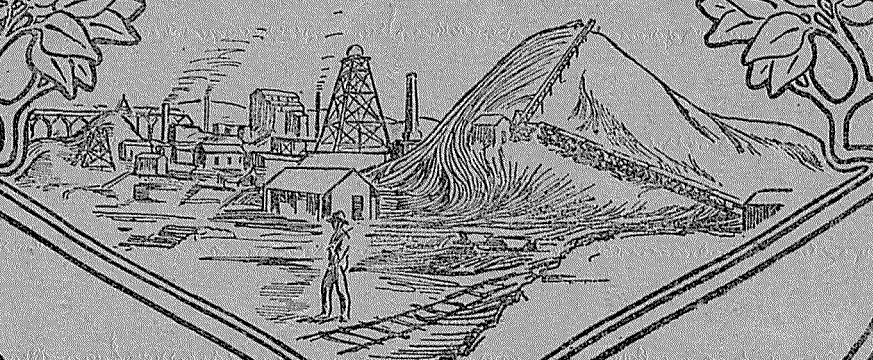




REPORT
OF THE
DEPARTMENT OF MINES
FOR THE YEAR
WESTERN · 1931 · AUSTRALIA



PRESENTED TO BOTH HOUSES OF PARLIAMENT

BY HIS EXCELLENCY'S COMMAND



H.C. HIGGINS

1932.
WESTERN AUSTRALIA.

REPORT

OF THE

DEPARTMENT OF MINES

FOR THE YEAR

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[SECOND SESSION OF THE FOURTEENTH PARLIAMENT.]

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

1932.

STATE OF WESTERN AUSTRALIA.

Report of the Department of Mines for the State
of Western Australia for the Year 1931.

To the Hon. the Minister for Mines.

Sir,

I have the honour to submit the Annual Report of the Department for the year 1931, 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.,

M. J. CALANCHINI,

Under Secretary for Mines.

Department of Mines,

Perth, 31st March, 1932.

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 1931.

The value of the mineral output of the State for the year was £2,524,557, being £333,000 greater than that for the previous year.

All minerals, excepting Gold, Arsenic and Tantalite showed decreases.

The value of the Gold yield was £2,168,771, being 85.90 per cent. of the total output.

The value of the Coal output was £336,178, Arsenic £7,291; Tin £3,945; Tantalite £2,953; Silver £2,833; Asbestos £1,446; Gypsum £304, and Lead £270.

The dividends paid by mining companies amounted to £53,125, and in the preceding year £31,250.

The total dividends paid to the end of 1931 amounted to £28,879,662. To the same date, the total mineral production was £177,813,224, and the total gold production £164,872,935. The value of gold is calculated at a fixed price of £4 4s. 11.45d. per fine oz. Sales of gold by the Gold Producers' Association averaged £5,825, £5,314, £4,693, £4,424, and £4,651.07 for the years 1920-1924 respectively, and owing to rate of exchange during part of year 1930 and whole of 1931 and premium higher prices were obtained. In addition the Commonwealth "Gold Bounty Act, 1930," was in operation during 1931. Amounts of £974,504, £590,428, £239,487, £89,158, £195,629, £90,780, £804,000, and £65,000, totalling £3,048,986, should therefore be added to arrive at the actual total value of gold produced.

GOLD.

The Gold yield shows an increase, being 94,203 fine ounces greater than in 1930, which was 39,193 fine ounces greater than in 1929.

The average value per ton of ore treated in the State as a whole has fallen from 54.95 shillings in 1930 to 44.81 shillings in 1931; and in the East Coolgardie Goldfield, which produced over 65 per cent. of the State's reported yield, it fell from 60.75 shillings to 54.05 shillings, but the added exchange and premium and gold bounty would increase the 1931 average by 50 or 60 per cent.

Table showing Results of Miner's Phthisis Examinations from inception of Act to 31st December, 1931 :—

Examinations.	Total No. of men examined.	Normals, etc.	Silicosis Early.	Silicosis, Advanced.	Silicosis plus Tuberculosis.	Tuberculosis only.
First Examination (1925-26)	4,023	{ 3,239 % 80.5	459 % 11.4	183 % 4.5	131 % 3.3	11 % .3
Second Examination (1927)	3,728	{ 3,116 % 83.6	381 % 10.2	93 % 2.5	128 % 3.4	10 % .3
Third Examination (1928)	3,483	{ 2,977 % 85.5	362 % 10.4	98 % 2.8	42 % 1.2	4 % .1
Fourth Examination (1929)*	2,588	{ 2,120 % 81.9	326 % 12.6	94 % 3.6	41 % 1.6	7 % .3
Fifth Examination (1930)	3,399	{ 2,785 % 81.9	383 % 11.3	67 % 2.0	114 % 3.3	50 % 1.5
Sixth Examination (1931)*	3,012	{ 2,530 % 84.0	346 % 11.5	53 % 1.8	58 % 1.9	25 % .8

*NOTE.—No examinations at the outlying Goldfields were carried out in 1929 or 1931, only the men employed in the Mines in Kalgoorlie and surrounding districts being examined during those years.

