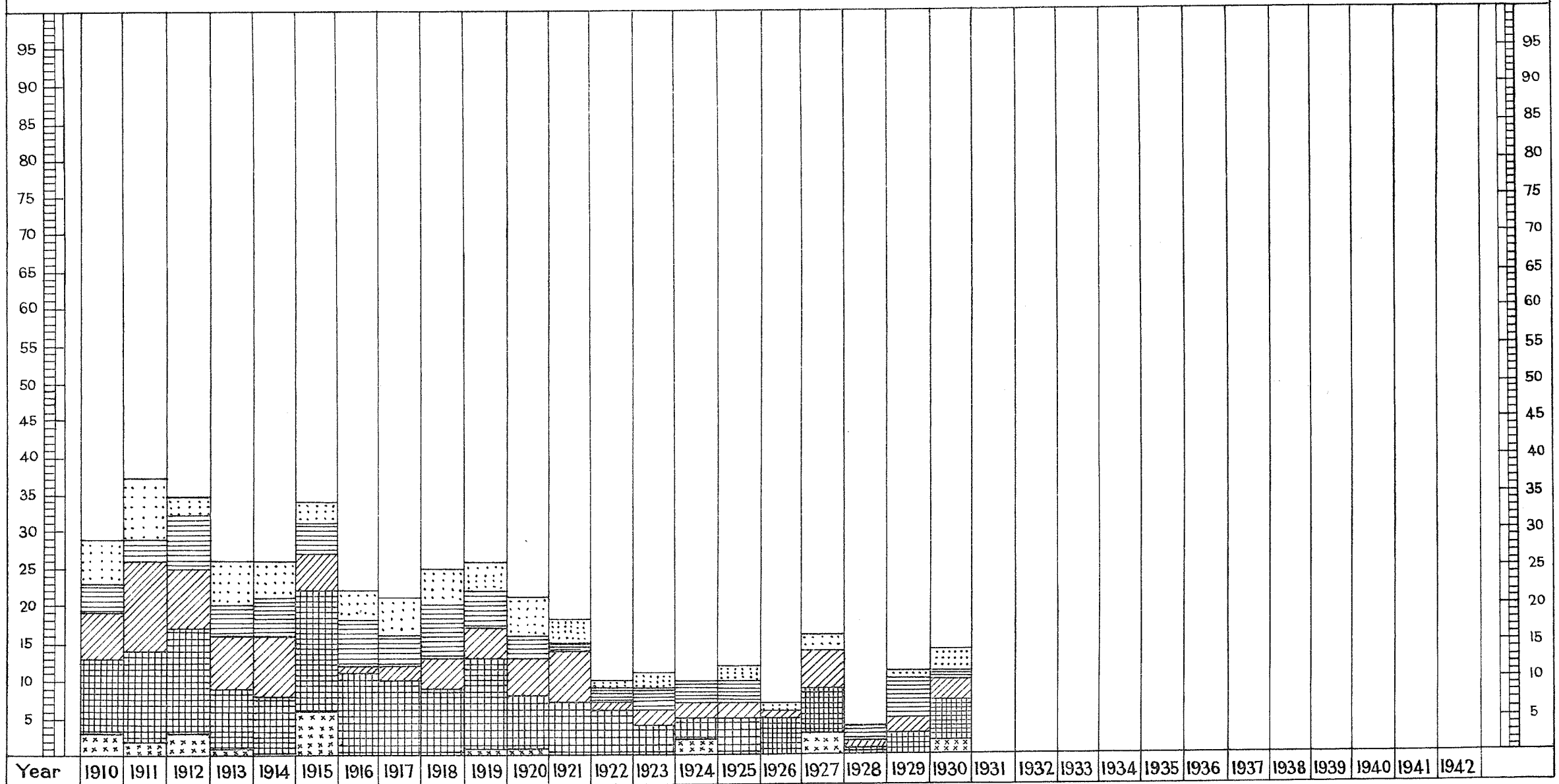
From the above table it will be seen that the total number of fatal accidents for the year 1930 was 14 as against 11 for 1929. The number injured shows a decrease of 10 as compared with the preceding year. In the report of the State Mining Engineer, published as Division II. of this Report, these accidents are classified according to the causes.

B.—According to Causes of Accidents.

	1929.		1930.		Comparison with 1929.	
	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.
1. Explosives ... ..	...	11	2	10	+ 2	— 1
2. Falls of Ground	3	23	5	36	+ 2	+ 13
3. In Shafts	2	14	3	4	+ 1	— 10
4. Miscellaneous Underground	5	195	1	172	— 4	— 23
5. Surface	1	115	3	126	+ 2	+ 11
Total	11	358	14	348	+ 3	— 10

Fourteen fatal accidents occurred in gold mines. The death rate per 1,000 men employed in gold mines was 3.29 as against 1.75 in 1929.

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



Explosions

Falls of Ground

In Shafts

Miscellaneous Underground

On Surface Including Machinery

PART VI.—STATE AID TO MINING.

STATE BATTERIES.

The number of State Batteries existing at the end of the year was 22.

From inception to the end of 1930, gold and tin to the value of £6,377,805 have been recovered from the State plants; 1,523,839 tons of auriferous ore have been treated and have produced £5,168,750 by amalgamation, £840,440 by cyanidation, £265,266 by slimes treatment, £9,353 worth from residues, and 81,726 tons of tin ore produced tin to the value of £93,423, and in addition a sum of £572 was recovered from residues.

During the year the gold ore treated was 29,285.5 tons for 20,708.3 ozs. of bullion by amalgamation, producing 17,432¼ tons of payable tailing yielding 5,509 ozs. and 7,186½ tons of unpayable tailing yielding 541 ozs., making a total of 53,904¼ tons for 26,759 ozs.

The working expenditure for all plants for the year totalled £30,558 11s. 8d. and the revenue £24,138 14s. 6d., which shows a loss of £6,419 17s. 2d. on the year's operations.

The Capital expenditure since the inception of the scheme has been £414,899 9s. 5d.; £322,918 7s. 9d. from General Loan Fund and £91,981 1s. 8d. from Consolidated Revenue. The cost of administration for the year was £2,109 5s. 8d. as against £2,564 4s. 1d. for 1929.

The working expenditure from inception to the end of the year exceeds the revenue by £184,570 4s. 3d.

GEOLOGICAL SURVEY.

The full reports on the work carried out during the year by the officers of this branch will be found in the following pages, under Division IV. of this report.

On reading the list of these reports it is pleasing to note that in addition to the usual mining reports considerably more attention has been given to fresh water supplies and agricultural problems as applied to geology.

On the Government Geologist's recommendation, the Pastoralists' Association has been officially notified that officers of the Survey will be available for investigating problems on water supply throughout

the State. As adequate water supply is such an important factor in the development of the State, it is to be trusted that advantage will be taken of the opportunity offered.

ASSISTANCE UNDER MINING DEVELOPMENT ACT, 1902.

The following statement shows the sums advanced during the year 1930 under the Mining Development Act:—

	£	s.	d.
Advanced in aid of mining work and equipment of mines with machinery	4,631	17	8
Subsidies on stone crushed for public	96	3	8
Providing means of transport and equipment to prospectors	7,562	2	2
	£12,290	3	6

In addition to the above, the Vote was charged with rebates on water as follows:—

	£	s.	d.
Southern Cross eastwards	27,819	0	10
Ingliston Consols	749	18	7
	£28,568	19	5

This arrangement dated from 1st July, 1923, Other assistance granted from the Vote during the year on various matters totalled £18,278 14s. 4d.

The subsidies paid on stone crushed for the public amounted to £96 3s. 8d., and are subsidies paid to owners of plants crushing for the public, the conditions being that they crush at fixed rates. The ore crushed during the year at these plants totalled 566½ tons.

The receipts under the Mining Development Act, exclusive of interest payments, amounted to £1,752 1s. 6d. and included—

	£	s.	d.
Refund of advances	822	8	9
Sale of securities	683	2	1
Miscellaneous refunds	246	10	8
	£1,752	1	6

PART VII.—INSPECTION OF MACHINERY.

The Chief Inspector of Machinery reports that the number of useful boilers registered at the end of the year totalled 3,627, as against 3,530, total for the preceding year, showing an increase, after all adjustments, of 97 boilers.

Of the total 3,627 useful boilers 2,000 were out of use at the end of the year; 1,588 thorough and 35 working inspections were made and 1,575 certificates were issued,

Permanent condemnations totalled 25, and temporary condemnations 42. There were no conversions, and 6 boilers were transferred beyond the jurisdiction of the Act.

The total number of machinery groups registered was 8,513, against 7,675 for previous year, showing an increase of 838.

Inspections made total 6,663, and 3,204 certificates were granted,

173 applications for engine-drivers' and boiler attendants' certificates were received and dealt with, and 148 certificates, all classes, were granted, as follows:—

Winding Competency (including certificates issued under Regulation 40 and Section 60)	2
First Class Competency (including certificates issued under Regulations 40 and 45 and Sections 60 and 63)	20
Second Class Competency (including certificates issued under Regulation 40 and Section 60)	10
Third Class Competency (including certificates issued under Regulation 45 and Section 63)	21
Locomotive Competency	4
Traction Competency	3

Internal Combustion Competency	..	..	23
Crane and Hoist Competency	..	..	2
Boiler Attendants Competency	..	..	54
Interim	..	..	3
Copies	..	..	5
Transfers	..	..	1
			—
			Total 148
			—

The total revenue from all sources during the year was £5,807 8s. 3d. as against £5,468 1s. 8d. for the previous year, showing an increase of £339 6s. 7d.

The total expenditure for the year was £5,541 1s. 3d. as against £5,341 7s. for the previous year, showing an increase of £199 14s. 3d.

PART VIII.—SCHOOL OF MINES.

There was an increase in the number of enrolments during this, the 27th year of the School's existence. In the preparatory classes the improved enrolments were very marked. In all classes the work was conducted in a capable manner and the grade of instruction maintained. The percentage of passes exceeded that of the previous year.

In the Metallurgical Laboratory the Metallurgist was very fully occupied on a variety of problems bearing on the treatment of ores, chiefly gold. The results of his work should be of considerable assistance to the industry.

The system of free assays for prospectors was continued, a total of 357 assays and mineral determinations having been made. This is an increase of nearly 60 per cent. on last year.

CONCLUSION.

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

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

I have, etc.,

M. J. CALANCHINI,
Under Secretary for Mines.

Department of Mines,
Perth, 31st March, 1931.

DIVISION II.

Report of the State Mining Engineer for the Year 1930.

Office of the State Mining Engineer,
Perth, 28th February, 1931.

The Under Secretary for Mines.

Sir,

I have the honour to submit, for the information of the Hon. the Minister for Mines, my report on the operations of this Branch of the Department for the year 1930.

STAFF.

Inspectors of Mines.—There was no alteration in the personnel of the inspectorial staff during the year. Mr. W. M. Deeble retired under the provisions of Public Service Regulation No. 44 on the 31st December, having reached the age limit. He served the Department in the capacity of inspector for thirty-one years, and during that long period worked in all the goldfield districts. At all times he displayed considerable ability and zeal, and was known throughout the goldfields for his well-directed activities and courtesy.

Workmen's Inspectors.—Mr. R. P. McMennemin was re-elected unopposed for the Cue District on the 6th June, and was re-appointed for a period of twelve months.

Mr. R. P. Hunt was elected for the Leonora district on the 1st March. Unfortunately he was compelled to retire during November for health reasons.

Mr. R. A. Jones, East Coolgardie district, was also compelled to retire during May for health reasons. He was first elected and appointed to the position in December, 1924, and rendered good and faithful service to the Department at all times.

Once again I desire to acknowledge the efficient and loyal services rendered by the members of my staff, and to express my appreciation of the valuable co-operation of the Government Geologist and the Government Mineralogist and Analyst and their staffs.

INSPECTION OF MINES.

The reports of the Assistant State Mining Engineer and Inspectors of Mines have been received as usual, but limitation of space this year prevents them being printed.

ACCIDENTS.

During 1930, 362 serious and fatal accidents were reported to this office, of which 348 were serious and 14 fatal. Serious and fatal accidents reported during 1929 were 369, of which 358 were serious and 11 were fatal. All accidents reported were closely investigated, particularly serious and fatal accidents.

Fatal Accidents.—Of the 14 fatal accidents 2 were due to explosions, 5 to falls of ground, 3 occurred in shafts, 1 was due to foul air in a winze and 3 resulted from machinery accidents on the surface.

Serious Accidents.—Any accident which causes an injured person to be absent from his work for 14 days is classed as serious. A large number of the serious accidents were of a minor nature, and a small percentage only were of a serious nature, such as breakage of bones, injuries to feet, hands or limbs, bodies or organs, which would cause lasting injuries.

Mining accidents for the year 1930 are classified in Table 11, and the previous year's figures being given for comparison, and is forwarded herewith for inclusion in your annual report, together with a diagram of the fatal accidents year by year and their causes. (See Division 1, Report of the Under Secretary for Mines.)

The following table gives the number of fatal accidents recorded during the last five years:—

	1926.	1927.	1928.	1929.	1930.
Fatal accidents to men engaged in mining	7	16	4	11	14
Total men engaged in mining (average)	5,437	5,036	4,853	5,159	4,284
Accident death rate per 1,000 men	1.29	3.18	.82	2.13	3.03

The following table shows all the fatal and serious accidents reported to this office during 1930, and are classified according to the gold or mineral field in which they occurred. The causes of accidents are also shown:—

	Explosives.		Falls of Ground.		In Shafts.		Miscellaneous Under-ground.		Surface.		Total.	
	Fatal.	Seri-ous.	Fatal.	Seri-ous.	Fatal.	Seri-ous.	Fatal.	Seri-ous.	Fatal.	Seri-ous.	Fatal.	Seri-ous.
1.—East Coolgardie	1	5	4	4	1	1	...	73	3	32	9	115
2.—Mt. Margaret	1	3	...	2	1	1	1	8	...	13	3	27
3.—Murchison	1	...	2	...	1	...	9	...	6	...	19
4.—East Murchison	1	...	1	...	10	...	41	...	53
5.—Coolgardie	1	...	...	...	...	...	...	...	1
6.—Yilgarn	1	...	...	...	...	...	...	...	1
7.—North Coolgardie	1	...	1	...	2
8.—North-East Coolgardie	1	...	...	...	...	...	...	...	1	...
9.—Broad Arrow
10.—Dundas
11.—Pilbara
12.—Peak Hill
13.—Yalgoo	1	...	...	...	...	...	1	...
14.—Phillips River
15.—Collie	25	...	...	...	71	...	18	...	114
16.—Greenbushes
17.—Northampton
18.—West Pilbara
19.—Swan	1	...	...	...	...	...	...	...	15	...	16
20.—Ashburton
Totals for 1930	2	10	5	36	3	4	1	172	3	126	14	348
Totals for 1929	11	3	23	2	14	5	195	1	115	11	358

ADMINISTRATION.

Amendments of Acts.—Amendment of Clause 4, Division 2 of Regulation 15, Mines Regulation Act, 1906, relating to Workmen's Inspectors of Mines. (Gazetted 29th August, 1930.)

Amendment of Regulations 6a, 6b, 6c, 6d, 6e, 6f, 6g, and 6h, Mines Regulation Act, 1906. (Gazetted 12th December, 1930.)

Prosecutions.—Three prosecutions for breaches of the Mines Regulation Act, 1906, were undertaken. A manager was prosecuted for failing to have a winding rope reshod in accordance with the provisions of Regulation 10, Clause 4. He was fined £20 and costs. Two men were prosecuted for driving underground hoists without holding the necessary certificates in accordance with the provisions of Section 31 of the Mines Regulation Act, 1906, and were fined £4 and £5 and costs. Other cases of alleged breaches of the Act were closely investigated, but the persons concerned were not prosecuted.

Exemptions.—Sixteen certificates were issued, in accordance with the provisions of Section 31 (4), during the year for exemptions from the provisions of Section 31, Subsection I (b) of the Mines Regulation Act, 1906.

Sunday Labour.—No permits were granted during the year for Sunday work.

LOANS AND SUBSIDIES.

Advances to aid developmental work and equipment of mines during 1930 amounted to £4,631 17s. 8d. Diamond drill boring was assisted to the extent of £3,990 4s. 11d.; providing transport and general assistance to prospectors through the Central Mining

Board cost £7,562 2s. 2d.; cartage subsidies paid to prospectors on ore treated at State Batteries amounted to £9,946 10s. 2d.; rebates on State Batteries crushing charges £1,396 12s. 4d.; free crushings at State Batteries £774 1s. 5d.; water supplies £608 12s. 6d.; subsidies paid towards the reduction in cost of water supplied to mines at Kalgoorlie and Meekatharra £28,568 19s. 5d.; subsidies paid to privately-owned batteries £96 3s. 8d.; and miscellaneous expenditure £1,562 13s. The total expenditure was £59,137 17s. 3d. (Appendix No. 1.)

ADVANCES ON ORES.

Eight parcels of asbestos were received, of which seven were forwarded to London; one parcel of 3 tons 15 cwt. 3 qrs. being retained at Fremantle, pending recovery of the London market. The tonnage forwarded to London was 36 tons 15 cwt. 3 qrs. 7 lbs., and advances made and charges paid amounted to £464 5s. 6d.

BORING.

The total amount of diamond-drill boring done during the year was 1,819 feet, as follows:—

	feet.
Mt. Magnet	669
Norseman	499
Riverina	651
	<hr/>
	1,819

During 1928 and 1929 the amount of boring done was 12,804 feet and 12,110 respectively.

Early in the year instructions were received to stop boring operations as soon as possible, on account of the difficulty experienced relative to finance,

The original programmes for Mt. Magnet and Riverina, two bores each, were fully completed, but the Norseman programme had to be stopped with the completion of the fourth bore; the fifth bore was not undertaken.

Mt. Magnet.—No. 2 Bore was drilled first and had reached a depth of 287 feet at 31st December, 1929. It was depressed at an angle of 65 degrees bearing 313 degrees, and was stopped at a depth of 481 feet on 30th January. The country penetrated was more or less schisted and mottled greenish rock throughout, of probably ultra basic origin, showing an admixture of chlorite and carbonate, the latter often forming bands. This bore passed through no less than six zones of a perfectly banded black and white jasper, carrying gold as follows:—

150ft. 6in. to 156ft. 3in.—Traces to 8 grains per ton.

191ft. 4in. to 197ft. 6in.—Traces to 26 grains per ton.

197ft. 6in. to 200ft. 6in.—11 dwts. per ton.

251ft. to 258ft.—Traces to 13 grains per ton.

263ft. to 307ft.—Traces to 2 dwts. 9 grains per ton.

341ft. 6in. to 352ft.—Traces.

450ft. 6in. to 454ft. 8in.—54 dwts. 8 grains per ton.

454ft. 8in. to 458ft. 7in.—3 dwts. 11 grains per ton.

458ft. 7in. to 466ft. 7in.—1 dwt. 15 grains to 13 grains per ton.

The high values between 450ft. 6in. and 454ft. 8in. are very well worth while being explored by mining developments.

No. 1 Bore was commenced on 7th February, depressed at an angle of 65 bearing 325 degrees. It was stopped on the 11th March at a depth of 475 feet. The rock throughout this bore varied from point to point, due to chemical and dynamic changes in the one rock formation, *i.e.*, a chlorite-carbonate rock analogous to that which formed the dominant rock in No. 2 Bore. The jasper lodes were not so frequent in this bore, the highest assay for gold being 6 dwts. 13 grains per ton between 194ft. 5in. and 196ft. 7in. Other gold values varied from traces to 21 grains per ton.

A plan of the Mt. Zion mine, showing position of the bores, appeared in last year's annual report. The total amount of boring done here was 956 feet.

Norseman.—No. 4 Bore (vertical). Continuing the report in the Annual Report for 1929, the bore was continued from 76 feet to a depth of 575 feet, in the hope of intersecting the downward continuation of the lode in the northern group of workings. It was stopped at 575 feet on 15th April.

The bore started in coarse-grained epidiorite and then passed through a great width of fine-grained epidiorite to 511 feet, where a schisted zone of hornblende-biotite came in and continued to 522 feet. From 522 feet to 575 feet the bore was in coarse-grained epidiorite. A large number of assays were made, including average samples of practically the whole of the core, but no gold was recorded in any of them.

The amount of boring done at Norseman during the year was 499 feet. The total boring done in this district was 2,118 feet. The plans relating to the work appeared in last year's annual report.

Riverina.—A report, accompanied by plans, showing the sites chosen for two bores at Riverina, appeared in last year's annual report. No. 1 Bore had reached a depth of 470 feet on 31st December, 1929, and was stopped at 596 feet on 1st February. It was depressed at an angle of 55 degrees, bearing 270 degrees, from a point about 30 feet east of the north-west boundary peg of Water Reserve 11194, in the hope of cutting the downward continuation of the lode at a vertical depth of 480 feet, or 200 feet below the present bottom workings (280 feet). The bore throughout its full length was in one rock formation, a reconstructed amphibolite, more or less coarse in grain, but of varying degrees of crystallinity. Three distinct zones of shearing and crushing, one being accompanied by a distinct quartz vein, were intersected as follows:—

462ft. to 469ft. 9in.—This zone contained a distinct siliceous pyritic lode formation from 465ft. to 469ft. 9in., assaying 24 dwts. fine gold per ton.

504ft. 9in. to 509ft. 10in.—This zone contained granulated biotite schist for 2 feet, followed by 3ft. 10in. of glassy quartz, slightly pyritic. Traces of gold were found in it.

583ft. 8in. to 588ft. 4in.—This zone consisted of distinctly biotised and schisted rock, but it did not carry gold values.

It is pleasing to note that the ore intersected between 465ft. and 469ft. 9in. carries payable values.

No. 2 Bore was commenced on the 17th February at a point 725 feet south 13 degrees east from No. 1 Bore. It was depressed at an angle of 55 degrees, bearing 270 degrees, and was stopped on the 9th May at a depth of 525 feet. The rocks intersected were decomposed amphibolite, reconstructed amphibolite, chlorite-carbonate actinolite schists and amphibolite. From 437ft. to 448ft. a white quartz reef was cut, but it did not carry gold values. In the shallow workings of the mine in this section the reef persisted along its strike, but gold values were exceedingly poor.

The boring done at Riverina during the year was 651 feet, and the total footage drilled in the two bores was 1,121 feet. Petrological reports of the cores from the above-mentioned bores will be found in the Geological Survey's section of this annual report.

MINING.

Kalgoorlie Mines.

The development programme mentioned in my report last year was prosecuted with vigour during 1930. The footage completed showed a substantial increase over the footage for 1929. The principal companies were responsible for the following work, *i.e.*, driving 12,177 feet, crosscutting 5,125 feet, winz-ing 4,198 feet, shaft sinking 423 feet, diamond drill boring 7,969 feet, total 29,892 feet.

It is pleasing and encouraging to note that important ore bodies have been opened up as a result

of the year's work. The matter of ventilation has been carefully watched during the year.

The wet treatment unit installed by the Lake View and Star, Ltd., which includes the use of the flotation process, has proved so successful in its operations that an announcement appeared in the Press recently to the effect that the company intended to add other units, having a total capacity of 30,000 tons a month, at an estimated cost of £300,000. It is most gratifying to know that, at long last, treatment of Kalgoolie ores is to be undertaken by modern processes, which will undoubtedly show a great saving in costs.

Wiluna Gold Mines, Ltd.

Since the Government railway between Meekatharra and Wiluna commenced running through to Wiluna at the beginning of the year, the machinery and material necessary for the construction of the 40,000 tons per month treatment plant has been delivered at the mine.

The work of construction has been undertaken in so thorough a manner, that it is expected the plant will be put into operation in March of this year, a most commendable effort. It will undoubtedly take some months for the plant to beat down to full capacity, but before the close of the current year the mine should be in full production.

During the year underground developments have been proceeded with in opening up the levels at 450 feet and 290 feet. The main shaft has been sunk to 800 feet, and as soon as circumstances permit levels will be opened up at 600 and 800 feet. Adequate supplies of ore have been developed for present requirements, and ventilation of the workings has been carefully handled.

Sons of Gwalia, Ltd.