Comparing the tonnage of ore treated in 1930 and 1931 there was an increase of 336,818 tons in the latter year, during which 982,162 tons were treated.

There were increases in East Murchison, East Coolgardie, Coolgardie, Murchison, Yilgarn, Mount Margaret, Yalgoo, Peak Hill, Dundas, Broad Arrow, Pilbara, and North-East Coolgardie Goldfields, and from the State generally of 221,685, 71,922, 8,435, 8,115, 7,677, 6,114, 5,618, 5,046, 3,746, 2,128, 1,654, 585, and 58 tons respectively.

In the North Coolgardie and Phillips River Goldfields there were decreases of 5,878 and 87 tons respectively.

There were increases in the production from every field excepting Gascoyne and Kimberley, where very little gold mining is going on.

The acreage held under Mining Lease for all minerals is 53,052 acres, being a decrease of 53 acres when compared with 1930.

The area held for Gold Mining is greater by 628 acres and for other minerals lesser by 681 acres.

The area held under Prospecting Areas is 34,815 acres, including 4,419 acres for Coal.

There is a decrease of 803 acres on the area held in 1930, the area held for Coal being lesser by 15,021 acres, and for other minerals greater by 14,218 acres.

The number of men engaged in all classes of mining was 7,147; an increase of 1,705 on the number employed in 1930. The number of men engaged in mining for minerals other than gold showed a decrease of 187, principally due to a falling off in the numbers employed in mining for Coal. Tin, Copper, Asbestos, and Gypsum also had decreases, but Tantalite and Lead increases. In Gold mining there was an increase of 1,892.

The average value of gold produced per man employed on gold mines was £414.85 in 1930 and £372.82 in 1931.

The average tonnage raised per man was 171.55 tons, and in the previous year 150.64 tons.

The sixth periodical examination under the Miner's Phthisis Act of persons employed in the Mines was completed on the 31st December, and the results of this examination, together with the results of previous examinations, are shown in the following table:—

The figures for 1931 indicate a substantial improvement as compared with those for 1930. There are still a very considerable number of men employed in the mines, however, who have been mining for many years, but with the gradual elimination of these old miners, and the introduction into the mines of a gradually increasing number of men of specially selected physique as a result of the initial examination introduced in 1927, combined with the improved standard attained in the mines during recent years as regards dust prevention and ventilation, it is anticipated that the position will show a marked improvement from now onward.

In the East Murchison Field there was an increase of 61,207 fine ounces.

In the Black Range district many prospectors were at work in the various centres and a result was an improved output. From Bellechambers some new discoveries were reported and the discoverers had satisfactory crushings. At Montague a plant was erected on the old Caledonian Lease and several other old shows were being worked.

At Sandstone prospects had greatly improved and a fair number of men were working.

In the Lawlers district, although there was a small increase in production, there was practically no change, mining being mostly confined to the treatment of accumulated sands. From Mount Sir Samuel one small crushing was reported.

In the Wiluna district there was a substantial increase, largely attributable to the output from the Wiluna Gold Mines, Ltd., but production from the smaller mines throughout the district also showed a very creditable increase. Mount Keith, after having been deserted for some years, reported several crushings.

At Cole's Find, Corboy's Find and Diorite mining was very active.

At Wiluna production from the big mine commenced in April, and it is anticipated that a substantial monthly output will be maintained for many years. The outlook for this mine is most promising.

The Murchison field had an increase of 5,032 fine ounces.

In the Meekatharra district there was an increase, the bulk of the production coming from the Meekatharra centre.

In the various other centres a great many prospectors were working.

In the Cue district there was an increase. Mining was active throughout the district and had the State Battery at Cue been able to cope with a larger tonnage the gold output would have been much larger. It is proposed to remedy this in the New Year by the erection of a new State Mill.

In the Day Dawn district there was also an increase. From Day Dawn there were several crushings from various prospecting areas.

At Lake Austin Messrs. Walker acquired the old "Eureka" Mine and during the year struck rich gold and reported some sensational returns.

They confidently expect to continue their, so far, most successful operations.

At Mainland and Pinnacles a good deal of prospecting was in evidence.