Development.—During 1930 a vigorous programme of development work was continued throughout the year, and mine benefited very materially from the work. The Government assisted to the extent of £8,656 16s. 10d., which enabled the company to complete 602 feet of driving, 201 feet of cross-cutting, 293 feet of winzing, and 79 feet of rising, a total of 1,175 feet of development work. From its own financial resources the company did 1,896 feet of development work, the cost of which was charged against working expenses. The total amount of development work done in the mine was therefore 3,071 feet.

The mullock scheme was completed and stopes are being filled in the lower levels. As a direct result of the development done in recent years, the ore reserves have been materially increased and supplies for the mill are now being drawn from a greater number of stopes, with the result that better grade ore can be maintained. At the same time the ventilation of the mine has been greatly improved, thus providing good conditions for underground employees.

General.—116,390 tons of ore were milled during 1930 and 39,484 tons of old tailing were retreated. The loss recorded on the operations during 1929 was converted into a substantial profit during 1930, and enabled the company to make payments of interest on loans and loan repayments. The outlook for the future is decidedly promising.

VENTILATION.

Considerable attention has been given to ventilation of underground workings, particularly in the Sons of Gwalia, Ltd., Wiluna Gold Mines, Ingliston Consols Extended, and the large mines at Boulder. Dust surveys have been made by Inspectors of Mines, and the results show that the general air of the mines was satisfactory. In some cases, however, the atmosphere in development ends should be improved by a more intelligent use of blowers. When properly constructed, blowers will deliver adequate quantities of air with a consumption of approximately 30 cubic feet of compressed air, or about a quarter of the quantity required for the operation of a rock drill. If the air is delivered in front of the machine men they will be protected from the risk of getting dusted. Properly directed currents of air induced into development ends by efficiently constructed blowers will eliminate dust.

The efficiency of blowers for the removal of dust and the determination of best position for the exit have been tested by Inspectors of Mines. It has been found that with a well-constructed blower and pipes placed so as to deliver the air close to the working face, the dust-laden air is rapidly diluted and swept away. During these tests the Konimeter proved itself to be an efficient and satisfactory instrument for sampling dusty air. Inspectors of Mines insist that blowers shall be installed in such a manner that the air is delivered in front of the machine men. Our Inspectors do all the work and the department incurs the expense of making dust surveys. Our Inspectors do not always get requisite assistance from mine officials or employees in having their instructions carried out, and in some cases blowers have been poorly erected and little, if any, trouble has been taken to keep them in order.

Although I am pleased to be able to state that decided improvements have been made in these matters, I am convinced that the time has arrived when we must insist, by regulations, that mines shall be equipped with dust-sampling apparatus and have officers appointed in charge of ventilation. As far as I am aware, one mine only has dust-sampling equipment, and recently two companies have very wisely appointed officers to supervise ventilation. Each large mine should have a ventilation officer, whose work cannot be effective and complete unless he is equipped with dust-sampling apparatus.

The serious results of dust have made themselves manifest amongst underground workers, particularly in the big mines. In addition to the danger to the health of the men, there is also a serious financial aspect, which, however, must be regarded as insignificant compared with the health of the workers. There is no doubt that the ventilation of mines generally has been greatly improved in recent years, and with the full co-operation of all parties concerned, still further improvements can be made.

LEAD AZIDE DETONATORS.

Additional to the remarks contained in my report last year, replies were received from South Africa, India, Canada and New Zealand. Each reply indicated that Lead Azide Detonators had proved entirely satisfactory, and that no premature explosions had been recorded.

GENERAL.

The metal and mineral markets have been weak in most instances and prices too low to permit of much activity in mining operations in this State.

The premium paid on gold produced in this State, as a result of the exchange between England and Australia and the establishment of a Gold Bonus of 20s. per fine ounce on excess production, for a period of ten years, have given decided encouragement to the gold-mining industry. Circumstances have unfortunately compelled monetary assistance to the in-

dustry by the government to be drastically reduced. Nevertheless there are a greater number of men out prospecting than there have been for some years, and companies are showing an active interest in the gold-mining industry. The gold yield is increasing and it is certain that it will continue to do so.

I am, etc.,

A. M. HOWE,
State Mining Engineer.

APPENDIX No. 1.

Mining Development Expenditure.

	£	s.	d.		£	s.	d.
Advances outstanding 31st December, 1930—							
Advances authorised prior to 1930	232,958	7	6	Interest paid prior to 1930	17,156	12	3
Advances authorised during 1930 ..	5,037	2	0	Interest paid during 1930	1,560	12	2
Total authorised	£237,995	9	6		£18,717	4	5
Principal Moneys Advanced—				Interest outstanding at 31st December, 1929	19,122	13	4
Prior to 1930	206,410	16	1	Interest outstanding at 31st December, 1930	19,503	19	4
During 1930	4,631	17	8	Principal Moneys advanced	211,042	13	9
	£211,042	13	9	Less principal moneys re-			
Principal Moneys repaid (including sale of Securities)—				paid	£39,574	1	6
Prior to 1930	38,068	10	8	Less Bad Debts written			
During 1930	1,505	10	10	off	21,760	0	3
	£39,574	1	6		61,334	1	9
Bad Debts written back and amounts transferred—				Principal outstanding at 31st December, 1930	149,708	12	0
Prior to 1930	21,661	7	4	Interest outstanding at 31st December, 1930	19,503	19	4
During 1930	98	12	11		£169,212	11	4
	£21,760	0	3				

APPENDIX No. 2.

Department of Mines.

COAL MINES REGULATION ACT, 1902-1926.

Annual Report of the Board of Examiners for Mine Managers, Under-Managers, and Overmen.

Office of the State Mining Engineer,
Mines Department,
Perth, 10th February, 1931.

The Under Secretary for Mines, Perth.

Sir,

We submit herewith, for the information of the Hon. Minister for Mines, the Annual Report of the Board of Examiners for the year 1930.

Examinations for Certificates.

Examinations were advertised in the Press to be held in April and October, but as no candidates came forward, no examinations were held.

Meetings.

A meeting of the Board was held on the 23rd April, but it was not necessary to call the usual October meeting.

As no examinations were held during the year, there were no papers available for exchange with kindred Boards.

We have the honour, etc.,

A. M. HOWE,
State Mining Engineer, Chairman.

T. BLATCHFORD,
Government Geologist, Member.

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

D. Townsend,
Acting Secretary.

DIVISION III.

REPORT OF THE INSPECTOR OF STATE BATTERIES.

The Under Secretary for Mines.

Herewith my report for the information of the Hon. Minister on State Battery operations for the year ended December 31st, 1930.

The total tonnage handled in all operations was 49,778.75 tons, an increase of 17,635.25 tons on 1929.

Milling and tailing treatment costs showed a considerable deduction, and notwithstanding a decline in revenue of approximately 1s. per ton, the total loss on working fell from £9,215 15s. 3d. in 1929 to £6,419 17s. 2d. for the year under review.

Comparative Synopsis of Results at State Batteries for 12 Months ended 31st December, 1929 and 1930.

	1930.			1929.		
	Tonnage.	Expenditure.	Revenue.	Tonnage.	Expenditure.	Revenue.
Milling	29,285.75	15/3.41	9/2.58	20,236.5	19/8.23	10/1.41
Tailing Treatment	20,334	7/11.16	10/2.30	11,275	10/3.64	11/2.8
Tin Treatment	159	14/5.16	3/4.24	632	5/2.8	3/4.7

Receipts and Expenditure.

	Tonnage.	Expenditure.	Revenue.	Profit.	Loss.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Milling	29,285.75	22,380 10 9	13,748 12 0	...	8,631 18 9
Tailing Treatment	20,334	8,063 6 6	10,363 9 4	2,300 2 10	...
Tin Treatment	159	114 14 5	26 13 2	...	88 1 3
	49,778.75	30,558 11 8	24,138 14 6	2,300 2 10	8,720 0 0
			Less Profit ... ..	...	2,300 2 10
			Net Loss ... ..	...	£6,419 17 2

MILLING.

Two 10-stamp and fifteen 5-stamp mills crushed 29,285.75 tons of auriferous ore in 674 parcels for a yield of 20,708.4 ozs. of bullion by amalgamation. The gross yield from the ore, including tailing, was 23,604.54 fine ozs. or 16 dwts. 4 grs. per ton, the total value being £100,248 9s. 7d.

MILLING COSTS AND REVENUE.

As shown in the synopsis, the cost per ton was 15s. 3.41d., a decrease of 4s. 4.82d. per ton on the 1929 cost, and is the lowest since 1920 and would have been considerably better if our working vote had not had to bear the cost of putting Yarri and St. Ives into commission after being closed down for a considerable period, and the fact that no loan funds were available for reconstruction.

Receipts per ton, including refunds from Mines Development for all free crushings since July 1st, 1930, and all low grade rebates, dropped from 10s. 1.41d. in 1929 to 9s. 2.58d. and is due in a large extent to owners taking advantage of time crushing

at Ora Banda and Coolgardie where the milling revenue per ton fell to 7s. 0.38d. and 8s. 11.37d. respectively. Low grade rebates recouped from Mines Development amounted to £1,553 11s. 9d.

The total loss on milling was £8,631 18s. 9d., the lowest since 1917.

TAILING TREATMENT.

Eleven plants were in operation and treated 20,334 tons. Costs per ton dropped from 10s. 3.64d. in 1929 to 7s. 11.16d. and revenue unfortunately declined from 11s. 2.8d. to 10s. 2.30d. This decrease is due to the fall in value of the tailing treated and also to the slightly decreased extraction obtained owing to our having to treat during the winter months. This was necessary on account of our paying the ruling exchange premium on tailing and the uncertainty regarding its continuance. Cost of handling was also increased for the same reason.

Refractory Tailing.—Except at Marble Bar, practically the whole of the tailing produced is purchased at ordinary rates and owners almost demand payment on any class of material.

Profit.—The profit on tailing treatment was £2,300 2s. 10d. Very excellent treatment costs were obtained at Cue and Coolgardie, the first mentioned plant treating for 6s. 1.56d. per ton, a reflection of the large tonnage treated. Particulars are shown on Schedule 7.

TIN TREATMENT.

The drop in the price of tin was responsible for our Greenbushes plant being idle for practically the whole year, and notwithstanding the plant was available for small rounds only 159 loads were treated, at a cost of £114 14s. 5d. and revenue of £26 13s. 2d. The expenditure includes the cost of repairs as the result of damage by bush fire. This amount will be recouped during this year.

STAFF.

Manager T. E. Prosser was transferred from the North-West Circuit to Ora Banda, to which is attached Yarri, and our Erection Officer, Mr. D. A. Wilson, appointed Acting Manager at Jimble Bar after that plant had been erected.

The Department is to be congratulated on its Goldfields officers, who have coped with the increased work without fuss. The year's costs are a reflection of their work and their loyal support and co-operation have enabled Head Office to carry on at a minimum of expense.

I must pay a special tribute to the Engineer for State Batteries, who has carried on during my absence on the fields.

HEAD OFFICE ADMINISTRATION.

The total cost, including salaries, postage, etc., was £2,109 5s. 8d., equal to 10.17d. per ton, as against £2,564 4s. and 1s. 3.1d. in 1929.

ERECTION.

Jimble Bar, erected by this Branch for the State Mining Engineer and financed from his Vote, was completed and commenced crushing in November, after being taken over as a State Battery. Certain adjustments were incomplete at the end of the year, but the actual cost will not exceed £4,000, including cost of water supply and tailing plant.

This mill is effective, and, considering that it is approximately 300 miles from the railway at Meekatharra, I think the effort was a good one.

GENERAL REMARKS.

The year 1930 has seen a general all round increase in mining activity which is reflected in the tonnage sent to our mills. The first six months produced 10,813 tons and the second 18,472, an increase of 70 per cent. for the second half. At the end of the year our plants were treating at the rate of 50,000 tons per annum. The handling of this increase, with finance difficult and without increase in staff, resulted in added responsibilities on both goldfields officers and head office.

No alterations were made to wages, but there was a tendency for all services such as cartage of general supplies and for fuel supplies to cheapen.

The high tariff and other causes reduced merchants' stocks of imported necessities to a minimum and caused great inconvenience at times, but has resulted in a more general use of locally-made articles. State batteries now use 90 per cent. Western Australian shoes and dies. These are cast steel and are not made elsewhere. The experimental stage was costly, but we are now receiving the benefit of approximately 33½ per cent. in cost.

A general request for finer screening by owners was acceded to, and 900 mesh screening is now standard. Exhaustive tests resulted in the discovery by this office that imported screening was anything but standard and some very unsatisfactory in quality. Negotiations extending over some months with an Adelaide firm have resulted in practically all our supplies now being manufactured in that city to our specification as regards wire, size of aperture and gauge of wire. The results are excellent and the cost 50 per cent. below the imported screening.

Assistance granted through State Batteries.

	1930.			1929.		
	£	s.	d.	£	s.	d.
Loss on working ..	6,419	17	2	9,215	15	3
Recoup—Low Grade Re-						
bates	1,396	12	4	1,110	9	7
Recoup—Free Crush-						
ings	774	1	5			
Cartage Subsidies ..	9,946	10	2	6,952	8	0
Loan Expenditure ..				2,334	3	10
	<u>£18,537</u>	<u>1</u>	<u>1</u>	<u>£19,612</u>	<u>16</u>	<u>8</u>

D. F. BROWNE,
Inspector State Batteries.

22nd June, 1931.

SCHEDULE I.

Return showing the number of tons crushed, gold yield by Amalgamation, average per ton in shillings, and total value for the year 1930.

Battery.	Tons crushed.	Gold Yield Bullion.	Average per ton in shillings.	Total Value.
		Fine ozs.		£
Bamboo Creek	411	1,051·3	184·17	3,784·68
Boogardie	1,339·75	1,594·55	85·68	5,740·38
Coolgardie	7,173·75	5,362·45	53·44	19,306·62
Cue	5,012·25	3,132·00	45·00	11,285·20
Jimble Bar	607·00	309·10	36·66	1,112·76
Marble Bar	421·00	851·50	145·60	3,065·40
Meekatharra	2,292·25	2,111·75	66·36	7,602·30
Mt. Ida ... ..	...	...	...	...
Norseman	2,049·50	1,587·40	55·76	5,714·64
Ora Banda	4,401·50	1,792·50	29·32	6,453·36
Payne's Find	378·50	355·30	67·60	1,279·08
Peak Hill	1,444·50	442·80	22·10	1,594·08
Sandstone	259·00	489·90	136·18	1,763·64
St. Ives	523·50	192·95	26·52	694·62
Warriedar	1,483·50	492·20	23·90	1,771·92
Wiluna	597·50	201·25	24·30	724·50
Yarri	641·50	634·45	71·20	2,284·02
Youanmi	249·50	106·90	30·80	384·84
Total	29,285·50	20,708·30	50·80	74,562·04

SCHEDULE 2.

Tailing Treatment for 1930.

Battery.	Tonnage.	Yield.	Value.
		Fine ozs.	£
Bamboo Creek	540	152·48	647·39
Boogardie	686	336·39	1,428·68
Coolgardie	4,224	767·26	3,258·64
Cue	5,031	1,327·86	5,639·46
Meekatharra	1,138	164·82	700·00
Norseman	1,487	354·88	1,507·22
Ora Banda	1,836	434·81	1,846·68
Peak Hill	1,671	190·58	809·42
Sandstone	270	198·18	841·67
Warriedar	2,835	642·24	2,727·58
Wiluna	616	349·08	1,482·40
	20,334	4,918·53	20,889·14

SCHEDULE 3.

Return showing Number of Parcels treated and Tons crushed at State Batteries for Year 1930.

No. of Parcels Crushed.	Battery.	Tons.	Yield by Amalgamation. Bullion.			Yield by Amalgamation. Fine Gold.			Gross Contents of Tailings. Fine Gold.			Total Contents of Ore. Fine Gold.			Average per Ton. Fine Gold.		Gross Value of Ore.		
			ozs.	dwt.	grs.	ozs.	dwt.	grs.	ozs.	dwt.	grs.	ozs.	dwt.	grs.	dwt.	grs.	£	s.	d.
9	Bamboo Creek	411	1,051	6	0	891	2	20	175	6	23	1,066	9	19	51	21	11	0	5
47	Boogardie	1,339 ³ / ₄	1,594	11	0	1,351	12	15	434	18	18	1,786	11	9	26	15	5	13	2
227	Coolgardie	7,173 ³ / ₄	5,362	9	0	4,545	10	9	1,115	4	18	5,660	15	3	15	19	3	7	1
90	Cue	5,066 ³ / ₄	3,132	0	0	2,654	17	6	1,321	0	17	3,975	17	23	15	16	3	6	7
6	Jimble Bar	607	309	2	0	262	1	22	162	6	0	424	7	22	13	23	2	19	4
22	Marble Bar	421	851	10	0	721	15	14	64	0	20	785	16	10	37	7	7	18	6
50	Meekatharra	2,329 ¹ / ₂	2,111	15	0	1,790	0	19	500	13	0	2,290	13	19	19	16	4	3	7
36	Norseman	2,049 ¹ / ₂	1,587	8	0	1,345	11	10	408	4	3	1,753	15	13	17	2	3	12	7
66	Ora Banda	4,401 ¹ / ₂	1,792	12	0	1,519	9	22	751	9	13	2,270	19	11	10	7	2	3	9
6	Payne's Find	378 ¹ / ₂	355	6	0	301	3	11	22	11	15	323	15	2	17	2	3	12	7
18	Peak Hill	1,444 ¹ / ₂	442	16	0	375	6	20	154	2	5	529	9	1	7	8	1	11	2
10	Sandstone	259	489	18	0	415	5	8	108	19	3	524	4	11	40	11	8	11	11
10	St. Ives	523 ³ / ₄	192	19	0	163	11	3	84	13	17	248	4	20	9	11	2	0	2
45	Warriedar	1,483 ¹ / ₂	492	4	0	417	7	17	349	12	1	766	19	18	10	8	2	3	11
10	Wiluna	402 ¹ / ₂	201	5	0	170	11	20	178	3	6	348	15	2	17	7	3	13	6
15	Yarri	601 ¹ / ₂	634	9	0	537	15	22	186	0	13	723	16	11	24	1	5	2	2
7	Youanmi	249 ¹ / ₂	106	18	0	90	12	7	33	6	10	123	18	17	9	22	2	2	2
674		29,142 ¹ / ₂	20,708	8	0	17,553	17	5	6,050	13	14	23,604	10	19	16	4	3	8	0

SCHEDULE 4.

Direct Purchase of Tailings for Year 1930.

	Tons.	Amount.
Bamboo Creek	335 $\frac{1}{2}$	436 6 8
Boogardie	701 $\frac{1}{2}$	897 16 2
Coolgardie	3,363 $\frac{1}{2}$	1,731 16 8
Cue	3,269 $\frac{3}{4}$	2,229 8 5
Meekatharra	1,390 $\frac{1}{2}$	1,124 11 9
Norseman	1,274 $\frac{1}{2}$	565 16 1
Ora Banda	2,432 $\frac{1}{2}$	1,102 0 11
Peak Hill	536 $\frac{3}{4}$	303 10 8
Sandstone	323 $\frac{1}{2}$	604 8 1
St. Ives	239 $\frac{1}{4}$	82 11 5
Warriedar	1,088	692 5 5
Wiluna	301	438 4 2
Yarri	281	273 10 11
Youanmi	182 $\frac{1}{2}$	31 19 5
	15,714 $\frac{1}{2}$	10,514 6 9

SCHEDULE 5.

Return showing Tailings payable and unpayable and Gross Contents for Year, 1930.

Battery.	Tailings payable.		Tailings unpayable.		Totals.	
	Tons.	Gross Contents.	Tons.	Gross Contents.	Tons.	Gross Contents.
Bamboo Creek	336 $\frac{1}{2}$	ozs. dwts. grs. 173 15 11	13 $\frac{1}{2}$	ozs. dwts. grs. 1 11 12	349 $\frac{3}{4}$	ozs. dwt. grs. 175 6 23
Boogardie	1,046 $\frac{1}{2}$	429 15 6	71	5 3 12	1,117 $\frac{1}{2}$	434 18 18
Coolgardie	3,346 $\frac{1}{2}$	894 18 6	2,704	220 6 12	6,050 $\frac{1}{2}$	1,115 4 18
Cue	3,475 $\frac{3}{4}$	1,267 12 4	830	53 8 13	4,305 $\frac{3}{4}$	1,321 0 17
Jimble Bar	468 $\frac{1}{2}$	159 9 12	47 $\frac{1}{2}$	2 16 12	516	162 6 0
Marble Bar	262 $\frac{1}{2}$	57 10 17	95 $\frac{3}{4}$	6 10 3	358 $\frac{1}{4}$	64 0 20
Meekatharra	1,323 $\frac{1}{2}$	443 2 12	657 $\frac{1}{2}$	57 10 12	1,980 $\frac{3}{4}$	500 13 0
Norseman	1,517	389 19 13	222 $\frac{3}{4}$	18 4 14	1,739 $\frac{3}{4}$	408 4 3
Ora Banda	2,772 $\frac{3}{4}$	690 16 20	921 $\frac{1}{4}$	60 12 17	3,694	751 9 13
Payne's Find ... ..	...	...	275 $\frac{3}{4}$	22 11 15	275 $\frac{3}{4}$	22 11 15
Peak Hill	372 $\frac{3}{4}$	101 9 7	858 $\frac{3}{4}$	52 12 22	1,231 $\frac{1}{2}$	154 2 5
Sandstone	219 $\frac{3}{4}$	108 19 3	...	...	219 $\frac{3}{4}$	108 19 3
St. Ives	324	75 1 10	122	9 12 7	446	84 13 17
Warriedar	1,077 $\frac{1}{4}$	333 15 15	184 $\frac{1}{2}$	15 16 10	1,261 $\frac{3}{4}$	349 12 1
Wiluna	313 $\frac{1}{4}$	174 10 17	38 $\frac{1}{4}$	3 12 13	351 $\frac{1}{2}$	178 3 6
Yarri	393 $\frac{3}{4}$	178 4 0	116 $\frac{1}{2}$	7 16 13	510	186 0 13
Youanmi	182 $\frac{1}{2}$	30 6 4	28	3 0 6	210 $\frac{1}{2}$	33 6 10
	17,432 $\frac{1}{2}$	5,509 6 13	7,186 $\frac{1}{2}$	541 7 1	24,618 $\frac{3}{4}$	6,050 13 4

SCHEDULE 6.

Statement of Receipts and Expenditure for Year ended 31st December, 1930.