In the Mount Magnet district there was a small increase.

In the neighbourhood of Mount Magnet the "Hill 60" was a regular producer and the "Hesperus Dawn" also reported a good crushing.

At Lennouville there was a decided revival and many prospectors were at work. This was also the case at Paynesville.

The Peak Hill Field had an increase of 1,976 fine ounces.

The principal production was from the vicinity of Peak Hill but outputs were also reported from Horseshoe, Jimble Bar, Murphy's Well, Mount Seabrook and Nabberu.

The manganese deposits at Horseshoe remained unworked throughout the year.

The Yalgoo Field had an increase of 1,495 fine ounces.

A State Battery has been erected at Yalgoo and commenced operations in October. It is anticipated that this will greatly stimulate prospecting in the adjacent districts. In the various outlying centres a considerable amount of prospecting was in evidence.

The Mount Margaret Field had an increase of 4,021 fine ounces.

In both the Mount Margaret and Mount Morgans districts there was not much change, but it is proposed to carry out some diamond drilling on the old "Lancefield" Mine in the former, with a view to endeavouring to locate payable ore bodies below the depth reached when the mine closed down. The result will be of considerable interest to both the district and the State.

In the Mount Malcolm district there was a substantial increase in the output from the "Sons of Gwalia," the principal mine. This property is being developed splendidly and looks to have many prosperous years ahead of it. Elsewhere in the district there was a fair amount of prospecting.

The Coolgardie Field had an increase of 6,600 fine ounces. This year was probably the brightest that has been experienced for many years. In the immediate vicinity of Coolgardie a great many prospectors were operating and many crushings were raised. The local State Battery was running continuously without being able to cope with all the ore available for treatment.

At Gibraltar there were satisfactory crushings from the "Lloyd George."

At St. Ives a fair amount of work was being done and crushings were reported by tributers on the Ives Reward. At Widgiemooltha there was a considerable increase in mining activity, and at the alluvial workings at Larkinvale a sensation was caused when, on 15th January, a miner named Larcombe unearthed the State's record nugget named the "Golden Eagle" from its shape, and weighing 1,134 ounces 12 dwts. The standard gold content was 1,057.94 ozs. and silver content 60.44 ozs. This resulted in a rush to the locality and a considerable amount of alluvial gold was won. At one time it was estimated that 1,000 men were there and at the end of the year 150 were still searching for alluvial, and there was a steady production.

At Wannaway a very promising discovery was made and a good crushing reported.

At Higginsville there was an increased number of prospectors working.

From the Kununalling centre there was an increased output and mining generally was more active.

The North Coolgardie Field had an increase of 238 fine ounces.

In the Menzies district there was a considerable decrease, consequent on the cessation of operations on the Sand Queen-Gladsome at Comet Vale and the "Golden Age" at Menzies.

At Menzies a number of excellent crushings were recorded, and a new discovery adjacent to the town and which is very promising, was reported. From Yunndaga there were several rich crushings. At Goongarrie some remarkable returns were got. One party in addition to a crushing of 28 tons returning 298 fine ounces recovered 793 fine ounces by dollying, a total of 1,091 fine ounces. Other parties also reported good returns.

At Comet Vale matters were quiet.

At Mount Ida there was a revival in prospecting and some parcels were treated at the State Mill.

In the Ularring district there was an increased output, mostly from operations at Mulwarrie and Davyhurst. At Riverina nothing was being done.

In the Yerilla district there was an increase and prospecting was very active.

Many prospecting areas were taken up at Yarri, Edjudina and Pingin, and the State Battery at Yarri treated a good deal of ore. Yerilla was practically deserted.

The Niagara district also had an increase. Most of the output was from Tampa, where a good many men were at work:

Crushings were also reported from Kookynie, Niagara and Jessop's Well.

The North-East Coolgardie Goldfield had an increase of 130 fine ounces.

In the Kanowna district, although more prospectors were out, their efforts were mostly concentrated on the old centres and no discoveries of importance were reported. A good return was obtained from a prospecting area at Gordon, and from Gindalbie several were reported, but not of any great value.

In the Kurnalpi district, although a few men were working, nothing of any importance was recorded.

The Broad Arrow Field had an increase of 2,451 fine ounces. In all centres on this field a great many prospectors were working and results were most satisfactory. Fenbark realised the prediction expressed last year, and several good crushings were recorded.

At Ora Banda the State Mill was operating throughout the year and a large tonnage was put through.

From Grant's Patch, Waverley and Bardoc crushings were reported.

At Cashman's, Dark Horse and Paddington a good deal of prospecting was in evidence, but nothing of note transpired.

Towards the end of the year the discovery of payable gold was reported from a locality North-Westerly from Carnage, and a mild rush resulted. The discoverers panned off a good deal of gold from ore at grass which is said to be exceptionally rich. The country is impressive from a prospecting point of view and the outlook is promising.

From the Broad Arrow centre some good crushings were reported.

In the East Coolgardie Goldfield the number of men engaged in mining was 2,388, and in 1930, 2,065; an increase of 323. This goldfield gave employment to over 37 per cent. of the number of men employed in gold mining, and the reported production during the year was 337,840 fine ounces, over 65 per cent. of the total reported yield.

The tonnage treated was 531,027 tons, being 71,922 tons greater than in 1930. The yield showed an increase of 9,214 fine ounces on the preceding year.

The average grade of the ore per ton fell from 60.75 shillings in 1930 to 54.05 shillings in 1931.

Steady production was maintained by all the large mines, the principal producer being the Lake View and Star. A new up-to-date plant is in course of erection on this mine and also on the Boulder Perseverance. Satisfactory results are anticipated from each and the managements deserve much credit for their enterprise. Many tributers are still operating and contributed largely to the output.

At the North end of the field mining was again active, and the Broken Hill Proprietary Company has acquired an option on the old "Hannans North." At Binduli, Feysville, Celebration and Golden Ridge a good deal of prospecting was being done.

In the Bulong district the most activity was at Mt. Monger, where several shows were being worked.

The Yilgarn Field had an increase of 2,921 fine ounces. In the Bullfinch centre mining was very active. Several good crushings were reported and a new find, which promises well, discovered. From Holleton several outputs were recorded. At Manxman the "Radio" and "Radio Deeps" were the largest producers, but other properties reported productions and many prospectors were about. Crushings were reported from Hope's Hill, Marvel Loch, Mount Jackson and Parker's Range. At Westonia there was a good deal of activity and several crushings, and the future prospect for this district is bright.

In the Southern Cross centre increased activity was very marked. Several good crushings were put through and a movement is on foot for the provision of local crushing facilities.

The Dundas Field had an increase of 1,263 fine ounces. The principal producer was the "Mararoa No. 1" but several other mines had crushings. The local State battery had quite a good run but most of the prospectors' returns were of low value. No new find of importance was reported.

The Phillips River Field had an increase of 22 fine ounces. A fair proportion of the output came from Hatter's Hill, where an average of 30 prospectors are working. Increased activity was noticeable at Kundip towards the end of the year and although no crushings had been put through there was considerable ore at grass.

The Pilbara Field had an increase of 1,726 fine ounces. No new finds of any note were reported, but prospecting throughout the field was active.

There was not any production from the West Kimberley Goldfield.

The Ashburton Goldfield had an increase of 23 fine ounces, the Kimberley Goldfield a decrease of 61 fine ounces, and the Gascoyne Goldfield a decrease of 7 fine ounces. In each of these fields mining is practically confined to fossicking for alluvial.

From districts outside the proclaimed goldfields crushings were reported from Burracoppin and the deposit being worked is considered promising.

At Wongamine, near Northam, a number of mining tenements were applied for towards the end of the year, all on private property, but insufficient work has been done so far to prove whether gold exists in payable quantities.

From the Jimperdine alluvial field in the Toodyay district, all comprising private property, 43.55 fine ounces of gold were reported and prospectors ranging in number from 40 to 100 were engaged during the whole year. Gold was obtained in small quantities over a wide area, but no definite evidence of a payable reef is yet forthcoming.

TIN.

The quantity of Tin exported was 39 tons, valued at £3,945; a decrease in tonnage of 23 tons, and in value of £6,663. The only production reported was 6.30 tons, valued at £531, from the Pilbara Goldfield; a decrease on the previous year in tonnage of 5.50 tons, and in value of £797.

TANTALITE.

Twelve (12) tons, valued at £2,953, were exported; an increase in tonnage of 9 tons, and in value of £1,699 on the previous year.

COPPER.

No Copper was exported, and no production was reported.

COAL.

The output of Coal was 432,400 tons, being 69,025 tons less than in 1930.

No work was done on the deposits at Wilga. All the production was from the Collie Field, where six (6) collieries were working most of the year.

The number of men employed, 752, is lesser by 144 than in 1930, and the output per man was in 1930, 560 tons, and in 1931, 575 tons.

OIL.

The Freney Kimberley Oil Company during the year shifted the boring plant to a fresh site on the area held by it on the West Kimberley Goldfield, and started drilling another deep hole. The results will be awaited with interest. In other parts of the State prospecting has been carried out, but no outstanding results have been reported, nor any deep boring undertaken.