MILLING AND TIN

Plant.	Tonnage.	Management.	Wages.	Stores.	Total Working Expenditure.		Cost per ton.	Repairs and Renewals.	Sundries.	Gross Expenditure.	Cost per ton.	Receipts.	Receipts per ton.	Profit.	Loss.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.
Bamboo Creek	411-00	42 2 6	298 8 10	126 3 10	466 15 2	22 8-56	45 0 0	41 8 1	553 3 3	26 11-01	233 5 6	11 4-22	...	319 17 9	
Boogardie	1,339-75	151 12 1	424 10 10	338 9 8	914 18 7	13 7-89	43 2 9	105 4 8	1,063 6 0	15 10-47	639 8 10	9 6-54	...	423 17 2	
Coolgardie	7,173-75	359 14 7	1,602 11 3	1,377 5 6	3,339 11 4	9 3-47	266 0 6	498 6 5	4,103 18 3	11 5-29	3,209 13 10	8 11-37	...	894 4 5	
Cue	5,012-25	298 12 5	1,485 8 10	1,137 19 9	2,922 1 0	11 7-91	89 7 3	209 15 0	3,311 3 3	13 2-55	2,434 16 3	9 8-56	...	876 7 0	
Jimble Bar	607-00	79 1 7	267 0 0	51 6 1	397 7 8	13 1-12	2 0 0	...	419 0 5	13 9-67	440 1 6	14 6-00	21 1 1	...	
Leonora	...	...	...	...	...	...	...	5 0 0	8 13 9	...	0 14 0	...	0 14 0	...
Linden	...	...	...	3 13 9	...	...	...	...	...	...	...	...	31 13 10	...
Marble Bar	421-00	98 19 4	305 12 2	291 7 1	695 18 7	33 0-73	56 15 10	93 2 7	845 17 0	40 2-19	242 12 2	11 6-3	...	693 4 10	
Meekatharra	2,292-25	259 18 10	864 18 4	576 19 0	1,701 16 2	14 10-17	122 15 3	140 0 8	1,964 12 1	17 1-69	1,141 0 9	9 11-46	...	823 11 4	
Mt. Ida	...	...	104 5 3	...	104 5 3	...	...	...	104 5 3	...	...	...	...	104 5 3
Mulwarrie	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Norseman	2,049-50	204 3 1	765 1 11	455 9 11	1,424 14 11	13 10-84	146 8 2	124 1 2	1,695 4 3	16 6-54	1,003 15 4	9 9-54	...	691 8 11	
Ora Banda	4,401-50	341 16 11	1,176 10 7	565 4 3	2,083 11 9	9 5-61	308 1 0	261 3 5	2,652 16 2	12 0-64	1,547 12 5	7 0-38	...	1,105 3 9	
Payne's Find	378-50	35 12 2	143 17 0	145 3 10	324 13 0	17 2-00	17 8 0	30 15 0	372 16 0	19 8-38	195 5 4	10 3-81	...	177 10 8	
Pingin	...	...	...	...	...	...	...	...	...	...	20 0 0	...	20 0 0	...
Peak Hill	1,444-50	65 5 7	446 12 1	268 14 11	780 12 7	10 9-7	60 4 1	123 0 10	972 17 6	13 5-64	626 18 0	8 8-15	...	345 19 6	
Sandstone	259-00	81 6 0	179 6 6	73 16 9	334 9 3	25 9-92	39 12 3	63 2 8	437 4 2	33 9-14	154 16 3	11 11-46	...	282 7 11	
St. Ives	523-75	55 15 9	231 4 11	122 6 0	409 6 8	15 7-57	106 15 2	29 2 8	545 4 6	20 7-47	243 11 11	9 2-56	...	301 12 7	
Tuckanarra	...	...	...	...	...	...	...	...	...	...	2 2 0	...	2 2 0	...
Warriedar	1,483-50	117 8 1	510 17 9	328 7 10	956 13 8	12 10-77	62 6 11	106 9 9	1,125 10 4	15 2-0	821 10 7	11 0-9	...	303 19 9	
Wiluna	597-50	100 5 10	246 3 6	163 15 5	510 4 9	17 0-95	98 15 1	79 13 0	688 12 10	23 0-61	295 13 3	9 10-76	...	392 19 7	
Yarri	641-50	112 15 2	458 3 1	298 18 10	869 17 1	27 1-43	289 1 3	97 18 2	1,256 16 6	39 3-14	336 8 9	10 5-86	...	920 7 9	
Youanmi	249-50	40 7 8	86 16 7	69 0 8	196 4 11	15 8-77	28 1 0	35 3 4	259 9 3	20 9-54	118 17 9	9 5-88	...	140 11 6	
Greenbushes	29,285-75	2,444 17 7	9,597 15 5	6,394 3 1	18,436 16 1	12 7-09	1,790 14 6	2,153 0 2	22,880 10 9	15 3-41	13,748 12 0	9 2-58	75 10 11	8,707 9 8	
	159-00	11 7 6	33 16 11	3 3 0	48 7 5	6 1-01	56 4 1	10 2 11	114 14 5	14 5-16	26 13 2	3 4-24	...	88 1 3	
	29,444-75	2,456 5 1	9,631 12 4	6,397 6 1	18,485 3 6	...	1,846 18 7	2,163 3 1	22,495 5 2	...	13,775 5 2	...	75 10 11	8,795 10 11	

SCHEDULE 7.

Statement of Receipts and Expenditure for Year ended 31st December, 1930.

TAILING.

Plant.	Tonnage.	Management.	Wages.	Assays.	Stores.	Total Working Expenditure.		Cost per ton.	Repairs and Renewals.	Sundries.	Gross Expenditure.	Cost per ton.	Receipts.	Receipts per ton.	Profit.	Loss.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.	
Bamboo Creek	540	42 2 7	124 10 0	14 10 0	49 18 4	231 0 11	8 6-68	9 0 0	32 12 7	272 13 6	10 1-19	377 3 8	13 11-64	104 10 2	...	
Boogardie	636	45 0 0	145 19 2	17 6 11	91 16 6	300 2 7	8 9	28 0 8	67 18 7	396 1 10	11 6-57	527 7 3	15 4-5	181 5 5	...	
Coolgardie	4,224	116 6 1	888 12 8	36 19 7	233 11 9	1,280 10 1	6 0-75	45 8 8	185 2 5	1,511 1 2	7 1-85	1,880 4 3	8 10-83	369 3 1	...	
Cue	5,031	134 12 4	799 16 8	45 1 3	273 19 7	1,258 9 10	5 0-33	49 9 10	223 10 5	1,531 10 1	6 1-56	2,809 12 4	11 2-08	1,278 2 3	...	
Meekatharra	1,138	43 18 4	223 16 8	10 14 1	71 0 0	349 9 1	6 1-69	3 4 11	39 19 11	392 13 11	6 10-81	416 6 6	7 3-8	23 12 7	...	
Mulwarrie	...	...	...	...	...	...	...	...	...	...	...	10 0 0	...	10 0 0	...
Norseman	1,487	47 9 8	329 15 4	17 6 7	122 7 8	516 19 3	6 11-42	39 9 2	64 1 1	620 9 6	8 4-14	538 17 8	7 1-68	81 11 10	...	
Ora Banda	1,836	120 4 1	441 6 0	25 5 2	158 14 3	745 9 6	8 1-4	169 4 11	89 5 11	1,004 0 4	10 11-23	1,075 13 6	11 8-64	71 18 2	...	
Peak Hill	1,671	64 1 11	374 9 0	16 2 6	104 0 1	558 13 6	6 8-24	15 16 5	99 5 0	673 14 11	8 0-76	575 16 7	6 10-7	97 18 4	...	
Sandstone	270	18 8 0	61 5 0	14 16 1	23 2 8	117 11 9	8 8-15	...	29 15 10	147 7 7	10 11-44	392 9 3	29 0-85	245 1 8	...	
Warriedar	2,835	71 16 6	520 6 9	70 16 8	342 5 10	1,005 5 9	7 0-87	19 10 2	142 1 7	1,166 17 6	8 2-77	1,431 12 6	10 1-19	264 15 0	...	
Wiluna	616	45 14 5	153 9 4	13 7 5	64 3 5	276 14 7	8 11-82	7 12 0	62 9 7	346 16 2	11 3-12	328 0 10	10 0-78	...	18 15 4	
	20,334	749 13 11	4,063 6 7	282 6 3	1,545 0 1	6,640 6 10	6 6-36	386 16 9	1,036 2 11	8,063 6 6	7 11-16	10,363 9 4	10 2-3	2,498 8 4	198 5 6	

*Annual Progress Report of the Geological Survey of Western Australia
for the Year 1930.*

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DIVISION IV.

Annual Progress Report of the Geological Survey of Western Australia for the Year 1930.

The Under Secretary for Mines.

I have the honour to submit for the information of the Hon. the Minister for Mines my report on the work of the officers of the Geological Survey for the year 1930.

STAFF.

During the year there has been no alteration in the personnel of the field officers. Unfortunately owing to the cessation of State diamond drill boring on the goldfields, and a general decline in petrological work, owing to the limited field staff and general depression in mining, the necessity arose for at least temporarily retiring the Acting Petrologist and his assistant. The staff has consequently been reduced to two field officers, a clerk-in-charge and a messenger.

FIELD WORK.

Government Geologist.—In addition to the general office duties the following work was carried out:—

1. Early in March an inspection was made of the Sons of Gwalia mine with special reference to the occurrence of the lodes in the southern end of the lower levels of the mine.
2. From 29th March to 25th April, Professor Prescott was accompanied through the 3,500 Farm Scheme areas so that the geological conditions could be discussed with him in the field, in so far as they had a bearing on soils.
3. On 15th May I left Perth to join the Geological Conference in Brisbane, particularly to discuss generally a prospecting scheme which was to have been the subject for a special conference to have been held in Melbourne later on, but which was eventually indefinitely postponed. The date of my return was 18th June.
4. From 13th August to 4th October my time was taken up in watching the cementing off of the water in the oil well at Poole Range. During the period when the cement was setting the opportunity was taken in visiting several of the stations and discussing with the various managers their artesian water problems. It is a pleasure to be able to record the progress which has been made in boring for water during the past few years on many of the stations in the Fitzroy basin; and the almost universal success, which has been met with, in locating good supplies usually of comparatively shallow sub-artesian water, though occasionally there has been sufficient pressure to cause surface flows.
5. From 16th-27th October a second visit was made to the Sons of Gwalia mine to examine certain developments which had taken place during the year since my first inspection.
6. A short visit was made to the South-West Division, extending from 11th to the 19th December, to inspect the new settlements at Denmark and Nornalup with the object of determining whether there was any geological reason for the "Wasting Disease" in cattle, which has been causing much anxiety on many of the new farms. The report of this inspection is not yet complete.

F. R. Feldtmann.—Immediately following his return from annual leave for 1929, he was engaged in the preparation of various geological plans and sections in connection with his examination of the "X" and other lodes near the Perseverance-Great Boulder boundary.

The period between the 11th February and the 15th May Mr. Feldtmann spent at Kalgoorlie completing the fieldwork in connection with the detailed survey of the western portion of the Boulder Belt. This work included detailed examinations of the Enterprise and Chaffers underground workings as well as of portions of the Golden Horseshoe and Great Boulder mines, and surface traverses on the Enterprise, Great Boulder and Chaffers mines. In addition he examined the cores of a number of bores put out to explore the ground in the vicinity of the "X" and "B" lodes.

The greater part of the remaining portion of the year he spent in the preparation of the main maps embodying the results of the Kalgoorlie survey, longitudinal sections of the more important lodes, detailed geological plans of the levels of the various mines, a number of cross sections, and on other work connected with the Kalgoorlie survey.

During my absence from Perth from the 15th May to the 18th June and the 13th August to the 11th October and other shorter periods, Mr. Feldtmann was in charge of the office, and carried out the various duties consequent thereon.

F. G. Forman, B.Sc.—In January Mr. Forman was occupied in constructing an isometric plan and cross-sections of the Eradu Coal Seams and in making a peg model to illustrate the correlation of the coal prospecting bores in that district.

During the months from February to May he was at Kalgoorlie assisting Mr. Feldtmann with the Kalgoorlie survey.

Between the months of May and August a number of short field trips were made by him, including an inspection of the Gingin District for the Agricultural Department, an investigation into the water supply at the Point Walter Recreation Reserve, and inspections of the new gold find at Edjudina and of Stein Bros.' prospecting area at South Burracoppin.

On 13th August he accompanied me on my visit to the Freney Kimberley Oil Company's bore at Poole Range, and before his return to Perth, early in September, he made an investigation of the artesian water prospects on Kimberley Downs Station.

From 24th November to 19th December was taken up by field work in connection with the Alunite survey of the Lake Brown District.

The remainder of the year he was occupied in office work in connection with the Kalgoorlie survey and in assisting in the preparation for despatch of the Mineral and Gold Exhibit to the Imperial Institute Exhibition in London.

CLERICAL.

F. Armstrong, B.Sc.—During the year Miss Armstrong was engaged in the ordinary routine work of the office and of the library and attending to the constant inquiries of the public for published information relative to gold and other mineral occurrences in the State.

On the retrenchment of the Petrologist and his assistant she undertook to cut what rock sections were required, making preliminary petrological determinations of same, and has taken charge of the Geological Survey Rock and Mineral Collection. This entails the reconstruction of the existing card index system of the specimens, which is still in progress.

In addition to the above she has compiled maps and plans for reports where necessary.

PETROLOGY.

Before severing his connection with the Survey in August Dr. Larcombe examined the cores from bores on the following mines:—Lalla Rookh, Riverina, Mount Zion and Norseman. The full reports, together with the petrological determinations of the bore cores, except in such cases where the inspection was made purely for departmental reasons, will be found in the following pages.

In conclusion I wish to express my appreciation of the work and loyal support of the staff during the past year.

T. BLATCHFORD,
Government Geologist.

13th February, 1931.

1.—REPORT ON THE SONS OF GWALIA MINE.

(T. Blatchford, B.A.)

I herewith submit my report on the Sons of Gwalia mine, with special reference to the absence, between the 17th and 21st levels of the South Gwalia shoot and the occurrence of several masses of highly siliceous material—known locally as quartzites—which were found on the footwall of the Gwalia

shoot at the 22nd and 23rd levels and the hanging-wall of the West Branch of the Main Lode at the 23rd and 24th levels. Both of these were new features and were important in that they might have a permanent effect on the general trend, size, and value of what to those depths had proved most remarkably regular ore bodies.

Geology.

Two geological reports have already been written of the Leonora District—one in 1904 by C. F. V. Jackson, Assistant Geologist, the second in 1910 by Dr. Malcolm Maclaren.

Jackson's report, which has been published as Bulletin 13 of the Geological Survey, dealt more with the general geological features of the whole district, with short descriptions of the then existing mines, rather than a detailed description of any particular mine. Maclaren's, on the other hand, was a special report of the Sons of Gwalia Mine, on which he concentrated his attention. I am much indebted to the Management of the Sons of Gwalia Mine for the use of a copy of this report, which contains considerable detail, much of which is now unprocurable, at least so far as the mine was developed at that time—which was about the 15th level.

As the following report is for a specific purpose the geology of the district and the mine itself to the 17th level will be referred to in general terms, and only in so far as it has a direct bearing on the subject under consideration.

General Geology.

The geology of the district is fairly simple and may be summarised as follows:—

Omitting altogether the surface deposits, which are of such minor importance as to be negligible, the geology resolves itself into a consideration of the relationship, structure and composition of not more than three rock types. Of these the oldest are a group of aqueous sediments originally sandstones, grits and possibly interbedded tuffs and lavas, which have been subjected to such intense earth pressure as to have been completely changed in their nature, the forms now existing being various classes of schists of which mica schists are the most promising.

Bounding these schists both on the east and on the west flanks are massive granites. As neither of these rock types is auriferous further reference is unnecessary here.

After the schists, representing the old sediments, had been formed, or at least partly so, they were invaded by a long and comparatively narrow basic dyke which will be referred to in the following pages as the Gwalia dyke. This dyke is the important rock type, for it contains the payable lodes.

The Gwalia Dyke.

On the surface the dyke shows a width of some 4,000 feet and a thickness of 2,800 feet. It strikes north and south and can be traced for a considerable distance.

Owing to intense horizontal earth pressure coming most probably from the east and squeezing up against the western granites the original structure of the dyke has been lost. As it stands at present the dyke represents a highly schisted rock mass, and

though originally probably a diabase or dolerite, can better be classified now as an epidiorite or epidiorite schist, according to how far the rock has been rendered schistose. The planes of schistosity strike north and south and dip at an angle of 45 degrees to the east.

During the period of structural adjustment there was a considerable alteration of the mineral contents. Generally speaking the rock now consists of almost any combination, and in varying proportions, of the following rock-forming minerals:—

Hornblende, biotite, chlorite, quartz, calcite and secondary biotite.

Of these the first three are derivatives of or are original minerals; the latter three have been introduced subsequently. Biotite is also found filling minute fractures crossing the planes of schistosity, in which case it has evidently been introduced as a secondary mineral, probably under very deep-seated conditions.

Similar to many other basic intrusions, the composition of the Gwalia dyke is not regular, but has been influenced by differential magmatic segregation. This action probably accounts for the acid mica schists of the eastern section of the dyke as compared with the more basic biotite schists on the western side.

The small patches or lenses of less foliated epidiorite may also be accounted for by their particular composition, being more resistant to pressures than the rock surrounding them. Variations in composition, however, would not account for the schistosity in a regional section of the dyke with comparatively unshattered massive rock lying at each end.

Such a condition is much more likely to have been caused by sectional lateral pressure induced by block faulting. Referring to the important schisted block of the dyke which contains the Gwalia lodes, Maclaren writes as follows:—

Some clue to the direction and results of shearing forces is indeed obtained near the south end of the 7th Level (1,500 feet south), where nearly vertical east and west striking faults dipping north 70 degrees, divide the rock into altered narrow bands (30 to 40 feet wide) of massive and of sheared epidiorite, the east and west breaks showing considerable schistosity along their walls. The same phenomenon reproduced on a larger scale would give the Gwalia auriferous sheared area with massive rock both to the north and south of it. The sheared block dips with the country 45 degrees to the east and pitches a little 70 degrees from the strike line to the south.

The Highly Schisted Section of the Dyke containing the Payable Lodes.

In the higher levels Maclaren estimated the length of this zone at 2,800 feet with a width of 800 feet. In the lower levels it is not possible to ascertain either the width or the length until some further crosscutting or boring has been done. In the bottom levels, however, the existing workings prove that the schisted zone is at least 200 feet wide.

What has already been stated about the composition of the main dyke mass applies equally to the schisted portion. Of the numerous rock sections, specially selected from the 17 level to the 24 level during the present inspection, no microscopic evidence has been found to suggest the occurrence of any rock which would not be a derivative of the original dyke. There certainly have been variations

in texture and mineral arrangement, but even these are rare, the most noted examples being from the crosscuts at the 1,320 south 17 level and 1,800 south 25 level, where the rock mass more closely approaches an epidiorite than an epidiorite schist. In this respect particular attention was given to the rock forms in the vicinity of where the Gwalia South shoot should have occurred between the 17 and 21 levels. All the sections cut of the rocks collected from this area proved to be typical chlorite, biotite quartz calcite schists or modifications of the same, which disproves any suggestion that the Gwalia South Shoot has been cut off by a foreign intrusion between those levels.

Structural Features of the Schisted Zone.

In addition to the lateral pressure which converted the dyke into a schist there is distinct evidence of an earth movement, developed by regional pressure from the north-east along a diagonal course north-east south-west. The frequent and pronounced slickensided faces striking in that direction provide fairly definite evidence of this movement. Such a pressure would account for the slight buckling of the schist in the vicinity of the Middle Lode, the shear planes in which the Main and the Western Lodes are developed and the opening out of the foliation planes for the development of the various lenses of ore, comprising the South Gwalia series of lodes. The shear plane running parallel to and in the vicinity of the Middle Lode might also have been developed from the same cause and be due to slight overthrusting, though there is no evidence of any extensive movement. This shear plane was traced by Maclaren from the shaft at No. 2 level to 700 south at the 12 level. It can be traced right through to the bottom level.

Referring to this break he considers it to be the most conspicuous in the mine though dislocation was small, the most obvious result being the complete crushing of the adjacent rock necessitating close filling of the stopes and timbering of the levels in the neighbourhood. This crushing is not so pronounced in the lower levels but still persists in a lesser degree.

The other minor shear planes which cross the lode channel at a fairly high angle and dip either north or south have scarcely influenced the lodes, except in that the gold values have a decided increase in their vicinity. Sometimes the joint planes are found filled with calcite; at other times there is no apparent evidence of filling.

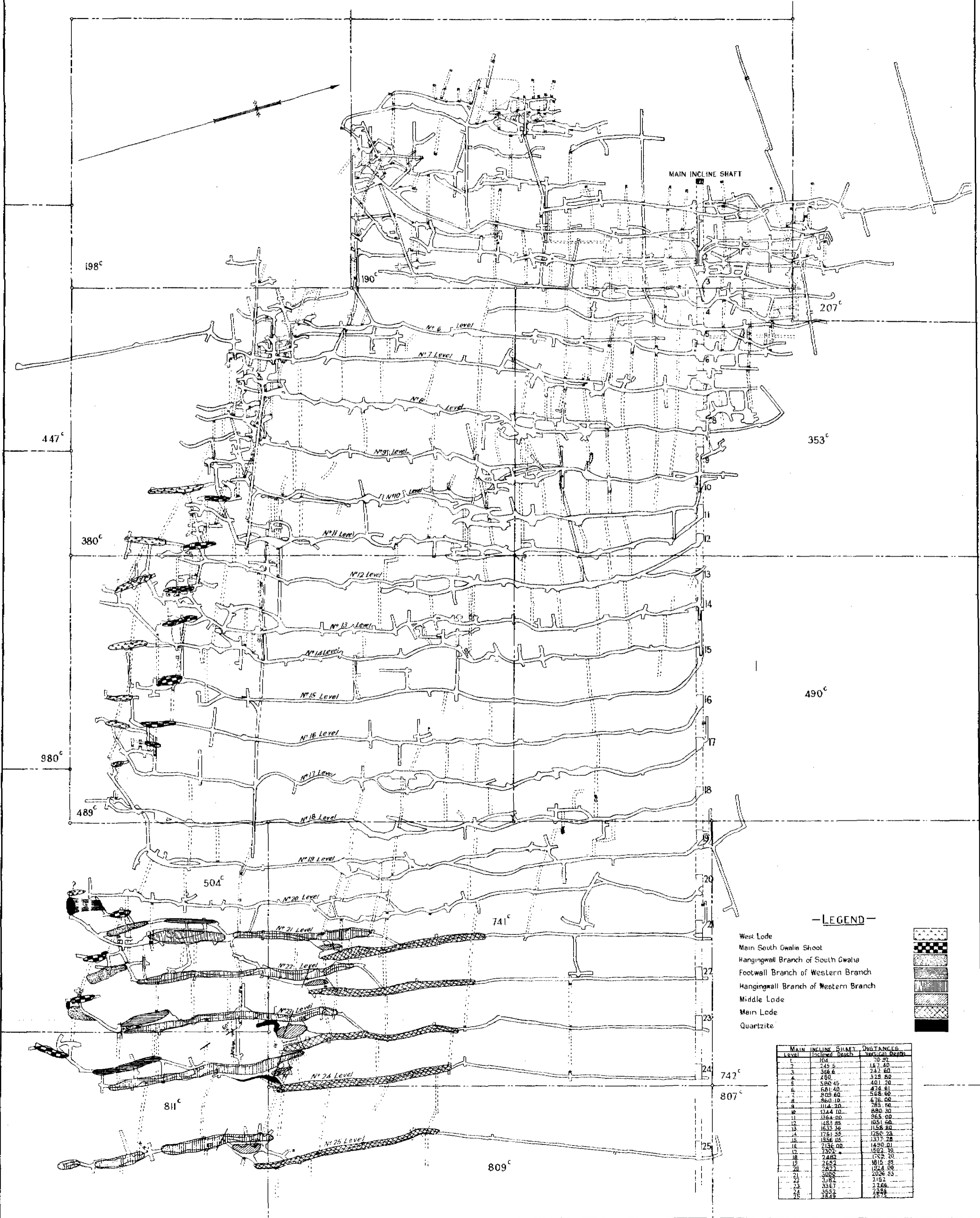
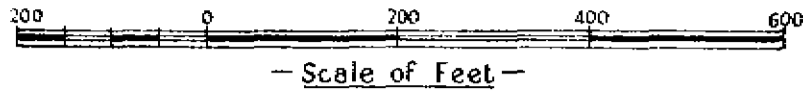
Lodes.

The auriferous deposits or lodes of the Gwalia Mine belong to a type formed by vein filling and replacement of the walls; the predominating minerals in the present case being quartz, sericite mica, calcite, and sulphides of iron. Zinc and lead sulphides also occur, but only in very small quantities. With the exception of the variation in the percentage of silica, the lodes possess the same characteristics throughout.

Where more replacement of the country rock has taken place the gold contents are usually greater, though in the upper levels there are large masses of almost barren quartz, particularly in the western series. The gold occurs in shoots which have a per-

PLAN OF SONS OF GWALIA MINE

TO ACCOMPANY REPORT ON THE BOTTOM LEVELS, PARTICULARLY AS REGARDS THE BLANK IN THE GWALIA SOUTH SHOOT BETWEEN THE 16 & 21 LEVELS & THE OCCURENCE OF BARREN QUARTZ (QUARTZITE) AT THE 23 & 24 LEVELS.



— LEGEND —

- West Lode
- Main South Gwalia Shoot
- Hangingwall Branch of South Gwalia
- Footwall Branch of Western Branch
- Hangingwall Branch of Western Branch
- Middle Lode
- Main Lode
- Quartzite

Level	Main Incline Shaft	Vertical Depth	Distances
1	104	70.97	167.40
2	148.5	247.60	247.60
3	358.6	329.80	329.80
4	480	401.20	401.20
5	569.45	474.61	474.61
6	621.40	568.60	568.60
7	809.60	676.00	676.00
8	860.10	785.50	785.50
9	1114.20	880.30	880.30
10	1244.10	965.00	965.00
11	1364.00	1051.50	1051.50
12	1483.85	1158.80	1158.80
13	1633.30	1266.23	1266.23
14	1781.55	1377.28	1377.28
15	1956.00	1490.00	1490.00
16	2136.00	1622.00	1622.00
17	2302	1782.30	1782.30
18	2482	1952.20	1952.20
19	2652	2153.50	2153.50
20	2822	2384.00	2384.00
21	3000	2636.53	2636.53
22	3182	2912.00	2912.00
23	3367	3216.00	3216.00
24	3557	3548.00	3548.00
25	3849	3909.00	3909.00

sistent pitch (in plan) to the east-south-east. These shoots are not cut off at the ends by joints or faults but gradually fade out at either end.