ASBESTOS.

The reported production was 2.57 tons, valued at £36, from the Pilbara Field; a decrease in tonnage of 62.73 tons, and in value of £4,192; also from the West Pilbara district 105.50 tons, valued at £1,410; an increase in production of 88.50 tons, and in value of £910.

OTHER MINERALS.

The quantity of Silver obtained as a by-product and exported was 43,739 ounces, valued at £2,833; a decrease on the preceding year of 2,609 ounces, and in value of £915.

Lead and Silver Lead, amounting to 24 tons, valued at £270; a decrease in tonnage of 367 tons, and in value of £5,312, was exported.

Also 409 tons of Arsenic, valued at £7,291; 104 tons of Felspar, valued at £423; 7 tons of Pottery Clay, valued at £22, and 24 tons of Sand, valued at £35.

The production was reported of 30 tons of Fuller's Earth, valued at £86, and 222 tons of Gypsum, valued at £304; a decrease in tonnage of 1,436 tons, and in value of £1,850 on the preceding year.

MINING GENERALLY.

The West Australian gold production was 69.78 per cent. of the total for Australasia, and in the preceding year 70.39 per cent.

Consequent on financial stringency, it has been impossible to continue assistance as liberally as in previous years, but whatever was possible was done. Cartage subsidies and concessions at State Batteries were reduced, but ore producers have had the compensating advantage of a greatly enhanced price for gold.

In mining for base metals there was not any improvement nor any indications to justify a prediction of a revival. The ruling prices continued at a very low ebb and consequently mining for the greater number was almost entirely neglected.

In gold mining the improved activity noted in last year's report was well maintained and the fact that practically every goldfield in the State reported an increased yield is most gratifying.

Two very helpful factors, apart from the gold bonus, are the rate of exchange and the enhanced price of gold resulting from the departure from the gold standard by Great Britain.

During the year the Federal Government decided to reduce the bonus payable on all gold produced each year for a period of 10 years, commencing on 1st January, 1931, in excess of the average number of fine ounces produced annually during the years 1928, 1929 and 1930 from £1 for each ounce of fine gold to 10s. per ounce with the proviso that for every reduction in the exchange rate by three per cent. the bounty is increased by 1s. per ounce until the full 20s. is restored. The alteration is operative from 1st July, 1931. Consequent on the limited funds available assistance to prospectors was almost entirely restricted to loan of equipment and transport facilities.

There was a very marked increase in the number of applications for assistance. The Board dealing with this activity granted 509 applications, representing 992 men, and extended 236 existing, comprising 405 men. The expenditure had to be watched carefully, and was kept down to the remarkably low figure of £1,987 12s. 1d., equivalent to £2 0s. 1d. per man. From the 1st September, 1919, when the State Prospecting Board came into existence, 2,535 parties, employing 4,152 men (including five specially selected State prospecting parties) have been assisted at a total cost of £72,465 18s. 4d. 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. Quite a lot of low-grade but payable ore was also crushed.

Weather conditions throughout the year were generally favourable, good rains over the Eastern Goldfields being reported late in November.

The area under prospecting areas, for gold and minerals, apart from Coal, viz., 30,396 acres, is 14,128 acres in excess of that held during the preceding year, and indicates the great activity in prospecting right throughout the goldfields. Apart from those assisted by the Government, there are considerable numbers out who are either relying on their own resources or are being backed by friends.

The expenditure incurred in rendering assistance to mine owners and the industry generally under the provisions of the Mining Development Act totalled £30,545 8s. 4d., and in the preceding year £59,137 17s. 3d. 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 Minerals produced during Years 1930 and 1931.

Description of Minerals.	1930.		1931.		Increase or Decrease for Year compared with 1930.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
		£		£		£
1. Arsenic (exported), statute tons ... ..	...	...	409	7,291	+ 409	+ 7,291
2. Asbestos (reported), statute tons	82	4,728	108	1,446	+ 26	+ 3,282
3. Coal (raised), statute tons	501,425	394,758	432,400	336,178	- 69,025	- 58,580
4. Copper Ore (exported), statute tons	10	102	...	...	- 10	- 102
5. Felspar (exported), statute tons ... ..	...	...	104	423	+ 104	+ 423
6. Fuller's Earth (reported), statute tons ... ..	...	...	30	86	+ 30	+ 86
7. Gold (exported and minted), fine ozs.	416,369	1,768,623	510,572	2,168,771	+ 94,203	+ 400,148
8. Gypsum (reported), statute tons	1,658	2,154	222	304	- 1,436	- 1,850
9. Lead and Silver Lead Ore (exported), statute tons	391	5,582	24	270	- 367	- 5,312
10. Pottery Clay (exported), statute tons ... ..	...	...	7	22	+ 7	+ 22
11. Sand (exported), statute tons ... ..	...	...	24	35	+ 24	+ 35
12. Silver (exported), fine ozs.	46,348	3,748	43,739	2,833	- 2,609	- 915
13. Tantalite (exported), statute tons	3	1,254	12	2,953	+ 9	+ 1,699
14. Tin (exported), statute tons	62	10,608	39	3,945	- 23	- 6,663
	...	£2,191,557	...	£2,524,557	...	+ £333,000

TABLE 2.

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

Year.	Total Exports.	Mineral Exports (exclusive of Coal)	Percentage.
	£	£	
1902	9,051,358	7,530,319	83.20
1903	10,324,732	8,727,060	84.53
1904	10,271,489	8,625,676	83.98
1905	9,871,019	7,731,954	78.33
1906	9,832,679	7,570,305	76.99
1907	9,904,860	7,544,992	76.17
1908	9,518,020	7,151,317	75.13
1909	8,860,494	5,906,673	66.66
1910	8,299,781	4,795,654	57.78
1911	10,606,863	7,171,638	67.61
1912	8,941,008	5,462,499	61.09
1913	9,128,607	4,608,188	50.48
1914	8,406,182	3,970,182	47.23
1915	6,291,934	2,969,502	47.19
1916	10,878,153	6,842,621	62.92
1917	9,323,229	5,022,694	53.87
1918	6,931,834	2,102,923	30.34
1919	14,279,240	6,236,585	43.67
1920	15,149,323	3,096,849	20.44
1921	10,331,405	1,373,810	13.30
1922	11,848,025	2,875,402	24.27
1923	11,999,500	3,259,476	27.16
1924	13,808,910	1,424,319	13.24
1925	13,642,852	173,126	1.27
1926	14,668,184	1,597,698	10.89
1927	15,805,120	472,041	2.99
1928	16,911,932	996,099	5.88
1929	16,660,742	1,802,709	10.82
1930	19,016,639	6,370,396	33.49
1931	14,266,650	4,333,421	30.37
Total since 1902 ...	344,830,764	137,746,128	39.94

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.					
	1930.	1931.	Percentage for each Goldfield.		Average Value of Gold per ton of Ore treated.	
			1930.	1931.	1930.	1931.
	fine ozs.	fine ozs.			shillings.	shillings.
1. Kimberley	63	2	.015	.001	...	174.44
2. Pilbara	2,268	3,994	.540	.771	159.27	120.87
3. Ashburton	3	26	.001	.005	...	...
4. Gascoyne	11	4	.003	.001	...	...
5. Peak Hill	1,074	3,050	.256	.589	41.81	37.08
6. East Murchison... ..	2,453	63,660	.584	12.288	120.44	24.21
7. Murchison	21,126	26,158	5.033	5.049	43.18	45.01
8. Yalgoo	2,191	3,686	.522	.711	58.42	37.07
9. Mt. Margaret	39,465	43,486	9.401	8.394	31.75	33.18
10. North Coolgardie	7,028	7,266	1.675	1.403	53.67	121.00
11. Broad Arrow	2,465	4,916	.587	.949	41.95	61.91
12. North-East Coolgardie	659	729	.157	.152	150.28	79.44
13. East Coolgardie	328,626	337,840	78.288	65.214	60.75	54.05
14. Coolgardie	3,707	10,317	.883	1.992	53.97	66.12
15. Yilgarn	6,373	9,294	1.518	1.794	63.17	48.61
16. Dundas	2,014	3,277	.480	.633	64.42	43.62
17. Phillips River	141	163	.033	.032	62.79	143.17
State generally	160	117	.024	.022	131.22	105.16
Totals and averages	419,767	513,045	100.000	100.000	54.95	44.81

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, Perth, which includes alluvial gold and gold not reported to the Department.