There are three distinct groups of ore bodies in the mine:—

- (a) The Main or Eastern Lodes.
- (b) The Western Lode.
- (c) The Gwalia South Series.

(a) *The Main or Eastern Lode.*

In the lower levels the Main Lode is the principal ore body and has a total length of about 1,100 feet. Locally for convenience sake it is divided into three sections known as the Main Lode, the Middle Lode, and the West Branch; the last being subdivided into a Footwall and a Hangingwall Branch when it divides into two at the southern end.

The Middle Lode lies between the southern end of the Main Lode and the northern end of the West Branch, sometimes forming a connection but usually dissociated. It is really a pipe of ore rather than a lode.

(b) *The Western Lode.*

The Western Lode has not been worked below the 18 level, where at least the known payable portion temporarily ceases to exist. Gold values found at the end of the crosscut 1880 south in the 21 level are in about the position where the West Lode should occur, but these have not yet been developed sufficiently to decide this point definitely. In the upper levels, until quite recently, the payable ore in the West Lode was confined mostly in the southern end, no ore being broken further north than 390 south. Recently careful prospecting has revealed payable ore at the second level extending much further north. This northern extension of the lode has been followed down to the 6 level and bids fair to yield quite an appreciable quantity of milling ore.

(c) *The South Gwalia Series.*

In the upper levels the South Gwalia Series is represented by several lenses of ore, of which the No. 2 is the most important. This shoot of ore, known as the Gwalia South Shoot No. 2, has continued from the surface nearly to the 17 level and then cut out, reoccurring at the 21 level, from which point it has since been opened up to the 24 level. A second lens—the South Gwalia No. 1—also came in at the 21 level, but so far has only been followed as far as the 23 level.

The South Gwalia Shoot for its length is a most remarkably persistent shoot of ore, when it is considered that except for the break between the 17 and 21 levels it has not only continued from the surface to the 24 level, a total distance of some 3,600 feet, but has also maintained persistently high gold values throughout that distance.

From where this shoot re-occurred at the 21 level it has pitched at a lower angle to the south, the exact significance of which is not yet known. This change in pitch corresponds with that of the main shear plane and the southern end of the Main Lode.

The pitch and break in the South Gwalia No. 2 Shoot can be followed on the plan, which has been hatched to emphasise these features.

A close investigation was made of the workings where the break occurred in the shoot and the rocks critically examined, both underground and microscopically. There is no evidence either of faulting or of subsequent rock intrusions, neither is there any evidence of a change in the mineral characteristics of the wall rocks. The most reasonable explanation for the break is that the shoot has simply ceased temporarily, owing the circulation of the mineralising waters being checked. In other words this section has probably not been subjected to the same crushing strains, which caused the rock to open out, as in the other portions of the southern end of the schisted zone.

Considered from a broad point of view, this is not extraordinary but rather what might be expected; and it is not the slight irregularity, but the regularity of this shoot, which is the most surprising feature.

It is a pleasing fact that the nature of the wall rocks between the 21 and 24 levels is similar in every respect to those in the upper levels, except that foliation and silicification are perhaps more intense. There is no apparent reason, therefore, for suggesting that the lodes will not continue in depth.

In addition to the regular lodes there are other siliceous bodies in the lower levels which are non-auriferous—locally these are known as “quartzites” to distinguish them from the quartz veins of the lodes proper. They have been noted as occurring in the following localities:—

No. 21 Level: Crosscuts 1970 south and 1760 south.

No. 22 Level: Footwall Gwalia South No. 2 1750 south.

No. 23 Level: Crosscut 1970 south; Hangingwall Main Lode 1270 south.

No. 24 Level: 1250-1370 Hangingwall Main Lode.

There is no doubt as to the origin of these siliceous bodies, for they are evidently vein fillings and replacements by silica, the latter being derived from circulating underground solutions. Underground, especially when found in close proximity to the ore channels, they present themselves as barren masses of practically pure silica—usually of a dull grey colour, without the ordinary quartz lustre.

As far as could be seen in the workings, particularly in the crosscut at the 21 level, there is no sharp line of demarcation between this massive quartz and the wall rock—the percentage of silica or degree of silicification varying in direct proportion with the distance from the ore channel. They are extremely hard to bore when compared with the adjoining schists or lodes.

Under the microscope the “quartzite,” even when massive and composed almost entirely of silica, still retains traces or streaks of the original chlorite schist, proving that it was formed subsequent to or possibly contemporaneously with the latter. Iron pyrites is not uncommon and occurs mostly in remnants of the chlorite. As a whole the “quartzites” are non-auriferous, the one exception being a rich pocket found at the 21 level in the 1970 crosscut.

Perfect slickensided faces are common, the prevailing strike of which is north-east south-west. These siliceous bodies also show marked signs of jointing and recementing with silica, though at times the joints have remained open. In the 1370 stope at the 24 level this is very noticeable—stoping having been made quite difficult owing to the fractured "quartzite" back.

The foregoing suggests several points of interest when considering the formation of these so-called "quartzites." The absence of gold even when in close proximity to the richer portions of the lodes certainly suggests that they were formed either before or after the latter. Persistent slickensided surfaces with a uniform strike of north-east south-west are positive evidence that earth movement along this line took place after their formation. It has been suggested that this earth movement was responsible for the opening out of the schists prior to mineralisation and formation of the ore bodies.

If such be the case then the "quartzites" were formed before the gold-bearing lodes, possibly during the period when the schists were being formed and when circulation of underground solutions was restricted. As they occur now, they may be best regarded as minor areas of silicified barren rock, apparently having no effect on the lodes and troublesome only when crossed in the workings, on account of their hardness.

Commenting in general terms on the bottom levels of the Gwalia Mine, the development of the past three years has been most encouraging both as regards ore reserves, values and geological conditions.

There is not the slightest doubt that the shearing of the Gwalia dyke is quite as intense, if not more so, in the bottom as in the levels higher up. The eastern ore bodies and the Gwalia South Shoot No. 2 have been almost ridiculously regular in their habit, and I can see no possible reason to suggest that they will not continue in the same way to greater depths. There is also quite a reasonable possibility that the shoot of ore of the western series, found at the second level in the northern end and proved to the 6 level, will continue to a much greater depth and provide a considerable amount of milling ore.

2.—INSPECTION OF GINGIN DISTRICT FOR THE DEPARTMENT OF AGRICULTURE.

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

Following a request from the Director of Agriculture I accompanied Dr. L. J. H. Teakle, Research Officer and Adviser in Plant Nutrition, and Mr. H. W. Bennetts, Veterinary Pathologist, to Gingin on the 14th June.

These two officers were engaged in the investigation of a disease affecting lambs, foals, and calves, and known as "Gingin Rickets." As it was suspected that the disease was limited to country occupied by outcrops of Cretaceous chalk and greensand,

I was requested to make an inspection of the affected country with the object of verifying or otherwise this point.

Gingin is a small farming town about fifty miles north of Perth, on the Midland Railway Company's line to Geraldton. It is situated on the banks of the Gingin Brook at the point where it emerges from the Darling Plateau on to the coastal plain.

The western edge of the granite and gneiss of the plateau lies some eight miles to the east of Gingin, and west of this no igneous rocks are exposed.

At Gingin the outcropping rocks are Cretaceous sediments consisting of an upper and lower greensand with an intervening chalk horizon, and basal shales. The Cretaceous sediments are exposed over an area from Poison Hill in the north to a little south of Moorgup Hill. They occupy the valley of Gingin Brook for about four miles above the railway station and to the east they disappear about three miles from the town. On the west there is a fairly sharp division between the Cretaceous rocks and the more recent sediments of the coastal plain on a line of a prominent scarp which probably marks a line of faulting.

To the north and east of Gingin the country is composed of a sandy plateau, its junction with the granite on the east being supposedly along the Darling Fault plane. Parts of this sandy plateau may be of Jurassic age, but there is no evidence of this in the immediate locality.

The junction of the sandy plateau and the coastal plain sediments is marked by the Poison Hill-Quinn's Pole scarp, which as already mentioned, probably marks a fault. Apart from the physiographic evidence of faulting supplied by the scarp, which is in a line with the main Darling Fault scarp further south, the presence of a line of mound springs lying roughly north and south a few miles out on the coastal plain would also suggest a dislocation of the strata somewhere in this locality.

The coastal plain is at the surface composed of recent sands with limestone patches, and is in places swampy.

The coastal hills of limestones and calcareous wind-blown sands occupy a strip of country from the coast to about eight to ten miles inland.

From information supplied by Mr. Bennetts it appears that the whole of the area occupied by outcropping Cretaceous rocks is liable to carry the disease. The disease is also apparent in those parts of the coastal plain adjacent to Gingin Brook, whose source is a few miles north of Gingin and which flows over Cretaceous sediments continuously until it emerges on to the coastal plain. Water shed from the granite country to the east, which would normally flow into Gingin Brook, is diverted to the south by the Brockman River.

Country adjacent to the Moore River, whose head waters are in the granite and gneiss of the Darling Plateau, is apparently unaffected.

At the junction of the Moore River and Gingin Brook there are two adjacent farms, the one watered by the Moore River being unaffected and the one watered by Gingin Brook being affected by the disease.

The coastal plain country north of Gingin Brook and known as the Beermullah plains is apparently sound. This country is watered by numerous swamps and lakes and by the Mungala Brook.

The only section of the area examined which is affected under all circumstances is that country close to Gingin occupied by Cretaceous outcrops.

On the coastal plain the disease appears to be governed by whether the country is watered by Gingin Brook or by the Moore River. The only apparent distinction between these two waters is their source. The Gingin Brook has its source in sediments and is entirely cut off from the granite, while the Moore River has its source in granite country and must receive a very large proportion of its water from granite areas.

Conclusion.—The disease is not confined to any particular geological type of country, but there is evidence that waters derived from country of different geological type may have some effect in the distribution of the disease. Analyses of water from various sources to test this conclusion is indicated.

3.—ARTESIAN WATER POSSIBILITIES ON KIMBERLEY DOWNS AND NAPIER DOWNS STATIONS, WEST KIMBERLEY.

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

Following your instructions I proceeded to Kimberley Downs Station on the 28th August and was engaged until the 2nd September, investigating the artesian water possibilities on Napier Downs and Kimberley Downs. During this visit I was able, through the courtesy of Mr. A. Thompson, manager of Kimberley Downs Station, to visit many of the outlying bores and wells on the two properties and to view the salient geological features of the district.

The area examined is shown on the Lands Department Litho. 134/300 and is bounded on the north-east by the Napier Range, on the south by the Derby-Hall's Creek Telegraph Line and on the west by the holdings of the Meda Pastoral Company.

The Lennard River, which forms the boundary between the Kimberley Downs and Napier Downs Stations, is flanked by red alluvial flats and black soil plains, carrying Rosewood, Boxwood and Bauhinia, with Bundle-Bundle, Flinders and Ribbon grasses. The remainder of the area is made up mostly of well grassed Pindan country carrying Beefwood, Bauhinia, Peach bush, small patches of dense wattle and small Boxwood flats. The grasses are mostly Ribbon grass and soft spinifex.

The rocks in this area consist of sandstones, grits and shales of Carboniferous age with regional dip of about 2deg.-3deg. S.S.W.

The sandstones with underlying shale beds are well exposed at Kimberley Downs homestead, where they outcrop forming a typical dip slope of which Mt. Marmion is an outlying remnant.

Scattered over the country are a number of small buttes of which Hawkstone Peak, Mt. North and Mt. Perry are typical examples. These hills are all composed of the same current bedded sandstones and

grits that are seen at Mt. Marmion, and are apparently remnants of an old tableland whose surface has since been denuded to the present configuration.

In the Napier Range, the lower Carboniferous limestones, which underlie the sandstone and shale series, outcrop and the strata here steepen and dip from 20deg.-25deg., but still in the same regional direction.

About two miles west of Napier Downs homestead a fossiliferous limestone outcrop was observed, with a dip of about 40deg. to the north-east. This unusual dip is probably caused by drag along a fault plane with a north-west-south-east strike, but may be evidence of normal reversal of dip due to local folding. Fossils, contained in specimens from this limestone, have been identified by Miss L. Hosking of the University of Western Australia, as possibly of Lower Carboniferous age.

The igneous and metamorphic rocks, which outcrop to the north and east of the Napier Range, require no mention here as they are not a potential source of artesian water.

The rocks of Carboniferous age, which occupy all the area under consideration, are lithologically and structurally well adapted for the storage of artesian or sub-artesian water. The sandstones and grits have the requisite porosity for the storage of water and the shale members of the series furnish efficient cover beds. The structure, which is that of a very gently dipping monocline, is an ideal one for an artesian basin, the low dips involved leading one to expect that supplies of water would be available by quite shallow boring.

During the wet season there is no lack of water, the chief difficulty being one of transportation owing to the wide spread flooding caused by the Lennard River and its tributaries. During the dry season, however, the rivers all cease running and there are very few reliable pools left at widely separated intervals in the river bed.

The water supply has been augmented to a certain extent by shallow sub-artesian bores and wells, while at the 67-mile peg of the Derby-Hall's Creek telegraph line there is a Government artesian bore, which is said to yield 142,000 gallons of water per day from a depth of 1,003 feet.

On Napier Downs station there are three sub-artesian bores; one, the Hawkstone bore, just west of Hawkstone Peak; a second, the Halfway bore, about halfway between Hawkstone Peak and Napier Downs homestead; and a third, the Travellers' Creek bore, on the road from Kimberley Downs to Napier Downs and about one and a half miles north of the Lennard River.

The three bores all yield good supplies of fresh water, the Hawkstone bore and the Travellers' Creek bore being fitted with pumps. A fourth bore has recently been put down at Napier Downs homestead. This bore was in shale and dense limestone and yielded no water, being sunk in an unfavourable location too close to the sedimentary outcrop.

Kimberley Downs station uses the water from the 67-mile artesian bore, but apart from this has no other bore waters developed. A number of shallow hand bores have, at different times, been sunk on this property in various places.

A hand bore three miles south of the homestead sunk to a depth of a little over a hundred feet, carried good fresh water but yields too small a supply to be of use for stock. Three wells, shown on the Lands litho. about nine miles south of the homestead, are said to have struck fresh water but seem not to have been developed. One of these is probably identical with the "Sisters Well" shown on the Kimberley Downs Pastoral Company's private map, the other two being apparently unknown to the present manager.

About two and a half miles east of the homestead on the south bank of a small creek, which parallels the sandstone scarp on which the homestead is built, a shallow hand bore has revealed fresh water but an insufficient supply. At a point about two and a half miles north of the 52-mile point on the telegraph line three shallow hand bores revealed the existence of small supplies of salt water.

Two wells, two and a half miles north and eight miles south-east, respectively, of Mt. North have been sunk and carry good supplies of fresh water. These wells have been improved by the erection of crude oil engines and pumping jacks. They are known as the Mungee Wheeler well and the Barnes' well.

Artesian or sub-artesian supplies of water should be available at moderate depth anywhere in the area examined which is, say, ten miles down dip from the outcrop of the sedimentary beds in the Napier Range. Closer to the Range than this there is risk of disappointment, as it is too close to the outcrop of the porous beds for the water to have developed any hydrostatic head.

Within this ten-mile strip close to the Range much perhaps could be done by sinking shallow wells and obtaining the necessary quantity of water to keep a pump running by putting in drives at the bottom. The presence of fresh water at shallow depth in widely separated localities, such as the Halfway Bore and Mungee Wheeler and Barnes' Wells, suggests that good wells could be obtained almost anywhere within this strip of country. Before sinking wells the sites should first be tested by hand boring.

The experience of the Meda Pastoral Company, who have in one bore passed through 1,100 feet of shale carrying intensely saline water, and who have met with shale continuously in other bores put down, indicates that there is a thick shale horizon within this area.

The bore now being put down by the Kimberley Downs Pastoral Company at the Telephone Dam is apparently close to the northern edge of this shale member of the series. A shallow hand bore put down about two miles to the north was almost wholly in sandstone, with only a few thin shale bands. The Telephone Dam bore started in shale and has continued with little change to its present depth of 800 feet. Taking into consideration the low dips observable at Mt. Marmion and the fact that the base of this shale must be somewhere south of the hand bore two miles to the north of the Telephone Dam, this bore should now be very nearly through the shale and should then pass into the sandstones met with in the hand bore further north, from which a good supply of water is to be expected.

Assuming a 4deg. dip for this shale bed and that the outcrop is two miles to the north of the bore site, the bore should have passed into a water-bearing sand at approximately 740 feet.* The results of boring up to date have not borne out this theory, and the only reason which can be advanced for this failure is that sub-surface dips in the vicinity of the bore are steeper than those observable at Mt. Marmion.

If boring operations in this area are considered in the future it would be well to locate any bore site to the north of the shale horizon and thus avoid the cost of penetrating it; the water in the shale itself being too saline for watering stock.

4.—THE UNDERGROUND WATER SUPPLY AT POINT WALTER RECREATION RESERVE.

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

Following a request from the chairman State Gardens Board, I was instructed to investigate the water supply possibilities at the Point Walter Recreation Reserve.

The Point Walter reserve is situated on the south side of the Swan River facing Freshwater Bay, and distant from Perth and Fremantle about eleven miles and three miles by road respectively.

Like most of the metropolitan area, the rocks in this locality consist of limestones and calcareous sandstones, overlain by drift sand. False bedding of the sandstone is common and at several horizons sub-recent fossil shells occur. The sandstones and limestones are in places cavernous, as evidence the number of small caves situated close to the water level and opening out in the cliffs which face Blackwall Reach on the western side of the reserve.

How far these caves extend is not known, as the openings are usually too small to be accessible, and even where they are accessible the caves soon become too narrow and too low for further travel. That these caves are undoubtedly water channels is evidenced by deposits of brown clay on the floors on which the marks caused by running water are plainly seen. They probably carry streams in wet weather. Along Blackwall Reach there are numerous fresh water springs issuing from the cliffs at or just below high water mark.

Two wells have been sunk on the reserve. One of these is situated near the foreshore on the northern side of the reserve close to the jetty. No reliable information relative to the quality of the water from this source is obtainable, as the well is now inaccessible; the brick lining having been removed and the well filled in. It is said that the water was unusable owing to a high salt content.

The second well is situated on the top of a hill near the centre of the reserve. The water level in this well is 92 feet below the collar of the shaft, and at the time of my inspection there was about three feet of water standing in the bottom. From the irregular shape of the bottom it is suspected that the well was at one time deeper, and that it has been partly filled in.

* Since writing this report water was actually struck at 868ft. and rose to within 23ft. of surface.

A sample of the water from the well, on analysis by the Government Mineralogist and Analyst, gave the following result:—

Total soluble salts	192.4 grains per gal.
Sodium chloride (calculated from chlorine)	154.7 grains per gal.
Magnesium	5.3 grains per gal.
Reaction pH 7.5 neutral.	

A comment at the end of the Analyst's report states that this water is too saline for irrigating any crops other than those highly resistant to salt.

With a view to obtaining further information on the quality of the underground water in this locality two further water samples were taken and sent for analysis.

The first of these samples was taken from a dis-used well 59 feet deep, situated on private property at the corner of Stock Road and Matheson Road, just outside the eastern boundary of the reserve. The result of the analysis is as follows:—

Total soluble salts	41.3 grains per gal.
Sodium chloride	23.8 grains per gal.
Reaction pH 7.7.	

The Analyst states that this water is of good quality for irrigating lawns or gardens.

The second of these samples was obtained from a well 23 feet deep on Mr. R. H. Mackenzie's property in Kent Street, just outside the southern boundary of the reserve and about three chains from the foreshore of Blackwall Reach. The result of the analysis of this sample is as follows:—

Total soluble salts	58.8 grains per gal.
Sodium chloride	34.3 grains per gal.
Reaction pH 7.3.	

The Analyst states that this water is of good quality for irrigating lawns or gardens.

The water level in this well is influenced by tides, but the quality of the water is said not to suffer. Mr. Mackenzie uses this water for irrigation and prefers it for this purpose to the scheme water.

It is the experience of residents in this locality and of other places adjacent to the foreshores of the lower reaches of the Swan River that fresh water may be obtained by sinking almost anywhere above high water mark, and also that great care must be exercised not to sink too far below the water table as brackish water, probably a soakage from the river, will nearly always then be obtained.

The salinity of the water in the deep well on Point Walter Reserve is certainly too high for irrigation, but whether this was so when water was first struck is not known. It may be that the present salinity is due to the well having been made too deep, thus allowing underlying brackish water access to the well.

The wells from which the second and third samples were taken have only about a foot to eighteen inches of water in them and the supply is consequently small, but in each case the well sinker has avoided the lower saline level.

The usual practice, when an increased supply is required, is to obtain it by putting in drives of the

requisite length and being careful that only the top foot or eighteen inches of the water-bearing stratum is drawn on.

Recommendations.—It is not advisable to seek a supply of fresh water by deepening the existing well. Such a course would involve shutting off the brackish water at present in the well, and owing to the very porous nature of the rocks this would be difficult. Also, the well might have to be deepened considerably before a suitable sub-artesian supply could be obtained.

It is suggested that an attempt be made to improve the supply by crosscutting eastwards, say ten feet, from the cuddy which has already been excavated at the bottom of the well; using the spoil to fill up the old sump. The quality of the water should then be tested by a hand bore at the inner end of the crosscut, and in the event of the water being suitable for irrigation, the supply could be obtained by driving at the water level from this crosscut, care being taken that the water bearing beds be not disturbed for more than a foot or eighteen inches below the water level. This method would make use of the existing shaft and would only involve the expense of, say, 30 feet of crosscutting and driving. It is probable that no timbering would be required, as the bottom of the well is in solid sandstone and self-supporting. The necessary crosscut would be utilised as a pump chamber. The length of drive to be excavated would depend on the supply of water required, but probably would not be more than twenty feet.

The alternative to repairing the existing well is to sink a new shaft in a different locality. A suitable site for a new shaft would appear to be in a small gully crossed by the tram line and west of the present deep well. The water should be obtained here at a depth of approximately 50 feet. From this site approximately 600 feet of piping would be required to convey the water to the existing tennis courts and gardens. At this site, owing to the cavernous nature of the sandstones along the foreshore, there may be some risk of pollution by river water conveyed to the well through open channels; but judging from the number of fresh water springs flowing from the foot of the cliffs and from the experience of well owners to the south of the reserve, this would seem not to be great.

An alternative site for a well is near the crest of the hill on the reserve. This being close to well No. 2 where the water yielded an excellent analysis, would very probably give a good quality water. A shaft at this point would need to be approximately 75 feet deep to strike the water, and approximately 1,320 feet of piping would be required to convey the water to the tennis courts.

If a well was sunk at either of the two suggested sites, the precautions mentioned above should be followed carefully, viz., the depth of the water in the well should not exceed 18 inches and that an increased supply should be obtained by driving and not by sinking. Also, before sinking any shaft, the site decided on should be tested by hand-boring, which would be inexpensive and would give proof of the quality of water before the expense of shaft sinking is incurred.

5.—NOTES ON THE GEOLOGY OF THOMPSON'S FIND, EDJUDINA.

By F. G. FORMAN, B.Sc.

Thompson's Find is situated on the west shore of an arm of Lake Raeside, distant $6\frac{1}{2}$ miles south-east of Mining Lease No. 872E, Edjudina.

General Geology.—The country rock in the vicinity of the discovery consists of chloritic schists (greenstone schist) which can be traced without a break from the mining area of Edjudina, where they have been described by Gibb Maitland.*

These greenstone schists are traversed by a series of narrow but remarkably persistent bands of haematite jasper. Jasper Range with One Tree Hill at its southern end, running parallel to the shore of Lake Raeside and about a mile to the west, owes its existence to the resistance to denudation offered by a number of these closely parallel jasper bars, which may be observed running in a long unbroken line right along the range.

There are also a number of quartz blows or reefs of varying width occurring along the planes of foliation of the schists, and in the low lying country about the shores of the lake these blows form in places bold precipitous ridges running out as spurs into the otherwise flat bed of the lake.

It is one of these quartz reefs lying in the lake close to the western shore which has been found to be auriferous. Running parallel to this reef and about 200 feet west of it there is a dyke of very fine grained granitic rock standing out boldly above the floor of the lake and forming at this point its western shore. Although the country was carefully examined for at least a mile on either side of this granitic dyke no other occurrence of a similar nature could be seen.

The Greenstone Schists.—These rocks are intensely sheared and contain a high percentage of chlorite. They are similar in all respects to the greenstone schists of the Edjudina line of country and in fact appear to be the easterly extension of these rocks. The planes of schistosity of the greenstones have a general strike of about 35deg. west of north, magnetic.

The Haematite Jaspers.—These are of varying composition, ranging from almost pure silica to rocks which appear to contain a high percentage of haematite. None of the jaspers are more than three or four feet wide, but all are remarkable for their continuity and persistence of strike, which appears to be parallel to the foliation of the schists.

The Quartz Blows or Reefs.—The quartz reefs appear to be lenticular in shape, and as previously mentioned occur along the planes of foliation of the schists. In some places the quartz appears almost pure and quite massive, while in others it contains a large amount of iron and shows traces of foliation. Several places were noted where the planes of foliation of the quartz were covered with chlorite, while in others, masses of unaltered chloritic schist were seen to be included in the quartz. To my mind this would indicate the origin of the quartz reefs as replacements of the greenstone schists, the traces of

foliation and the occasional occurrence of schist included in the quartz being remnants of the former condition of the rock.

At the time of writing only the quartz reef in which the discovery was made has been proved auriferous. This reef can be traced along its strike for at least three hundred yards, and varies in width from about eighteen inches at its southern end to about ten feet at its central portion, where the reef is made up of at least three separate parallel lenses.

Some of the gold is associated with the ferruginous areas in the quartz, but it also occurs in the solid quartz, and in three places pieces as large as wheat grains were seen lying apparently in foliation planes.

The Granitic Rock.—This is a very fine-grained rock and is known locally as "quartz porphyry." On examination under a hand lens the rock is seen to be holocrystalline and to consist of quartz, feldspar, and muscovite. In the absence of facilities for making a microscopic examination of the rock it is difficult to give an exact name, but I would point out the absence of a porphyritic structure.†

Conclusion.—The present examination shows this area to be geologically an extension eastwards of the Edjudina line of country.

There seems to be no doubt that the gold in the discovery reef is genetically related to the adjacent granitic dyke, as the relationship between acid intrusives and the occurrence of gold is such a marked feature of so many of our goldfields. For this reason also the auriferous belt will probably be confined to a narrow strip in the proximity of the granitic dyke and extension of the auriferous belt east and west is rather to be doubted.

Sufficient work has not been done on the discovery reef from which definite ideas on the vertical shape of the reef can be formed, but from the otherwise marked similarity between this and the Edjudina area, where the reefs occur characteristically as lenses or bulges of no great vertical depth, it might be inferred that similar conditions will be found in this case.

As the discovery reef occurs within the bed of a salt lake where the water table is normally at, or very close to the surface of the ground, it is likely that mining operations beneath the surface will meet with a difficult water problem.

PETROLOGICAL REPORTS.

(C. O. G. Larcombe, D.Sc.)

1.—BORING AT LALLA ROOKH G.M.

(For Locality Plans and Plans of Working see Dept. of Mines (S.M.E.'s) Report, 1929.)

No. 1 Bore.—Lalla Rookh South G.M.

1. This bore, judging from assay results, finished at 405 feet, but core to 298 feet only petrologically examined.

2. This bore from surface to 248 feet was in a feldspar-chlorite rock containing scattered yellowish grains of leucoxene. From 248 to 298 feet the rock was strongly schisted and made of a carbonate-chlorite-quartz schist.

*A. Gibb Maitland: G.S.W.A. Bull. 11—"Notes on the Country between Edjudina and Yundamindera."

† A Petrological Report by Dr. Larcombe determines this rock to be a muscovite microgranite.

3. Fifty-four assays were made at the Government Analyst's Department; 51 of these contained no gold; two assayed a trace; and from 348 to 350 feet the core assayed 10 grains per ton.

No. 2 Bore.—Lalla Rookh North G.M.

1. This bore was completed at a depth of 394 feet.

2. The bore started at 21 feet in a fine-grained schist which continued to 161 feet. Between 161 feet and 216 feet is a well-defined carbonate-chlorite schist. The fine-grained chlorite continued from 216 to 315 feet, where the carbonate schist came in again and continued to 357 feet.

3. Details of the formations are as follow:—

Depth in feet.	Nature of rock.
21—102	.. Fine-grained chlorite schist.
102—125	.. Brown oxidised rock.
125—161	.. Fine-grained chlorite schist.
161—216	.. Schist country made of carbonate and chlorite.
216—315	.. Chlorite rock.
315—357	.. Mottled carbonate-chlorite schist.

4. No distinctive lodestuff was seen. The Government Analyst's Department made 55 assays, of which 53 contained no gold, one contained a trace, and from 373 to 375 feet the core assayed 3 dwt. 11 gr. per ton.

2.—BORING AT RIVERINA.

(For Plan of Bores see Dept. of Mines (S.M.E's) Report for 1929.)

No. 1 Bore.

1. This bore was put down at an angle of depression of 55 degrees to cut the lode below the 280ft. level. It reached a total depth of 597ft. 2in. along the direction of inclination.

2. The bore throughout its full length was in one rock formation, viz., a reconstructed amphibolite, more or less coarse in grain but of varying degrees of crystallinity.

3. *Ore Deposits and Zones of Alteration:*

Throughout the course of this bore three distinct zones of shearing and crushing—one being accompanied by a distinct quartz vein—were met with as follow:—

a. Zone 1, from 462' to 469' 9".—This zone contained a distinct lode formation from 465' to 469' 9". The assay values are as follow:—

462ft.-465ft.—Gold, a trace (under 3gr. per ton).

465ft.-469ft. 9in.—Gold, 1oz. 3dwt. 23 gr. per ton.

From 462 to 465 feet the rock was powerfully stained with biotite. Under the microscope it consisted of a mass of shapeless red-brown scales and cleavage strips of biotite set in a more or less water-clear material resolvable by high powers into a granulitic mass of quartz and felspar. This special granulitised and biotised rock—finely schistose—is evidently a feature of the hangingwall of the shear zone containing the lode from 465ft. to 469ft. 9in.

In the shear zone it is clear that this biotite rock has been formed by dynamic stress, heat and pressure, and has resulted from the breaking up of the hornblende of the reconstructed amphibolite.

From 465ft. to 469ft. 9in. is true siliceous pyritic lodestuff formed along a line of shearing. This lodestuff is quite interesting from the fact that it contains tourmaline and microcline. Under the microscope the lodestuff is made up of microcrystalline granulated quartz and felspar with some biotite scales and rods of pale brown tourmaline, arranged parallel to the planes of foliation or schistosity.

This tourmalinised quartz-felspar schist is traversed by a coarse-textured mosaic of quartz—with a pseudo-elastic appearance—and occasional remarkable plates of microcline.

The tourmaline rods lie parallel to the quartz veins, and the microcline seems to frequent the borders of the secondarily introduced quartz. Iron pyrites (and possibly pyrrhotite) occurs in grains and veinlets cutting across the planes of foliation.

The hanging-wall rock from 451ft. 9in. to 460ft. 10in. was also assayed with the following results:—

451ft. 9in.-455ft. 10in.—Gold, nil.

455ft. 10in.-458ft. 3in.—Gold, 5gr. per ton.

458ft. 3in.-460ft. 10in.—Gold, 5 gr. per ton.

The footwall rock, represented by a specimen from 471 feet, was normal reconstructed amphibolite. Under the microscope it consisted of bunches and ragged plates of hornblende set in water-clear material made of a microcrystalline aggregate of quartz and felspar. No biotite was seen. A little more crushing would convert this rock into a hornblende schist.

b. Zone 2, from 504ft. 9in. to 509ft. 10in.—Between these depths there occurred another zone made up as follows:—

504ft.-506ft.—Granulated biotised schist.

506ft.-509ft. 10in.—Glassy quartz—slightly pyritic.

The assay results gave:—

504ft.-506ft.—Gold, 5gr. per ton.

506ft.-508ft.—Gold, nil.

508ft.-509ft. 10in.—Gold, 5gr. per ton.

The hangingwall rock from 504 to 506 feet was seen under the microscope to be a pyritic biotised granulated quartz-felspar schist (like that in Zone 1) with scattered grains and plates of hornblende traversed by veins and impregnated with patches of coarse silica mosaic and some carbonates.

The footwall of the quartz reef from 506ft. to 509ft. 10in. is reconstructed amphibolite grading into hornblende schist. Under the microscope it consists of bunches and sheaf-like aggregates and bundles of green hornblende separated by colourless interstitial material made of micro to almost microcrystalline mosaic of quartz mainly with traces of biotite.

c. Zone 3, from 383ft. 8in. to 588ft. 4in.—Between these depths was still another distinctly biotised and in part strongly schistose zone. According to assay results Zone 3 contained no gold. Core from this zone has not been microscopically examined, but macroscopically the zone appeared to contain—

(i) granulated biotised schist,

(ii) siliceous quartz rock, and

(iii) strongly schistose actinolite quartz rock,

Conclusions.

Petrographic investigations indicate that this bore passed through the three shear zones described under a, b and c, viz. :—

- a. Zone 1: 462ft.-469ft. 9in.
- b. Zone 2: 504ft.-509ft. 10in.; and
- c. Zone 3: 583ft. 8in.-588ft. 4in.

With the exception of the comparatively rich 4ft. 9in. of lodestuff from 465ft. to 469ft. 9in. in Zone 1 (a), the values were negligible.

These three zones all contained the curious granulated biotised rock—mostly on the hangingwall. They resulted from the breaking down and crushing under heat, solution, and pressure of the reconstructed amphibolite in which they occur. The rich lodestuff in Zone 1 (a) from 465ft. to 469ft. 9in. is of considerable interest on account of the microcline and tourmaline it contains. It looks as if it is in some way connected with acidic residual solutions which have been forced along and between the foliation planes of the schisted rock in the shear zones.

No. 2 Bore.

1. This bore was completed at a depth of 525 feet.

2. The following is the succession of rocks passed through:—

Depth in feet.	Nature of rock.
20—210	.. Rotten decomposed amphibolite.
210—240	.. Reconstructed amphibolite.
240—243	.. Pyritic siliceous actinolite rock with granular sphene and microcline—a grade of lodestuff.
243—261	.. Chlorite-carbonate actinolite schist containing magnetite.
261—340	.. Amphibolite; semi-schisted and containing distinctly schisted bands, with a band of epidote rock from 264ft.—265ft.
340—437	.. Amphibolite of varying grades of crystallinity, grading into hornblende schist.
437—448	.. White quartz reef.
448—516ft. 6in.	.. Amphibolite.
516ft. 6in.—520ft. 9in.	.. Patch of oxidised schist.
520ft. 9in.—521ft. 6in.	.. Rock somewhat schisted, slightly pyritic and epidotic.
521ft. 6in.—525ft	.. Amphibolite.

3. One hundred and eleven (111) assays were made in the Government Analyst's Department: 98 yielded no gold at all; seven yielded traces; one 5 grains per ton; four yielded 3 grains, and one yielded 1 dwt. 5 grains per ton.

3.—BORING AT MT. ZION GOLD MINE.

(For Plan showing bores, see Dept. of Mines (S.M.E.'s.) Report for 1929.)

No. 2 Bore.

1. This bore was put down at an angle of depression of 65 degrees with a view to cutting the lode at deeper levels.

2. The total depth reached was 481 feet 8 inches.

3. The country rock of this bore was the same throughout, viz., a somewhat mottled greenish rock due to an admixture of chlorite and carbonate, the latter often forming bands. The rock on the whole was more or less schisted. Its origin is doubtful, but it was more than likely some ultra-basic rock.

4. The bore passed through no less than six zones of a perfectly banded black and white jasper. These zones will be referred to as lodes. Their positions along the bore are as follow:—

Depth in feet.	Width.
	ft. in.
Lode 1—150ft. 6in.—156ft. 3in.	.. 5 9
Lode 2—191ft. 4in.—200ft. 6in.	.. 9 2
Lode 3—251ft. —258ft.	.. 7 0
Lode 4—263ft. —307ft.	.. 44 0
Lode 5—341ft. 6in.—352ft.	.. 10 6
Lode 6—431ft. —466ft. 7in.	.. 35 7
Total	.. 112 0

The total thickness of these jasper bodies along the direction of the bore is therefore seen to be 112 feet.

5. *Values.*—The values derived from these so-called "lode formations" may be summarised as follows:—

Lode 1: 150ft. 6in. to 156ft. 3in.

Values: 150ft. 6in.—153ft.—Gold, trace.
153ft.—156ft. 3in.—Gold, 8 grains per ton.

Lode 2: 191ft. 4in.—200ft. 6in.

Values: 191ft. 4in.—195ft.—Gold, trace.
195ft.—197ft. 6in.—Gold, 1dwt. 2gr. per ton.
197ft. 6in.—200ft. 6in.—Gold, 11dwt. 0gr. per ton.

The rock from 197ft. 6in. to 200ft. 6in. was a heavily pyritic phase of the black and white jasper. The pyrites occurred in patches and partly as crystals. Some secondary veins of quartz and carbonates were noted.

Lode 3: 251ft. to 258ft.

Values: 249ft. 6in.—255ft. Gold: 13gr. per ton.
255ft.—258ft. Gold: trace.

Lode 4: 263ft. to 307ft.

Values: 263ft.—268ft. 6in. Gold: 5gr. per ton.
268ft. 6in.—272ft. 6in. Gold: 1dwt. 12gr. per ton.
272ft. 6in.—276ft. 9in. Gold: 1dwt. 0gr. per ton.
276ft. 9in.—281ft. Gold: 2dwt. 9gr. per ton.
281ft.—285ft. Gold: 1dwt. 7gr. per ton.
285ft.—289ft. Gold: 17gr. per ton.
289ft.—293ft. 6in. Gold: 1dwt. 18gr. per ton.
293ft. 6in.—297ft. 6in. Gold: 17gr. per ton.
297ft. 6in.—299ft. 6in. Gold: 3gr. per ton.
301ft. 6in.—307ft. Gold: 10gr. per ton.

Lode 5: 341ft. 6in.—352ft.

Values: 341ft. 6in.—345ft. 9in. Gold: 5gr. per ton.
345ft. 9in.—350ft. Gold: 5gr. per ton.
350ft.—352ft. Gold: nil.

Lode 6: 431ft. to 466ft. 7in.

Values: 431ft.—450ft. 6in. Gold: nil.
450ft. 6in.—454ft. 8in. Gold: 2oz. 14dwt. 8gr. per ton.
454ft. 8in.—458ft. 7in. Gold: 3dwt. 11gr. per ton.
458ft. 7in.—462ft. 8in. Gold: 1dwt. 15gr. per ton.
462ft. 8in.—466ft. 7in. Gold: 13gr. per ton.

This lode was banded black and white jasper to 450ft. 6in., at which point a change came in. The banded rock gave place to a much shattered siliceous stone between 450ft. 6in. and 454ft. 8in. Under the microscope it was seen to consist of microcrystalline quartz cut by shatter cracks and small shear lines bordered by carbonates. Carbonate and quartz veins, and some chlorite as well as jasperoid to chalcedonic silica were noted. At 450ft. 9in. was second-

ary silica, plates of carbonates and strong brown prisms of tourmaline. The iron pyrites was in small amount and in an exceedingly fine state of division.

6. In addition to the foregoing assays core from the following depths was assayed with results that showed no gold at all:—354 to 431 feet, and 466ft. 7in. to 481ft. 8in.

No. 1 Bore.

1. This bore reached a total depth of 461 feet along its angle of inclination.

2. The core started in rotten rock at 26 feet. From this point to the bottom of the bore the succession of rock formations met with is as follows:—

Depth in feet.	Nature of rock.
26ft.—78ft.	Rotten banded ferruginous jasper.
78ft.—157ft. 10in.	Green carbonate rock.
157ft. 10in.—167ft. 2in.	Pyritic quartz carbonate rock with some heavy iron sulphide in places.
167ft. 2in.—168ft.	Pyritic green schist.
168ft.—204ft.	Banded black and white jasper.
204ft.—233ft.	Almost white carbonate rock.
233ft.—235ft.	Glassy white quartz.
235ft.—255ft.	Pyritic dense white carbonate rock.
255ft.—273ft.	Mottled chlorite carbonate rock, in part schistose and like the average rock in No. 2 Bore.
273ft.—287ft.	Gray carbonate rock.
287ft.—309ft.	Mottled chlorite carbonate rock.
309ft.—355ft.	Massive dark carbonate rock.
355ft.—434ft. 2in.	Mottled chlorite carbonate rock.
434ft. 2in.—446ft. 7in.	Mottled chlorite carbonate rock with 6 inches of pyritic jasper (some red) and glassy quartz at 440 feet.
446ft. 7in.—461ft.	Mottled chlorite carbonate rock.

3. The rock throughout the whole of this bore varied somewhat in appearance from point to point. This was simply due to chemical and dynamic changes in the one rock formation, viz., a chlorite-carbonate rock analogous to that which formed the dominant rock in the No. 2 Bore.

4. The so-called jasper lodes were not so frequent in this as in the No. 2 Bore. Their positions along the direction of the bore, together with assay results, are as follows:—

No. 1 Lode: 26 to 78 feet. Rotten jasper.

Values: 26ft.—48ft. 9in. Gold: nil.
48ft. 9in.—60ft. Gold: trace.
60ft.—62ft. 6in. Gold: 5gr. per ton.
62ft. 6in.—67ft. 4in. Gold: 3gr. per ton.
67ft. 4in.—78ft. Gold: 8gr. per ton.

No. 2 Lode: 157ft. 10in. to 167ft. 2in. Pyritic quartz carbonate rock with some heavy iron sulphide in places.

Values: 157ft. 10in.—162ft. 6in. Gold: 21gr. per ton.
162ft. 6in.—167ft. 2in. Gold: 14gr. per ton.

No. 3 Lode: 168ft. to 204ft. Banded black and white jasper.

Values: 167ft. 2in.—169ft. 2in. Gold: 5gr. per ton.

169ft. 2in.—176ft. Gold: nil.

176ft.—194ft. 5in. Gold: trace.

194ft. 5in.—196ft. 7in. Gold: 6dwt. 13gr. per ton.

196ft. 7in.—200ft. 9in. Gold: trace.

200ft. 9in.—202ft. 10in. Gold: 2dwt. 4gr. per ton.

202ft. 10in.—204ft. Gold: trace.

The foregoing were the only three lode formations noted. At 440 feet there was 6 inches of pyritic red jasper, but it contained no gold.

The only other values recorded were between 78ft. 6in. and 89ft. 2in., carbonate rock yielding 3 grains of gold per ton.

5. The remainder of the core was averaged and assayed. It contained no gold for the most part, with traces in places.

4.—BORING AT NORSEMAN.

No. 4 Bore, Viking Gold Mine.

(For Locality Plan and Cross Section of No. 4 Bore, see Department of Mines (S.M.E.'s) Report for 1929.)

1. This bore reached a total depth of 575 feet.

2. The bore started in coarse-grained epidiorite, it then passed through a great width of fine-grained epidiorite to 511 feet, where a distinct schisted zone made of hornblende-biotite schist came in. The bore after passing through this zone continued in coarse-grained epidiorite.

3. Details of rock formations are as follow:—

Depth in feet.	Nature of rock.
35ft.—150ft.	Coarse-grained epidiorite.
150ft.—511ft.	Fine-grained epidiorite.
511ft.—522ft.	Schisted zone of hornblende-biotite schist with some quartz.
522ft.—575ft.	Coarse-grained epidiorite.

4. Assays.—A great number of assays were made, including average samples of practically the whole of the core. The results were negative, no gold being recorded in any of them.

5. Although no gold was recorded it is of interest that sheared and schisted zones persist to depths of 511 feet.

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Section N°1 Bore - South Reef

LALLA ROOKH G. M.

Scale :- 50 Ft. = 1 In.

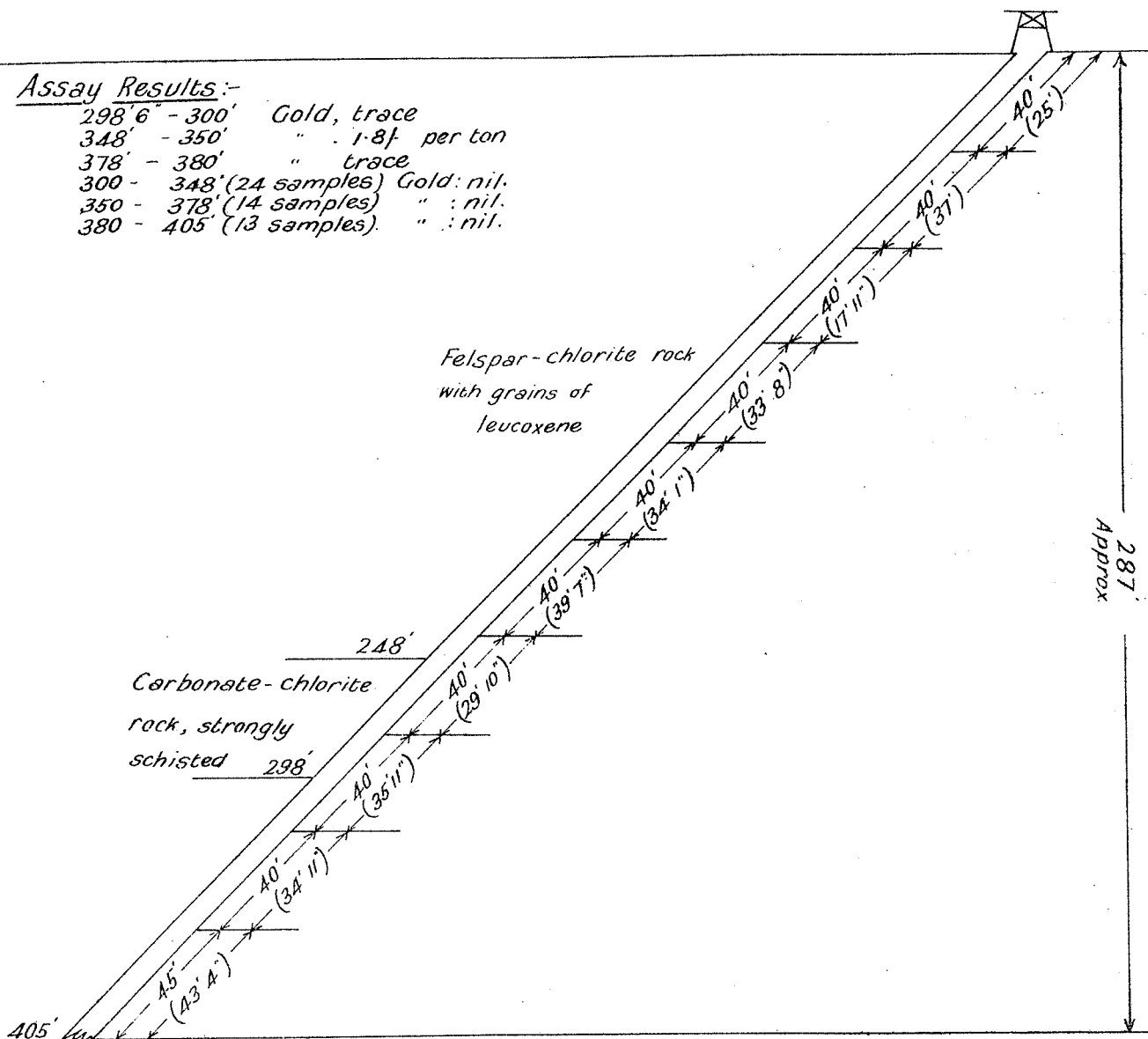
Commenced 19. 7. 1929

Completed 14. 8. 1929

Angle of depression 45°

Assay Results:-

298' 6" - 300' Gold, trace
 348' - 350' " 1.8f per ton
 378' - 380' " trace
 300 - 348' (24 samples) Gold: nil.
 350 - 378' (14 samples) " : nil.
 380 - 405' (13 samples) " : nil.