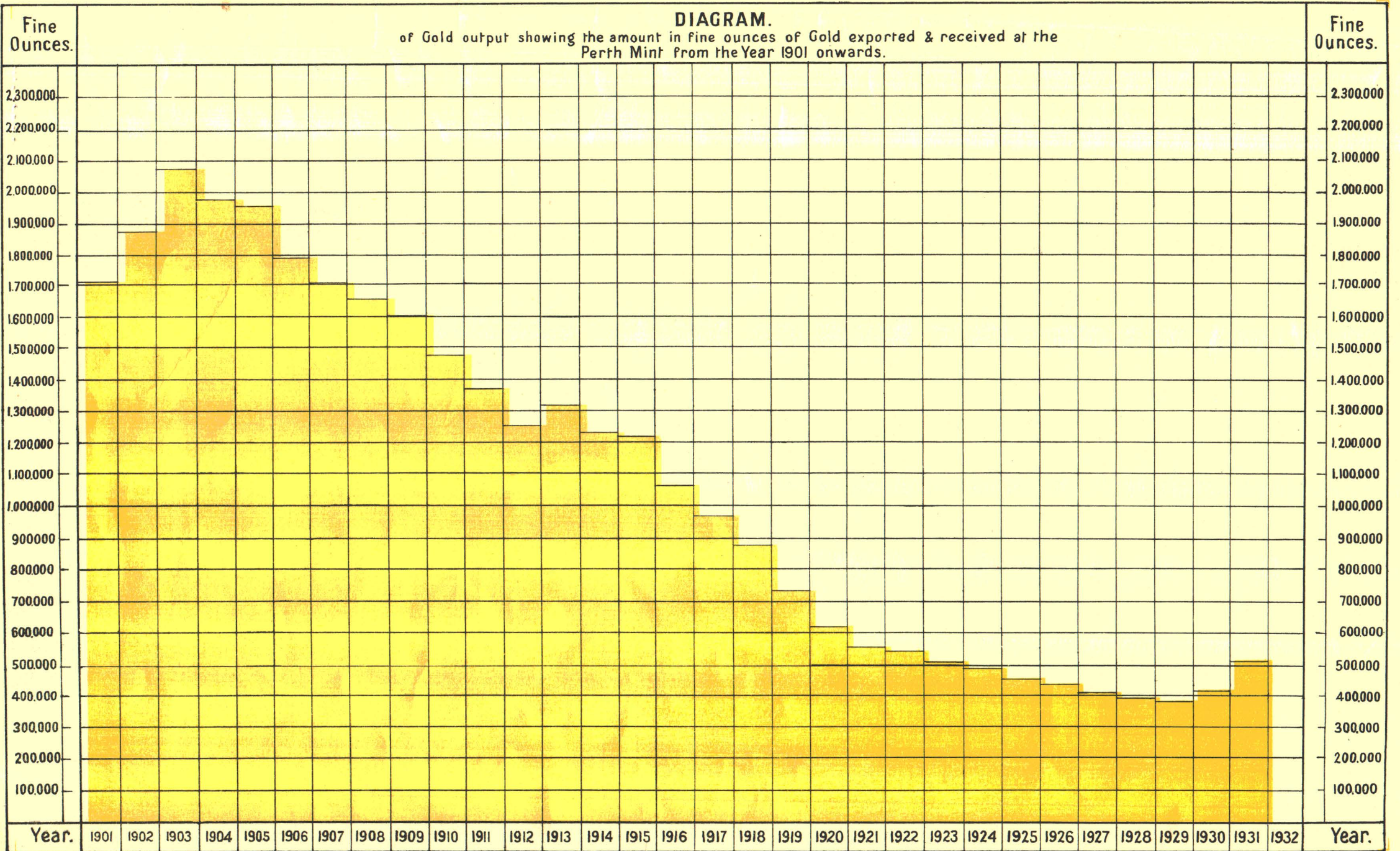
When comparisons are made as to the yield from any particular field with the preceding year, the figures reported to the Department are used.

TABLE 4.

Averages of Gold Ore raised and treated, and Gold produced therefrom, per man employed on the several Goldfields of the State, during 1930 and 1931.

Goldfield.	1930.				1931.			
	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	31.16	16.71	58.37	31.30	49.25	23.01	70.07	32.74
3. Ashburton ... ..	...	...	...	...	...	...	...	...
4. Gascoyne ... ..	...	...	...	...	...	...	...	...
5. Peak Hill	114.15	66.91	56.18	32.93	317.57	139.73	138.61	60.99
6. East Murchison	10.00	3.05	14.17	4.33	526.90	267.87	150.14	76.33
7. Murchison	209.44	104.45	106.45	53.09	184.92	83.54	97.97	44.26
8. Yalgoo	55.47	27.46	38.14	18.88	53.13	29.03	23.13	12.67
9. Mt. Margaret	489.49	271.24	182.92	101.36	389.34	245.27	152.05	95.78
10. North Coolgardie	130.71	63.10	82.58	39.87	43.23	19.47	61.58	27.73
11. Broad Arrow	74.48	36.65	36.78	18.10	71.01	31.67	51.75	23.08
12. North-East Coolgardie	13.61	6.01	24.08	10.64	27.21	11.83	25.44	11.11
13. East Coolgardie	424.70	226.94	303.71	162.28	426.87	222.37	271.57	141.47
14. Coolgardie	69.85	31.50	44.38	20.01	83.36	22.89	64.88	17.82
15. Yilgarn	142.74	59.06	106.13	43.92	149.00	59.49	85.26	34.04
16. Dundas	90.90	44.68	68.94	33.88	187.72	86.25	96.38	44.28
17. Phillips River	46.25	18.50	34.18	13.67	16.21	9.72	27.31	16.39
Total Averages	307.45	150.64	198.86	97.43	325.29	171.55	166.42	87.77