NOTE:- The Figures in brackets indicate the length of core recovered from the corresponding section of boring.

Section N^o 2 Bore - North Reef

LALLA ROOKH G. M.

Scale :- 50 Ft. = 1 In.

Commenced 18. 7. 1929

Completed 14. 8. 1929

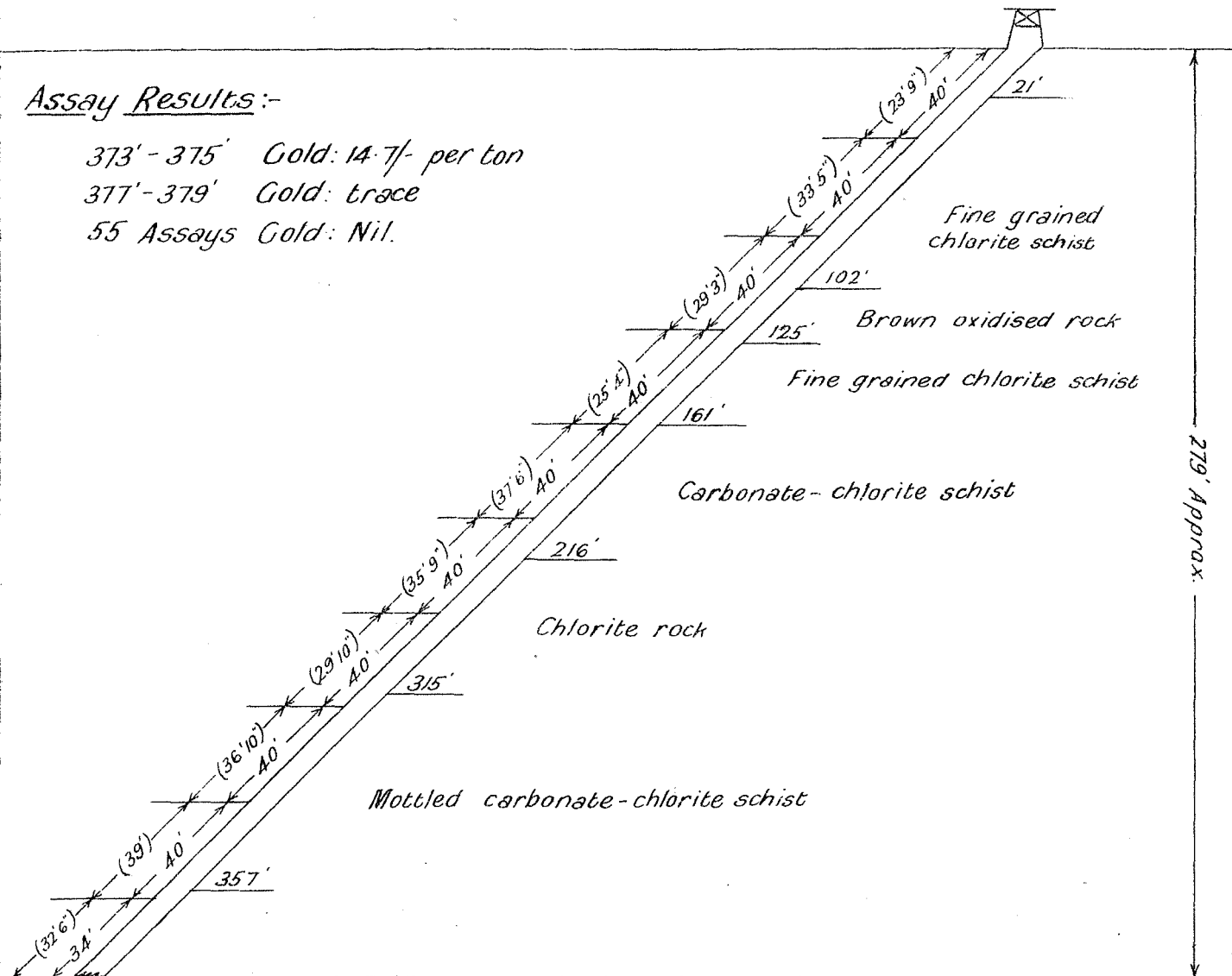
Angle of depression 45°

Assay Results:-

373' - 375' Gold: 14.7/- per ton

377' - 379' Gold: trace

55 Assays Gold: Nil.

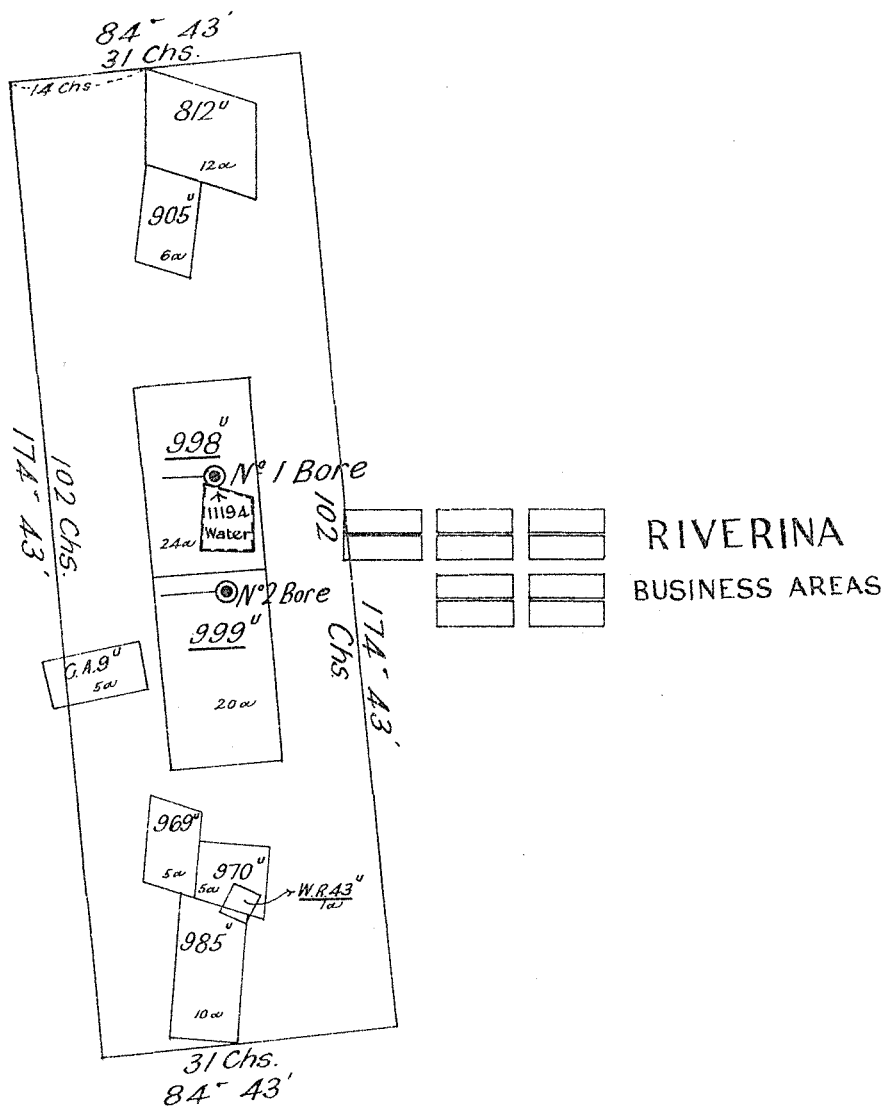
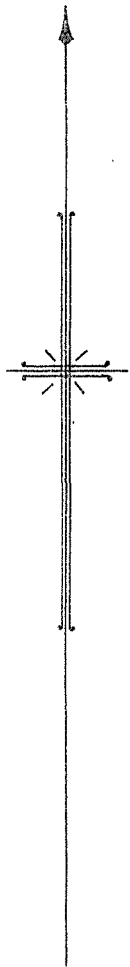


NOTE:- The figures in brackets indicate the length of core recovered from the corresponding section of boring.

Locality Plan
of Bores at

RIVERINA

Scale: - 20 Chs. = 1 In.



Section N°1 Bore

RIVERINA

Scale:- 50 Ft. = 1 In.

Angle of depression 55°

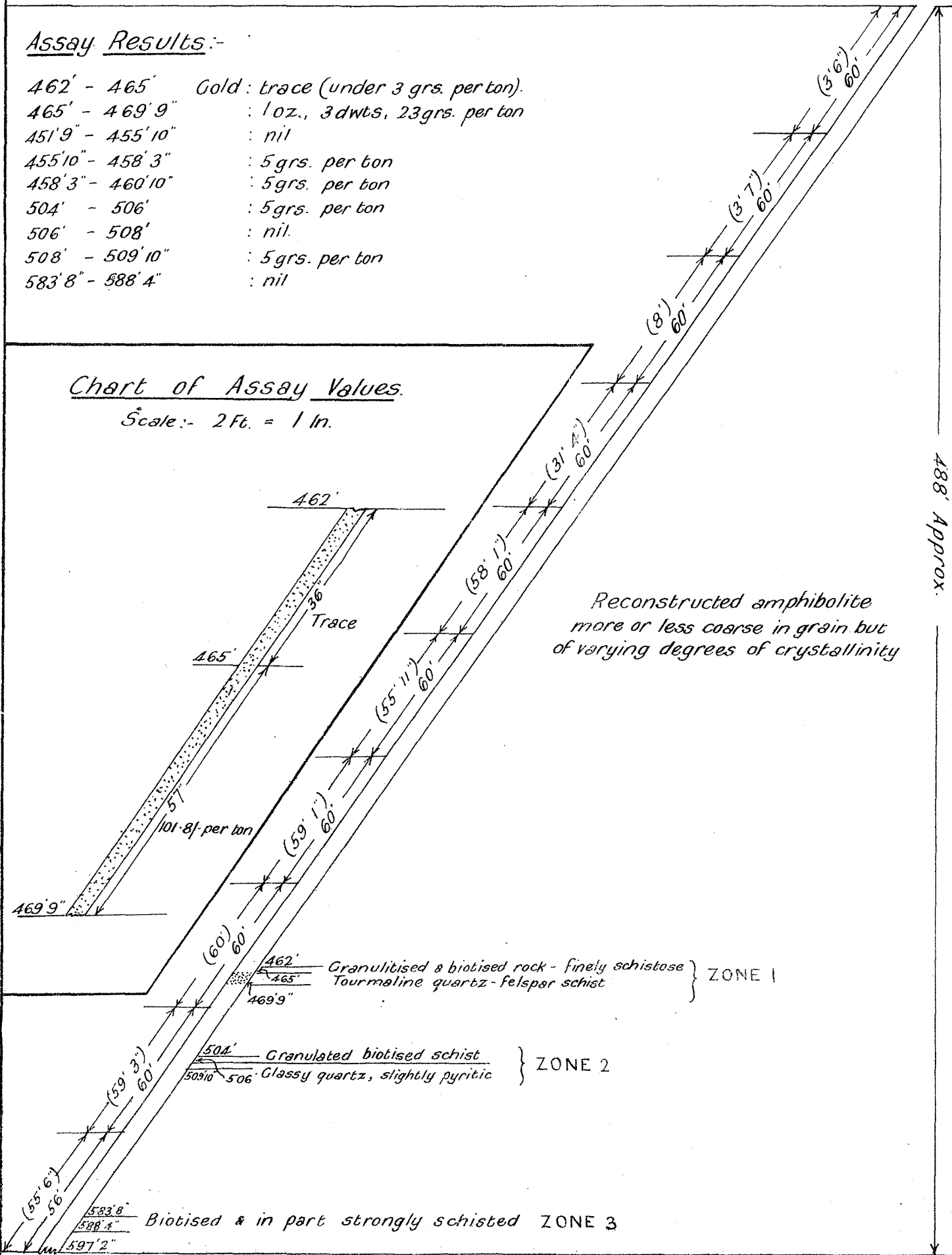
Commenced 17. 7. 1929
Completed 1. 2. 1930

Assay Results:-

462' - 465'	Gold: trace (under 3 grs. per ton).
465' - 469' 9"	: 1 oz., 3 dwts, 23 grs. per ton
451' 9" - 455' 10"	: nil
455' 10" - 458' 3"	: 5 grs. per ton
458' 3" - 460' 10"	: 5 grs. per ton
504' - 506'	: 5 grs. per ton
506' - 508'	: nil.
508' - 509' 10"	: 5 grs. per ton
583' 8" - 588' 4"	: nil

Chart of Assay Values.

Scale:- 2 Ft. = 1 In.



NOTE: The figures in brackets indicate the length of core recovered from the corresponding section of boring.

Section N°2 Bore

RIVERINA

Scale:- 50 Ft. = 1 In.

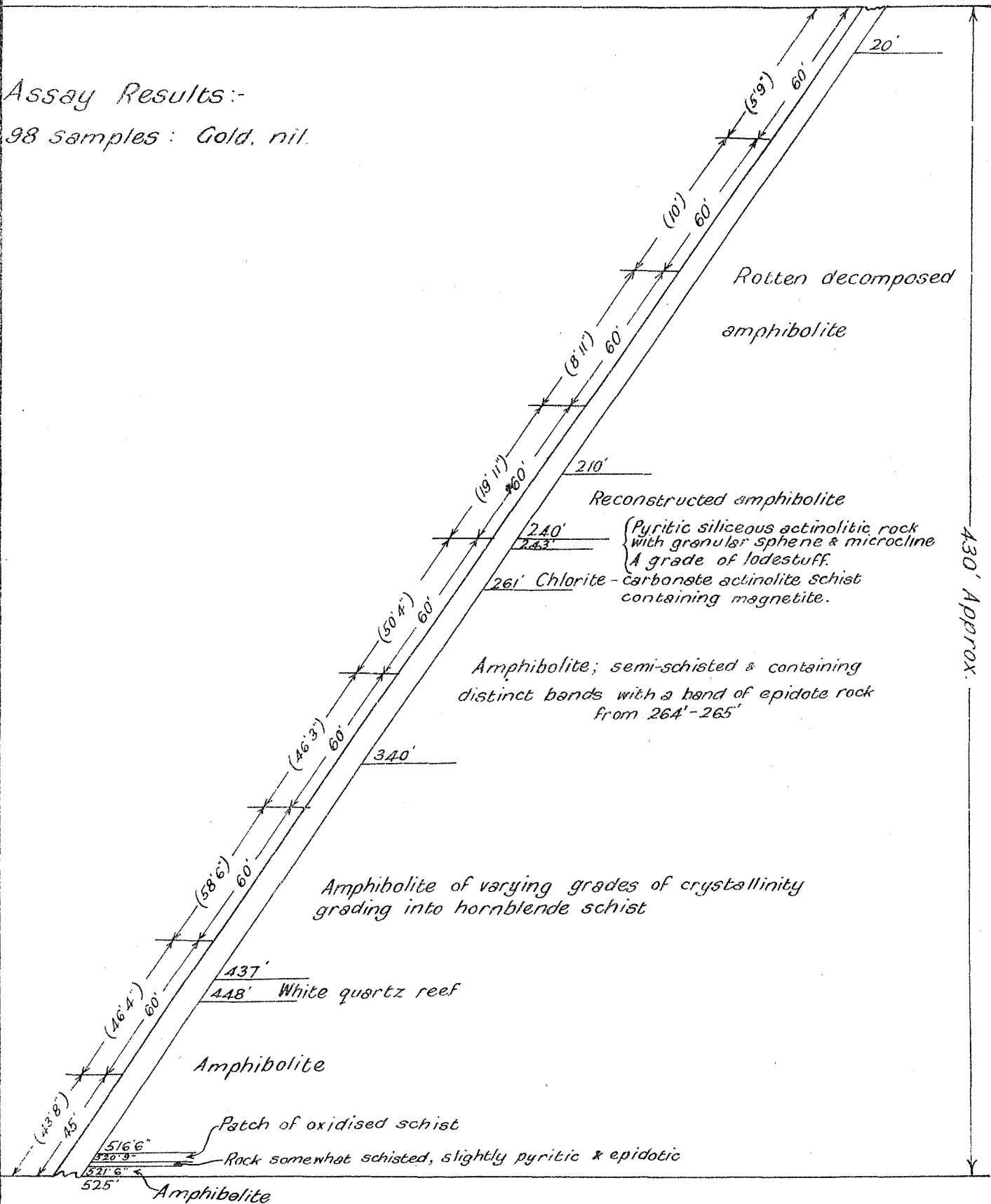
Angle of Depression 55°

Commenced 17. 2. 1930

Completed 9. 5. 1930.

Assay Results:-

98 samples : Gold, nil.



NOTE: The figures in brackets indicate the length of core recovered from the corresponding sections of boring.

Section No 1 Bore

MT ZION G. M.

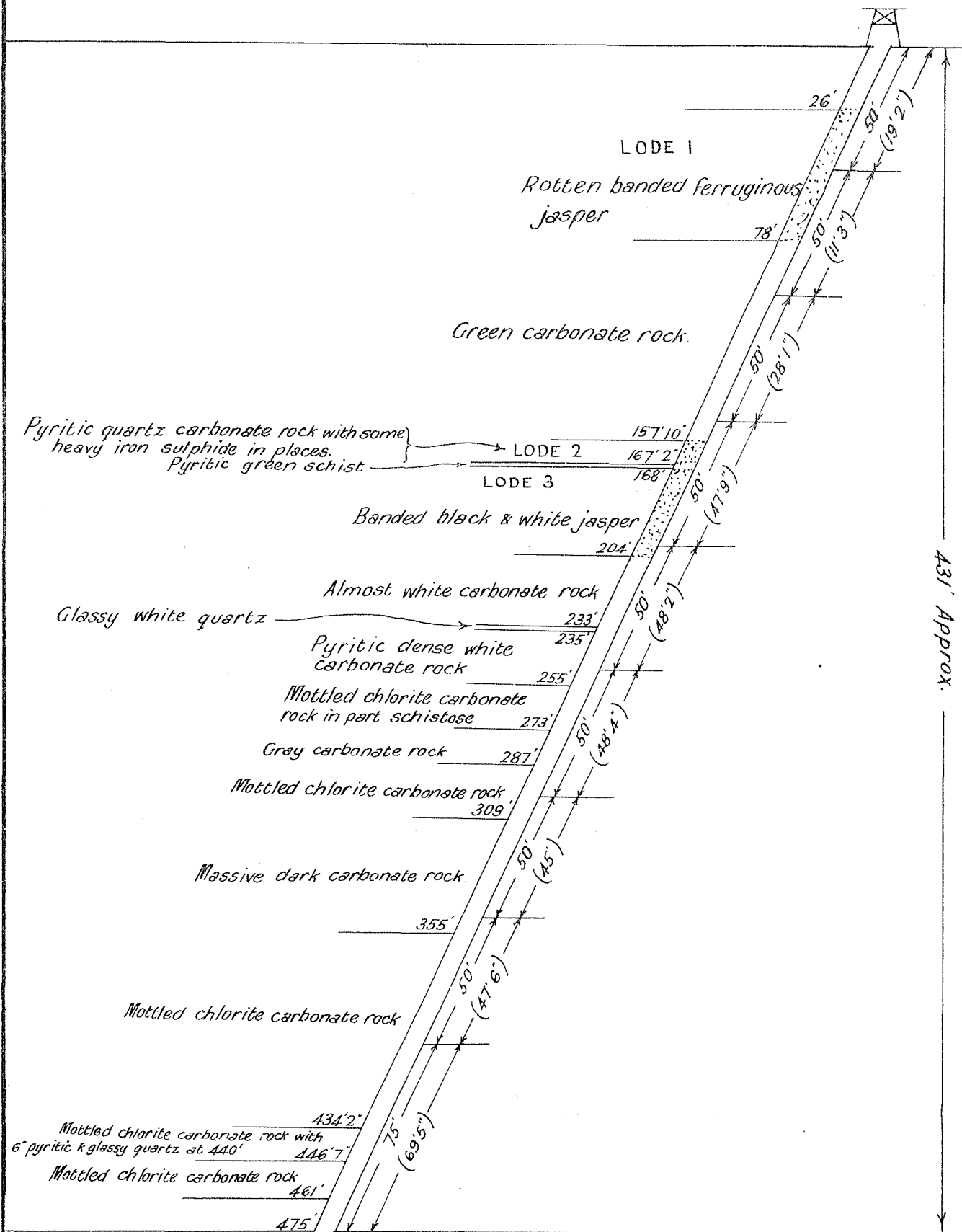
BOOGARDIE

Scale:- 50 Ft. = 1/4 in.

Angle of depression 65°

Commenced 7. 2. 1930.

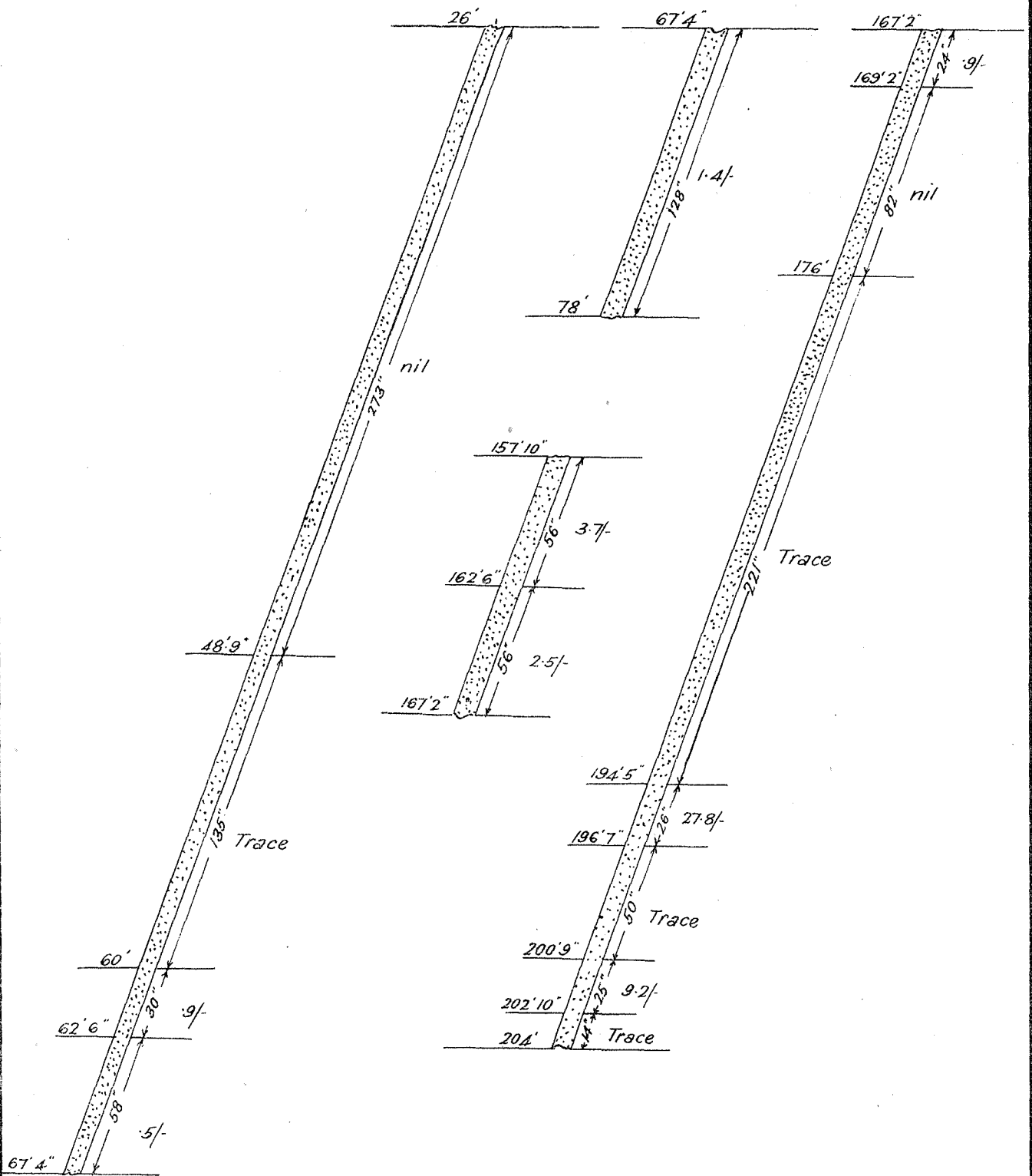
Completed 11. 3. 1930.



NOTE:- The figures in brackets indicate the length of core recovered from the corresponding section of boring.

N^o 1 Bore
M^t ZION G. M.
BOOGARDIE

Chart of Assay Values pierced between
26' and 204' in shillings per ton.
Scale:- 5 Ft. = 1 In.



Section N° 2 Bore

M^T ZION G. M.

BOOGARDIE

Scale:- 50 Ft. = 1 In.

Angle of depression 65°

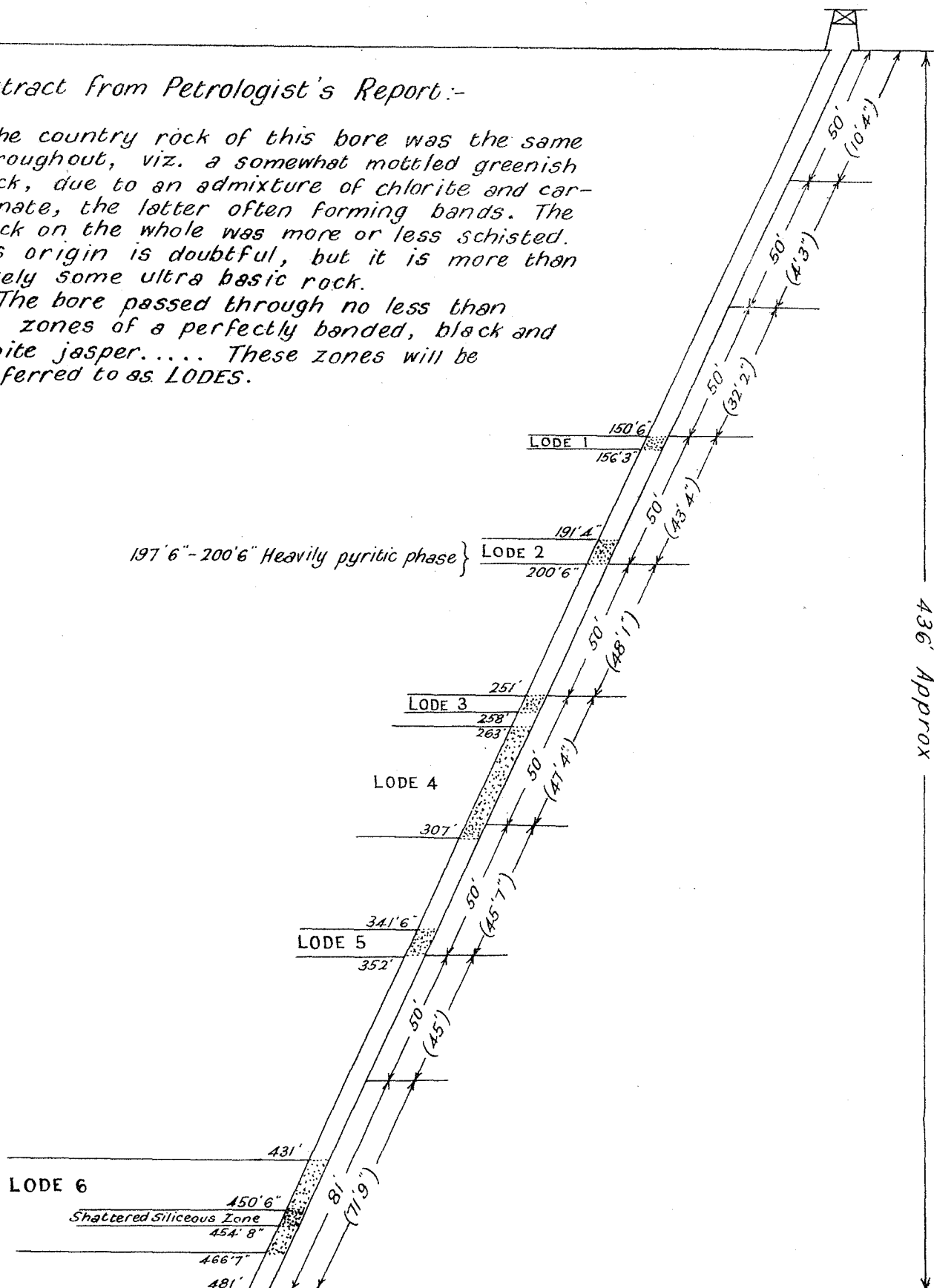
Commenced 27. 11. 29.

Completed 30. 1. 30.

Extract from Petrologist's Report:-

"The country rock of this bore was the same throughout, viz. a somewhat mottled greenish rock, due to an admixture of chlorite and carbonate, the latter often forming bands. The rock on the whole was more or less schisted. Its origin is doubtful, but it is more than likely some ultra basic rock.

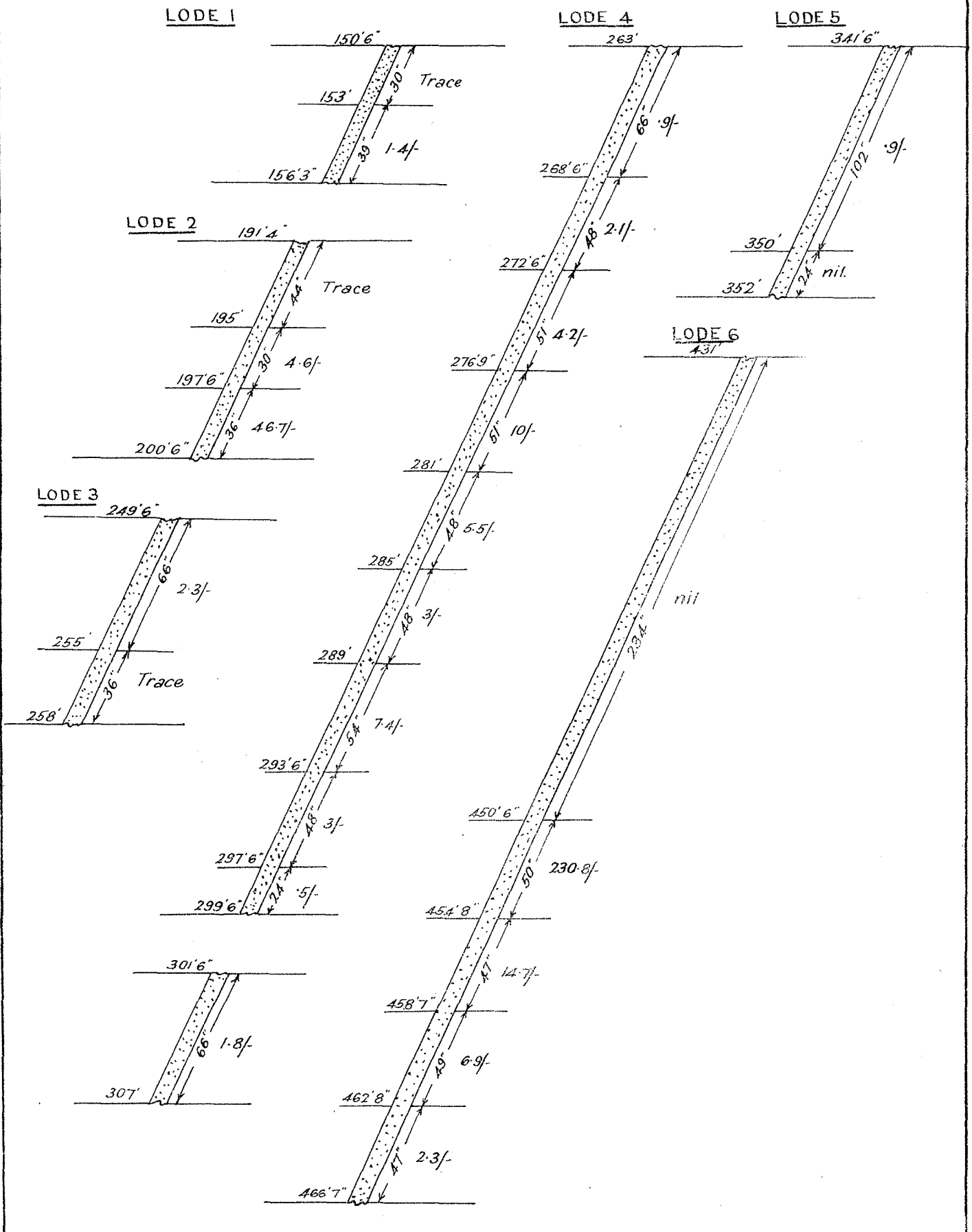
The bore passed through no less than six zones of a perfectly banded, black and white jasper..... These zones will be referred to as *LODES*.



NOTE:- The figures in brackets indicate the lengths of core recovered from the corresponding sections of the boring.

Nº 2 Bore
M^r ZION G. M.
BOOGARDIE

Chart of Assay Values pierced between
150'6" and 466'7" in shillings per ton.
Scale:- 5 Ft. = 1 In.



Section N°4 Bore

VIKING G. M.

NORSEMAN

Scale:- 60 Ft. = 1 in.

Vertical

Commenced 6. 12. 1929

Completed 15. 4. 1930

Assay Results.

Gold: Nil.

Shaft 14'

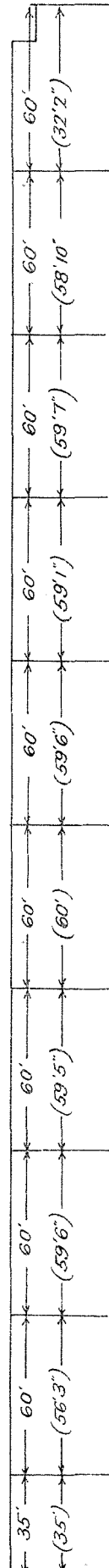
Coarse grained epidiorite

Fine grained epidiorite

Schisted zone of hornblende } 511'
 biotite schist with some quartz } 522'

Coarse grained epidiorite

575'



NOTE. The figures in brackets indicate the length of core recovered from the corresponding section of boring.

DIVISION V.

School of Mines.

ACTING DIRECTOR'S REPORT FOR THE YEAR 1930.

The Under Secretary for Mines, Perth.

School of Mines,
Kalgoorlie, 31st December, 1930.

Sir,

I beg to forward for the information of the Honourable the Minister my report on the work of the School for the year 1930.

The number of students who entered in this year was 164, an increase of fourteen on the previous year. This year there were inquiries up till a much later period in the year than usual, a number of them being too late to enable any work worth while being done in the time available.

Much of this was no doubt due to the more optimistic feeling as to the future of the mining industry as far as gold is concerned, and to the difficulty of finding employment in the coastal and agricultural areas.

The granting of the gold bonus will further improve this situation on the fields, and, along with a wider recognition of the need for better technical control and equipment in the industry, will create a larger demand for adequate technical knowledge bearing on it.

Our students, past and present, continue to hold their positions in the mining and engineering sides of the work with credit to themselves and to the school, and the effect of larger numbers of them finding employment in the industry, as has been the case lately, will be reflected on the school enrolment.

Classes have been held in almost all of the subjects of the school courses. The entries in the preparatory classes, which are the main feeders to the school, were as great this year as four years ago, while the attendance in the third term was larger than it was six years back at the same period of the year. At the annual examinations in November last 196 passes were secured—an increase of 46 over last year.

In all classes the work has been conducted in a capable manner, and the grade of instruction has been maintained. As usual, assistance has been given to several students who were taking subjects with a view to University degree examinations in such subjects as Chemistry, Mathematics, Geology, Physics, etc.

In the Metallurgical Department the public assays, of which 357 were done during the year, show an increase of nearly 60 per cent. over last year, due to a much greater interest in prospecting, especially for gold.

The Research Laboratory has been very fully occupied on a variety of problems bearing on the treatment of gold ores, chiefly. These, naturally, are the more difficult ones, and call for much initiative and skill, besides search in metallurgical literature, though the problems are generally quite original as far as records of such investigations go. Problems, too, which at first sight appear as though they may be quite simple, have often proved not so easy to arrive at a method of treatment promising to be

satisfactory. In carrying out this work 912 assays were made and 1,739 chemical determinations.

The investigations made included the treatment of cupriferous gold-bearing tailings from Gabanintha, Murchison Goldfield; the roasting and cyanidation of flotation concentrates from the Wiluna Gold Mines, Limited; the treatment of clean-up material from the Lake View and Star, Limited; the separation of cassiterite and tantalite from cassiterite-tantalite concentrates for Mr. Galt, Wagin; test of the efficiency of West Australian eucalyptus oils as frothing agents in flotation of gold ores (Australian Machinery and Investment Company, Limited); some comparative frothing tests on Lake View and Star flotation feed; treatment of sulphide ore from the Patricia lease of the Kimberley Options Company, Edjudina.

This work will form Bulletin No. 6 of the school. These Bulletins still attract favourable attention in various parts of the world, and inquiries are being constantly received for them.

In regard to the work of the Metallurgical Laboratory, attention might be drawn to the fact that several inquiries have been received from the Eastern State for investigations to be made on the treatment of gold ores, especially, and if considered within the policy of the Department, it might be worth while letting it be known over East that such work would be undertaken at the School of Mines for a reasonable fee. Further, although this work has been done in the past for the local mines without fee, there are cases where the matter of a charge might have been legitimately considered.

At this time last year I drew attention to the fact that the chairman of directors of the Lake View and Star, Limited, had announced that his company was installing a flotation unit of a capacity of 5,000 tons per month. This plant started up at the middle of the year, and has given great satisfaction. Within the last few days the same gentleman (Mr. J. A. Agnew) has announced through the general manager that the plant is to be increased to a capacity of 30,000 tons per month. The result of an important investigation bearing on the flotation treatment of Lake View ore was handed to the consulting engineer of the mine at the end of July, 1928, from the school, and was considered very satisfactory.

In severing my connection with the school after my service of twenty-seven years as Assistant Director and as Acting Director, I may be allowed to express my belief that the school has been a very useful institution to the mining industry and to the local youth, and, while its influence in the past has, owing to a variety of circumstances, been slower than might have been hoped for, its influence and progress in the future is likely to be much accelerated, if the standard is kept up.

I have to thank the different members of the staff, including the registrar, for loyal service and support during my term of office generally.

T. BUTEMENT,
Acting Director.

DIVISION VI.

REPORT OF THE DEPUTY CHIEF INSPECTOR OF MACHINERY.

The Under Secretary for Mines.

Sir,

The report of the Deputy Chief Inspector of Machinery on the administration of "The Inspection of Machinery Act, 1921," for the year 1930 is submitted for the information of the Hon. Minister for Mines.

Despite the times, the number of boiler and machinery groups showed an increase and the report gives the reasons for this pleasing state of affairs. The number of accidents showed a decrease of 11 and totalled only 31. Unfortunately there were five fatal accidents.

The work of the officers of the Inspection of Machinery Branch was most satisfactory, and in addition to the standard of efficiency having been maintained, which is a most important factor, the financial result showed a small profit.

Amendments to the Act and Regulations have been drafted to provide for existing conditions, which have been altered in recent times, on account of the introduction into the State of new types of machinery. The proposed amendments to the Act are not of a controversial nature, and I hope will be submitted to Parliament next session.

I have, etc.,

A. M. HOWE,
Chief Inspector of Machinery.

10th March, 1931.

The Chief Inspector of Machinery, Perth.

Sir,

I have the honour to submit my report on the operations of "The Inspection of Machinery Act, 1921," for the year ending 31st December, 1930.

Our records show that the financial depression had not affected our work up to the end of the year. As a matter of fact you will note increases in the number of new registrations and certificates issued for both boilers and machinery. The fact being due in the first place to some large new plants being started, and that although many factories have reduced the number of employees, the same machinery had to be kept running.

The work is shown under the following headings:—

1. Inspection of Boilers.
2. Explosions and Interesting Defects.
3. Inspection of Machinery.
4. Accidents to persons caused by Boilers and Machinery.
5. Board of Examiners for Engine-drivers.

DIVISION I.

Inspection of Boilers.

The number of boilers registered at the end of the year was 3,627 as against 3,530 last year. New registrations amounted to 123, but as 25 were put permanently out of use, either being scrapped by owners or condemned by the Department, the nett increase was only 98. The improvement was general throughout all districts. Fifty-four more certificates were issued than in previous year, and one and a half per cent of the boilers inspected were permanently condemned.

The number of inspections carried out was 1,588 thorough and 35 working inspections under steam.

It is a pity that pressure of work in other directions does not permit of more working inspections being made, because although owners are responsible for the proper maintenance of fittings between inspections, experience proves that safety valves and other important fittings are neglected and out of order.

DIVISION II.

Explosions and Interesting Defects.

We have had no explosions of registered boilers of any sort, but two cases came to our knowledge of small unregistered air-receivers having exploded and caused damage which might easily have resulted in loss of life. Such vessels having a capacity of less than five cubic feet are exempt from inspection, and a manufacturer of these vessels for motor service stations decided to save the expense of fitting a safety valve, and initial and subsequent inspections, by making them just within the exempted size. They were cylindrical vessels 4 feet long x 15 inches diameter with dished ends, one concave and the other convex to the pressure, all seams electrically welded. Each vessel had a pressure gauge but no safety valve, and each was guaranteed for a working pressure of 150 lbs. per sq. inch. In the one case some person had started the air compressor, but no one had troubled to watch the pressure gauge, up to the time the explosion occurred, an hour afterwards; so that it is not known at what pressure it exploded. The vessel stood upright on its convex end and parted at that circular seam. The shell tore through the roof about 18 feet above, landed on a neighbouring roof, and rolled to the ground fifty feet away from where it started.

The second one was standing on its convex end on a wooden floor, and was tied to a single brick wall by iron bands. As in the other instance no attention was paid to the pressure, so that no information could be gleaned as to what it was at the time of explosion. When it occurred the bottom convex end was driven through the floor, breaking a

4in. x 2in. joist, and leaving a hole two feet in diameter. The shell with concave end intact was precipitated upwards against the collar-ties of roof, breaking one and splintering another, and then fell back to the floor. Fortunately no one was hurt in either case.

The result of each of these explosions is positive proof that even small receivers should be inspected because serious injury, if not death, might easily have been caused in either of the cases mentioned. As bearing on the subject, a recent explosion in England might be mentioned. This was a small steam receiver four feet high by two feet four inches in diameter, which had been made for a pressure of 40 lbs. per sq. inch, but had been subjected to about 85 lbs. owing to defective fittings, was blown away from its lower end, and in its flight destroyed the stokehold roof, passed over several buildings, and was found about 103 yards away in the back yard of a cottage where it had partly demolished the roof and side wall of the scullery. Only one person was killed.

DIVISION III.

Inspection of Machinery.

There was an increase in the number of groups of machinery, in all but one of the six sources of power. Hydraulic remained stationary, and only a slight increase shown in compressed air, gas and steam, but those driven by electric motors show an addition of 703 to last year's figures. The extra power required will be found in the increase of 101 in oil engines. Searching for a reason for this increase in these troublous times we find the following contributing factors. The starting up of the mill plant of the Wiluna Gold Mines, Ltd., the Superphosphate Works of Messrs. Cuming Smith and Mt. Lyell Companies at Picton, the former company's works at Geraldton, the re-arrangement and increase of plant of the Lake View and Star Company, and the Collie Power Station.

The power plant of the Wiluna Gold Mines, Ltd., consists of seven vertical "National" six cylinder oil engines of 600 h.p. each, direct coupled to three phase 50 cycle 3,300 volt. K.V.A. generators by the British General Electric Co. There are three vertical, two-stage Bellis & Morcom air-compressors of 2,000 cubic feet per minute capacity, each driven by a four cylinder Crossley Premier oil engine of 400 h.p. For raising the ore there are two double drum electric winding engines by Robey & Co., and driven by 300 h.p. motors supplying current at 3,300 volts by the Vickers Metropolitan Co.

Underground haulage is done by electric locomotives which draw thirty tons per trip. All mine water will be led to a storage well below the 450 level, and two electric pumps will be controlled automatically so that first one and then the other will start and stop according to the height of water in the well.

The skip winder has a capacity of 150 tons per hour, and the second is fitted with a large double-deck cage which comfortably holds 40 men, and is large enough to carry a locomotive intact so that previous dismantling is unnecessary. The various units of the plant are driven by electric motors, and the only steam boiler will be one working at atmospheric pressure to provide heat for the change-house. Water

for the plant is obtained from shallow wells about 3½ miles away equipped with electrically-driven pumps controlled by a float from the mine storage tank. Every detail of the mine and plant reveals careful forethought and efficiency to the last degree.

The new power house at Collie is now completed, and very soon the town and all the mines in the district will be served by it. The steam plant consists of two large tri-drum water tube boilers, supplied by the International Combustion Steam Generators, Ltd., using pulverised coal and working at a pressure of 260 lbs. per sq. inch with a maximum evaporative capacity of 3,750 gallons per hour. They are fitted with all the latest recording instruments, automatic feed regulator, and high and low water alarm. In the engine-room are two Metropolitan Vickers turbines each of 3,350 h.p. driving A.C. generators with rotary converters for D.C. current.

There has been a slight falling off in the timber industry, which presages worse conditions next year, but the seven butter factories, two more than last year, are doing well. Boilers in the agricultural districts are beginning to require very careful inspection, especially those on portable engines and tractors owing to bad feed water and rough travelling.

The Lake View and Star, Ltd., is not only largely increasing its plant but re-arranging it and re-organising methods of dealing with the ore. Old engines are being overhauled to bring them to a proper state of efficiency. Power costs have been reduced in a marked degree, and when the completed plant is in operation it will do much towards attracting capital again to the goldfields.

Eleven new passenger and four new goods lifts were erected during the year, bringing our total to 236. A few mishaps have been reported, but they were mainly due to over-loading of automatic lifts having traction drive. This is being guarded against in future by restricting floor space, because notices, however prominent, do not appear to deter people crowding in if they can.

There was an increase of 838 over last year's figures for the total registration of useful machinery in the State, *i.e.*, 8,513 groups against 7,675. And whereas last year 24.2 per cent. were out of use, this year there was only 22.8. There were 842 more inspections made by the same staff. One reason for this was there was no distraction caused by any change of staff or illness of any of its members.

Nearly all the new installations have been oil engines of the Diesel and Semi-Diesel types, and as in many instances they are used for generating electricity the increase of 703 electric motors is explained.

Two hundred and thirty-eight notices were issued for extra guarding and repairs.

DIVISION IV.

Accidents to persons caused by Machinery and Boilers.

Despite the 838 new groups of machinery and 842 more inspections made, the number of accidents recorded was only 31 against 42 last year. But unfortunately the number of fatal cases was more than doubled, or five against two. In every case the verdict of the coroner's jury was that no blame was attachable to anyone and no suggestion was made for additional guards or safety appliances. In two instances the machinery had not been registered and was unknown to the Department, and it is highly

probable that neither would have happened if they had been inspected. A short description is given of each case, partly as examples of the deplorable want of care and thought amongst those working with machinery, and partly to show that accidents will occur however much care is taken by Inspectors to prevent them.

1. *Killed by burst emery-wheel.*—This machinery was not registered and therefore uncertificated. The owner was found in his workshop with the fragments of an emery-wheel round him, and died soon afterwards from the result of injuries to his head evidently caused by the flying pieces. Subsequent investigation proved that the emery-wheel was mounted improperly, because the spindle was too small in diameter and the collars too small and badly fitted. Official inspection would in all probability have prevented this accident.

2. *Clothing caught on revolving shafting.*—A mill hand on a large Kalgoorlie mine was engaged in securing a belt so as to keep it off the revolving shafting. He was standing on a platform or gangway alongside the shafting, and was last seen alive with his left hand loosely holding the belt, and his body about 12 inches away from shafting. He was reaching up with his right hand to a rope hanging down which was used for the purpose of securing the belt. In doing so his shirt and subsequently other parts of his clothing was seized by the shafting, and he was whirled round until almost dismembered through legs and arms striking the gangway before the machinery was stopped. The shafting was sticky with belt composition, and a witness at the inquest stated that "Deceased always had his shirt hanging out over the top of his trousers a little." He had frequently done this work during the previous two years.

3. *Hand crushed in bevel gearing—death from tetanus.*—A mill hand in this case was engaged in clearing a choked water-pipe on the top of an ore-roasting furnace. He need not have stood close enough to the bevel gearing to have his hand caught and could not explain subsequently how it occurred. The injured hand had to be amputated, and tetanus set in and caused death.

4. *Crushed between spoke of winding drum and machinery alongside.*—This occurred on a very large winding engine on the goldfields. It has two loose drums with a centre bearing between them, and the lubrication of the former is done by grease cups which are attended to once a day. To reach one of them the greaser has to insert half his body through the spokes of drum, and during that time the engine must not be moved. The operation takes only a few minutes.

The engine-driver who was unwittingly the cause of the fatality stated at the inquest that it had been the custom for years to grease the drums during the mid-day crib, and that after the engine was done with at noon the greaser would take up a position between the drums, and the driver would move the engine round until the grease cups were in a convenient position for filling. The greaser was not allowed to commence the greasing until given notice by the driver that the engine was safely at rest. On this occasion the driver had not finished with the engine, did not see the greaser waiting between the drums and did not suspect that he would be half inside the drum before he got permission. He

moved the engine and heard a groan, and then discovered that the greaser was crushed between the spoke of a drum and the pedestal of centre bearing. As the body was practically severed death was instantaneous.

5. *Drawn into moving engine by loose belt.*—The plant where this accident occurred was situated on an isolated dairy farm, and had been erected by the deceased. It had not been registered and its existence was unsuspected. It consisted of a small gas-engine driving a counter-shaft on the end of which was a crank actuating a horizontal pump. On the day of the accident the deceased intended using the pump, and having started up the engine he put the belt in position on the driven pulley and when working it on to the engine pulley it slipped off the former. This happened twice, and when approaching the countershaft to put it on again the third time it unaccountably got caught on the engine pulley and began to wind up, got entangled between the deceased legs and dragged him into the engine. After being whirled round two or three times he was pulled clear, but sustained injuries which proved fatal. On examination of the plant by an Inspector it was found that the belt was made up of odd pieces of canvas and rubber belting fastened together with fencing wire. Also that the countershaft had been unable to go round because of the connecting rod to the pump being jammed, which accounted for the belt slipping off the driven pulley. A more experienced man would probably have not been caught as he was, and previous inspection would at least have given the man advice and warning.

DIVISION V.

Board of Examiners for Engine-drivers.

Engine-driving matters occupied the Board for 56 days against 43 days last year, although the number of certificates issued was 13 less. Four examinations were held in Perth, and two each at Kalgoorlie, Leonora, and Bunbury. One hundred and seventy-three applications were received and one hundred and forty-eight certificates granted. One reason for this was that two examinations were held in Leonora which could not supply the necessary number of candidates last year. Another is that fewer candidates appeared for each examination. One satisfactory feature to be noted is the comparatively large number of First Class Certificates granted, because it is hoped that most of these will quickly qualify for the full Winding Grade and make up the shortage which threatens at present through many of the older drivers wishing to retire. Most of the best trained drivers come from the Sons of Gwalia Mine, and they have reason to be grateful to the manager and engineer for granting them facilities for obtaining the necessary experience required by the Act and encouraging them to progress step by step until the highest grade is reached. This kindly and very wise policy might well be followed by other mines.

The Board inquired into two overwinds and one runaway during the year. One was due to the very reprehensible practice of drivers and platmen sometimes arranging a short private code of signals from a certain level from which most of the hauling is done. A private code had been arranged for one level, but the driver forgot that a signal was from another and was really the authorised one. Fortunately no serious damage was done, and such incidents are not likely to occur again.

In another case a driver had neglected to have his steam engine-controls in good order, but as there were extenuating circumstances and no damage had been done he was seriously warned against a recurrence.

Considering the fast hauling on our large mines having from 10 to 30 levels and necessitating frequent changes of gear and careful attention to signals, it is a tribute to our winding engine-drivers that so few mishaps occur.

DIVISION VI.

General.

All the boilers and groups of machinery registered were inspected by the end of the year, but not as many boilers as I wish could be visited for working inspections under steam. Attention was drawn in another section of this Report to two explosions of small air receivers exempted by the size from the provisions of the Act, which could not have occurred had inspection been compulsory.

Work for the Standards Association entailed a certain amount of time during official hours in research for the guidance of the various committees, but the main work was conducted during the evenings. Twenty-four meetings were held, nineteen for boilers, three on lifts, and two on cranes and hoists.

Expenses to the amount of £13 12s. 6d. were incurred in inspecting boilers and machinery for Government non-trading concerns on which no fees are chargeable, which otherwise would have returned over £90.

In addition much advice on technical matters was given to other departments throughout the year.

Mileage.

The increased work for the year entailed about 2,000 miles more travelling, but the average number per inspection was slightly less—5.23 against 5.5 last year. Owing to the number of isolated centres in the goldfields, the average miles per inspection there is more than double than in the Metropolitan and South-Western Districts—9.9 against 4.7.

Staff.

Mr. Inspector Stone, who commenced his long service leave towards the end of 1929, was taken with a sudden illness early in the year and died on 17th January to the sorrow of all who knew him. With a sound knowledge of his work he carried great firmness tempered by a happy tactful manner that disarmed opposition.

Mr. R. W. Frankish who had been relieving him was appointed permanently. The remainder of the staff remained unaltered, and the satisfactory result of the year's work was due to the splendid esprit-de-corps and loyalty to the service existing in the Department.

I wish to thank all those officers of the Mines, Crown Law, Police and Postal Departments for assistance throughout the year, and especially you for ever willing advice and support.

I have, etc.,

B. PRYNN JONES,

Deputy Chief Inspector of Machinery.
9th March, 1931.

DIVISION VII.

ANNUAL REPORT OF THE CHEMICAL BRANCH, MINES DEPARTMENT, FOR THE YEAR 1930.

The Under Secretary for Mines, Perth.

Government Chemical Laboratory,
Perth, 31st January, 1931.

I have the honour to submit, for the information of the Hon. Minister, my report on the work of this Branch during the year 1930.

Staff and Equipment.

The technical staff at the end of the year comprised fifteen permanent officers and one temporary officer. A member of the Agricultural Section was on loan to the Commonwealth Government in connection with investigations into stock diseases. Mr. S. C. Palmer, who for many years was in charge of the Agricultural Section, and who after retirement had been temporarily employed for some months, died in harness during December to the regret of all with whom he had been associated.

The experimental flour mill, which was used to test the quality of all wheats under trial on the State farms and to decide the awards of prizes in connection with the Royal Agricultural Show, has finally broken down after 23 years continuous service. Unless this type of investigation is to cease it should be renewed immediately at an estimated cost of about £400.

A highly desirable addition to the equipment would be an ultra violet lamp, which in recent years is being more and more used by official chemists throughout the world in criminal and other investigations.

In other respects the Laboratory is well equipped, and with minor exceptions the equipment is in good order.

Material Examined.

The samples registered during 1930 numbered 5,242, as against 5,235 for the previous year. Their source and distribution is shown in the following table:—

Sources and Distribution of Samples received, 1930.

	Food, Drugs, and Toxicological Section.	Mineral Section.	Agriculture, Water Supply, and Sewerage Section.
Agricultural Bank ... ..	...	...	2
Department of Agriculture	81	1	521
Department of Health	83	...	5
Department of Mines	3	1,386	1
Department of Public Works	1	...	68
Explosives Branch	74	...	...
Forestry Department	6	...	83
Government Abattoirs	17	...	...
Government Laboratory	44	68	19
Government Stores	31	...	2
Geological Survey	5	49	13
Lands Department ... ..	...	...	6
Liquor Inspection Branch	57	...	...
Main Roads Board	5	...	...
Metropolitan Water Supply and Sewerage	3	...	1,461
Museum and Geological Gar- dens	2	...	...
Police Department	122	...	...
Premier's Department ... ..	...	...	3
Royal Agricultural Society ... ..	...	...	30
State Hotels	7	...	4
State Implement Works	1	...	...
State Saw Mills	1	...	1
State Insurance	6	...	...
State Meat Works, Wyndham	2	...	6
Public Pay	26	30	200
Public Free	25	665	16
	602	2,199	2,441
Grand Total ... ..	...	5,242	...

Foods.

Sixteen samples of foodstuffs were examined for compliance with the regulations. These included (in numerical order) butter, bacon, bread, and biscuits, tripe, confectionery, honey, etc. A fair proportion complied with requirements. In addition nine condiments were analysed. No abnormal results were obtained from any of them.

Child welfare clinics and maternity hospitals were assisted by the examination of 22 human milks. Only 18 bovine milks were dealt with, as a very large number are regularly tested at the Municipal Laboratory.

Beverages.

Forty-five alcoholic and twelve non-alcoholic beverages have been analysed. Spirits were mostly tested for alcohol content, and beers and non-alcoholic liquids for preservatives.

The Food and Drug Advisory Committee has met during the year, and considered amongst other matters the reduction of the proportion of alcohol permitted in sweets, which now stands at one per cent. (Reg. 44), and proposals to use glucose in ice cream (Reg. 46), and preservatives in non-excisable fermented drinks (Reg. 60).

Drugs.

The Police Offences (Drugs) Act was proclaimed in February, and is likely to lead to a certain amount of advisory and analytical effort on the part of the laboratory staff. The question of adding to the list of prescribed drugs several synthetic narcotics has already been under consideration.

Ten drugs or medicines were analysed. One, a proprietary article, contained 84 per cent. of phenazone, a drug the percentage of which must be declared on the label under Regulation 72. This drug was only declared to be present to the extent of 25 per cent., whilst two other declarable drugs which were present in smaller amounts were not declared at all.

In another case proof was forthcoming that a certain inflammatory drug was being criminally used in order to obtain compensation under the Workers' Compensation Act for an alleged occupational injury.

Toxicology.

One hundred and five cases of suspected poisoning were inquired into for the Police Department, and thirty-five others for the Agricultural Department and private persons. Some details will be found in Mr. Stacy's sectional report hereunder.* A point stressed by him is that when iron is present in large excess it masks certain of the standard tests for the presence of arsenic. This is especially important, as "dialysed iron" is not uncommonly given as an antidote, thus rendering the search for arsenic more difficult, besides introducing a possible error owing to the difficulty of establishing a "blank" for the antidote administered.

One unusual case was connected with the death of a valuable hippopotamus at the Zoological Gardens. The sick animal was suspected of having been pois-

* Not printed.

oned, but no poison could be detected, and a post mortem examination made later proved the sickness and subsequent death to be due to a rubber ball thrown into the animal's mouth and swallowed.

Explosives.

Seven complete analyses and sixty heat tests were made of explosives imported for local use.

Flotation Oils.

In view of the early opening of the Wiluna Gold Mines treatment plant, in which oil flotation is an important part of the process, a research was begun into the comparative yields of oil from local eucalypts and tittrees (*Melaleuca*), the composition of the oils, and their relative value as flotation agents. Preliminary investigations have already been made on *Eucalyptus rostrata*, *E. oleosa*, *E. leptopoda*, *E. spathulata*, *E. salmonophloia*, and a *E. sp.* (lemon scented mallee).

Tallow Decolorisation.

At the request of the Department of Agriculture a research was made into the possibility of decolorising a green tallow produced at the Midland Junction abattoirs, and only saleable at a much lower price than their first grade tallow. The cause of the coloration was first traced to chlorophyll from partly digested herbage, and after trial of other methods, an economical means of removing the colour by means of local fullers' earth was subsequently discovered and perfected in detail.

Metropolitan Water Supply.

Owing to its complexity the city water supply continues to take up the whole time of one officer and part of the time of others. The Advisory Committee, of which I am a member, has met at regular intervals, and considered various problems in connection with it. About 1,400 samples of water have been analysed in part or completely. Approximately 950 of these were examined for dissolved oxygen in connection with a proposal to de-aerate the water supply and thus reduce corrosion of pipes to a minimum. Regular tests of all sources of supply are made for mineral constituents, nitrogen compounds, and reaction. In the latter part of the year a new artesian bore was commenced close to the banks of the river in King's Park. At a depth of a little under 1,000 feet this developed a flow of two million gallons of water containing 78 grains of soluble salts per gallon (1,110 parts per million), of which 58 grains are potential sodium chloride. The pH is 7.8 and temperature 90 deg. F. It is proposed to use this water in the summer months to supplement the present city supply.

Country Water Supplies.

Several of the new small public supplies have been investigated. Those derived from bare granite catchments are very low in mineral matter, usually under five grains per gallon, but are sometimes affected in the hot weather by an abundant growth of vegetable and animal micro-organisms. This could and should be minimised by local "working bees" periodically removing from the catchment all rabbit and sheep carcasses and bones, and accumulations of dung, and other sources of nitrogen and phosphorus.

Farmers and pastoralists submitted 145 waters for partial analysis to determine their applicability. These were mostly ground waters from trial drill holes or wells. A large proportion of them were highly saline, some being unsafe even for sheep. The proportion of saline ones received is not, however, typical of the farming areas, as obviously good waters, pleasing or only faintly brackish to the human palate, are seldom sent for analysis, the human test being sufficient to decide their value.

Soils.

Over 200 soils were examined, mostly for their soluble salt content or pH value. Samples from any one area in the drier region on the fringe of the wheat belt were found to be contaminated with salt in proportions roughly corresponding to their clay content. The prevailing forest trees (*Eucalyptus* and *Melaleuca* spp.) appear to be highly tolerant of salt, so that a dense and vigorous stand of timber cannot be looked upon as always indicative of first-class wheat-growing land.

Fertilisers.

The ninety-one fertilisers examined proved in almost every instance to be well up to the registered standards. Requests for a reconsideration of the screening regulations for bone dust and blood and bone were investigated, and Regulation 7 was revised in June so that now the whole of such fertilisers must pass through a three-sixteenths inch screen, but only 55 per cent. (formerly 65 per cent.) must pass a 20-mesh I.M.M. screen.

In Victoria it is an offence to mix with blood and bone a nitrogen compound of "an inferior form," and sulphate of ammonia has been deemed to be such. In this State, unfortunately, there is no definition of "blood and bone" in the Act, and several samples on the market have been found to be charged with sulphate of ammonia to increase their nitrogen contents, as much as 2.5 per cent, of nitrogen being present as ammonia salts in one instance.

Denmark Cattle Disease and Gingin Sheep Disease.

In connection with my membership of the Departmental Committee inquiring into these diseases a large amount of chemical work has been carried out. Fodders, waters and soils have been subjected to examination, including in many cases minor constituents likely to have an effect upon animal nutrition and development. These investigations have not reached finality.

Wheat and Wheat Products.

From the State farms about 250 wheats were submitted in connection with breeding and culture experiments. These were mostly for moisture and nitrogen only, but some were for the determination of copper content and others for complete milling test. The usual batch of competitive wheats were milled, and the flour examined, for the Royal Agricultural Society, the championship going to a parcel of Comeback grown at Three Springs.

Brans and pollards were found for the most part to be in agreement with the official standards under the Feeding Stuffs Act.

Assistance to Prospectors.

There has been a distinct revival in prospecting during the year, partly because of unemployment in other directions, partly because of the premium on

gold and the stimulus of several new finds. Over 400 mineral determinations were made chiefly for prospectors, besides about 500 assays for gold. In addition 650 assays were made for the State Batteries, and an approximately similar number of bore samples were assayed for the State Mining Engineer. Besides gold assays, 77 assays were made for lead, 54 for copper, 26 for tin, 34 for tantalum, and 25 for titanium.

Alunite Deposits.

The investigation of our local sedimentary alunite deposits was continued. These occur right at the surface of salinas ("lakes") which are dry for the greater part of each year, and the mineral being only lightly compacted it could be readily exploited by means of dredges. In addition to Reward Lake and Chandler Lake at Campion, where such deposits were first proved to exist by officers of this Branch, sedimentary alunite has now been observed in Wolfe's Lake and another small lake five miles further south, as well as in several small lakes at Warrachuppin, 17 miles to the north-east, and in a lake at Kununoppin, 33 miles to the west. As at least two million tons of 55 to 70 per cent. alunite have been proved to exist down to a depth of five feet, experiments are being carried on to determine the possibility of producing from it a pure alumina for smelting into metallic aluminium, or alternatively alum and potash salts of commercial grade.

Commercial Caesium and Rubidium.

For the first time a commercial demand has arisen during the last few years for caesium, principally for wireless apparatus, and there is evidence of a demand also arising for rubidium, a closely related metal, for photoelectric and microchemical purposes. Some caesium having been detected in the State for the first time in beryl from Wodgina, a further search was made during the year for possible commercial supplies. So far the search for caesium has been disappointing, the highest proportion found in any mineral being 0.92 per cent. Cs_2O in Wodgina beryl. Rubidium has proved to be more plentiful, the highest figure being 2.34 per cent. Rb_2O in a Ravensthorpe lepidolite.

Tantalite.

A number of samples of tantalum ore still continue to be submitted for assay, though the main tantalite mine at Wodgina is closed down and the total ore exported only amounted to about two tons. The most of the samples received were alluvial manganotantalite from McPhee's Range, 20 miles east of Wodgina, but a new find of marketable ore was made at Two Sisters Hills near Moolyella. At pre-

sent buyers are loth to handle ore below 60 per cent. tantalic oxide, but there are indications that in future some of them may pay for the associated niobic oxide as well, which would widen the sources of supply, and increase the percentage paid for up to an average of 75 per cent.

New Mineral Discoveries.

Gold, Larkinville, Gen. Div. For the first time for many years a sensational series of gold nuggets were found at Larkinville at a shallow depth. The first public record was of the discovery in one day (18th December, 1930) of four nuggets weighing approximately 25, 30, 30 and 59 ounces. At short intervals several others even larger were found, culminating in the "Golden Eagle" of 1,135 ounces on the 15th January, 1931. This is by far the largest nugget ever found in the State, the previous record being held by the "Bobby Dazzler" of 487 ounces found in 1899, two miles south of Sharks Gully on Split Rock Station in the North-West.

Of far less importance, but of some local interest, was the discovery of alluvial gold at Jimperding Valley, near Toodyay, for the first time.

Cassiterite, Globe Hill, N.W. Div. Alluvial tin ore was found on Globe Hill Station, and its source subsequently discovered to be pegmatite of the usual type. This find is 225 miles away from Mt. Francis, the nearest previously known tin field. The tin ore was associated with felspar, quartz, muscovite, ilmenorutile, rutile, ilmenite, topaz, bismutite, agricolite, garnet and fluorite.

Mineral Phosphates, Ninghanboun Hills, S.W. Div. A number of mineral samples were received from here which contained up to 30 per cent. of phosphoric oxide. As there was a possibility that these might prove to be from an outcrop of phosphate rock of economic importance, the locality was inspected by myself. It was found that the phosphate minerals were confined to two small (2ft.) veins traversing a hill of serpentine. The tonnage available was too small to be of any commercial value and the phosphates were almost entirely iron compounds, dufrenite, etc., which have no fertilising value.

Meteorite, Bencubbin. A new meteorite was found on F. Breakall's wheat farm twelve miles N.W. of Bencubbin, and handed to me for investigation. It is a complete body, 119 lbs. in weight. In composition it appears to be about one-third nickeliferous iron, two-thirds silicates.

EDWARD S. SIMPSON, D.Sc., B.E., F.A.C.I.,
Government Mineralogist and Analyst.
Perth, 31st January, 1931.

DIVISION VIII.

REPORT OF THE CHIEF INSPECTOR OF EXPLOSIVES FOR THE YEAR 1930.

The Under Secretary for Mines.

I have the honour to submit, for the information of the Hon. the Minister for Mines, in compliance with Section 45 of "The Explosives Act, 1895," a report on the working of the Branch for the year 1930.

The following statement, table No. I., shows the quantities of explosives imported into the State during the year:—

TABLE I.

Importations of Explosives into Western Australia during 1930.

	Quantity in lbs.
Gelignite	413,500
Gelatine Dynamite	447,000
Blasting Gelatine	220,000
Permitted Explosives	61,000
Powder, Blasting and Pellet	150,000
Lig Dyn	10,000
Detonators (Number)	1,075,000
Fuse (Coils)	232,500

Table No. II., hereunder, gives a comparison of explosives imported into Western Australia during the past five years:—

TABLE II.

Comparison of Explosives imported into Western Australia during the past Five Years.

	1926.	1927.	1928.	1929.	1930.
	lbs.	lbs.	lbs.	lbs.	lbs.
Gelignite	586,000	663,000	640,000	337,000	413,500
Gelatine Dynamite	380,000	428,000	487,500	405,000	447,000
Blasting Gelatine	103,000	85,000	127,500	233,500	220,000
Permitted Explosives	35,000	40,000	57,000	47,500	61,000
Powder, Blasting and Pellet	92,500	221,250	152,250	207,500	150,000
Fuse (Coils)	204,000	247,280	202,500	213,000	232,500
Detonators (No.)	2,360,000	2,269,000	1,480,000	975,000	1,075,000

It will be noted from this table that there has been an increase in the importation of high explosives, while there is a slight falling off in regard to blasting powder.

Table No. III. shows the distribution and consumption of Explosives during 1930, with a comparison for the year 1929:—

TABLE III.

Distribution and Consumption of Explosives for Years 1929 and 1930.

	1929.		1930.	
	Lbs.	Percentage of Total.	Lbs.	Percentage of Total.
Gold Mining	836,300	74.00	935,900	80.85
Agricultural and Land Clearing	123,600	10.93	61,000	5.28
Government Departments, including Railways, Public Works and Water Supplies	21,700	1.92	28,500	2.40
Quarrying	101,800	9.00	86,500	7.49
Lead Mining	1,000	.08	550	.04
Coal Mining	42,500	3.76	43,000	3.71
Tin Mining ... ..	...	...	650	.05
Asbestos	1,750	.15	...	...
Manganese ... ..	...	...	250	.02

It will be seen from these figures that there has been a very distinct increase in the consumption of explosives of the nitro compound classes used in gold

mining, while that used in agriculture and land clearing has fallen away to about one half of that used in 1929.

The following licenses, Table No. IV., have been issued during the year for the storage and sale of explosives:—

TABLE IV.
Licenses issued during 1930.

For Magazines on Government Reserves	47
For Magazines used by Government Departments	27
For Magazines erected on Private Property ..	54
Store Licenses for the sale of Explosives—	
Mode (a)	107
Mode (b)	3
For sale of Fireworks only	343
Licenses for the preparation and use of Explosives of Class IV.—Chlorate Mixture	1
Licenses for the importation of Explosives into the State of Western Australia	2

Inspections of licensed premises were made throughout the greater part of the State, including the North-West as far as Wyndham. The total number of inspections made being 159.

As a result of these inspections it was not found necessary to take action against any persons for breaches of the Explosives Act, but the following explosives, Table V., were destroyed as not being fit for consumption, or for failing to pass the prescribed tests:—

TABLE V.

Destruction of Explosives during 1930.

Date.	Place.	Kind and Quantity.	Remarks.
31-1-30	Northcliffe	2,200 detonators	Owing to damage by water.
31-1-30	do.	300 detonators	do. do. do.
3-2-30	Pemberton	5 lbs. gelignite	Owing to exudation of nitro glycerine.
3-2-30	Manjimup	1,500 detonators	Owing to damage by water.
4-2-30	Bridgetown	2 lbs. gelignite	Owing to chemical deterioration.
5-3-40	York	2 lbs. gelignite	do. do. do.
10-3-30	Albany	5 lbs. gelignite	do. do. do.
11-3-30	Denmark	5 lbs. gelignite	do. do. do.
12-3-30	do.	200 detonators	Owing to damage by water.
24-7-30	Roebourne	9 lbs. sporting powder	Owing to chemical deterioration.
1-8-30	Wyndham	50 lbs. blasting powder	Owing to damage by water.
1-8-30	do.	2 lbs. gelignite	Owing to exudation.

The following number of tests, Table VI., were made with a view to ascertain whether the explosives imported into, or stored in the State, complied with the requirements of the Act:—

TABLE VI.

Tests and Analyses made during 1930.

Heat Tests	526
Complete Analyses	68
Fuse Tests	152
Fireworks	123
Velocity of detonation	36
A.D.C.	21
Tests of Detonators	128
Miscellaneous Tests	60

Application was received to have one new explosive added to the list of authorised explosives for manu-

facture, importation or keeping within the State. After thorough investigation and tests this explosive was added to the authorised list.

There were no new reserves for explosives declared during the year, therefore the number remains the same as last year, viz., 59, with a total area of 2,394 acres.

I desire to again acknowledge the courtesy of the Commissioner of Police and his officers for the assistance they have given to the Department during the year.

T. N. KIRTON,
Chief Inspector of Explosives.

12th February, 1931.