The average value of gold produced per man above and under ground was £414.85 in 1930, and £372.82 in 1931. The average tonnage of ore raised shows an increase from 150.64 tons to 171.55 tons. The average tonnage raised per man was highest in the East Murchison Goldfield, viz., 267.87 tons, average value £324.25; the next being Mt. Margaret Goldfield with 245.27 tons, average value £406.9. (Values calculated on normal price of fine gold.)



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

TABLE 5.

Output of Gold from the several States of Australia, the Northern Territory, Papua, and the Dominion of New Zealand during 1931.

State.						Output of Gold.	Value.*	Percentage of total Output of Australasia.
						Fine ozs.	£	
1.	Western Australia	...	...	...	...	510,572	2,168,771	69·78
2.	Victoria	...	...	...	...	43,638	185,362	5·96
3.	New South Wales	...	...	...	...	19,673	83,565	2·69
4.	Queensland	...	...	...	...	13,147	55,845	1·80
5.	South Australia	...	...	...	...	2,782	11,817	·38
6.	Tasmania	...	...	...	...	4,760	20,219	·65
7.	Papua	...	...	...	...	6,760	28,715	·92
8.	Northern Territory	...	...	...	...	642	2,727	·09
9.	New Zealand	...	...	...	...	129,720	551,015	17·73
Total						7,11,694	3,108,036	100·00

* Exclusive of premium.

TABLE 6.

Dividends paid by Western Australian Mining Companies during 1931 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.	Paid up to.	Paid in 1931.		Grand Total paid to end of 1931.
						No.	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	Great Boulder Proprietary G.Ms., Ltd.	175,000	1,750,000	0 2 0	0 2 0	1	21,875	6,085,967
Do.	South Kalgoorlie Consolidated, Ltd.	150,000	250,007	0 10 0	0 10 0	2	31,250	533,751
Do.	Other Companies	...	...	...	...	...	...	16,423,734
Coolgardie	Various Companies	...	...	...	...	...	...	339,495
Yilgarn	Various Companies	...	...	...	...	...	...	513,199
Dundas	Various Companies	...	...	...	...	...	...	222,625
							53,125	28,879,662

TABLE 7.

Quantity and Value of Minerals, other than Gold and Coal, reported to the Mines Department during 1931.

Goldfield, District, or Mineral Field.	1931.		Increase or Decrease for Year compared with 1930.	
	Quantity.	Value.	Quantity.	Value.
	tons.	£	tons.	£
BLACK TIN.				
Pilbara Goldfield (Marble Bar District)	6.30	531	— 5.50	— 797
Yilgarn Goldfield ... ..	...	...	— .60	— 46
Greenbushes Mineral Field ... ..	...	...	— .65	— 63
Total	6.30	531	— 6.75	— 906
ASBESTOS.				
Pilbara Goldfield (Marble Bar District)	2.57	36	— 62.73	— 4,192
State generally (West Pilbara)	105.50	1,410	+ 88.50	+ 910
Total	108.07	1,446	+ 25.77	— 3,282
GYPSUM.				
Yilgarn Goldfield	117.00	117	— 489	— 489
State generally	105.00	187	— 870	— 1,197
Total	222.00	304	— 1,359.00	— 1,686
FULLER'S EARTH.				
Broad Arrow Goldfield	30.00	86	+ 30.00	+ 86

The ruling prices for base metals continued at a very low ebb during the year, and the high value obtainable for gold resulted in the winning of copper, lead, tin and other ores being almost entirely neglected. The only output of black tin came from the Pilbara Goldfield, and showed a further decrease in tonnage and value, being 6.75 tons and £906 less than 1930 respectively. The market for asbestos was very limited and the production declined by 25.77 tons, and the lower prices obtained reduced

the value by £3,282. As a result of the restricted building operations, the quantity of gypsum required was much less than in previous years, and showed a reduced output of 1,359 tons and in value £1,686. Towards the end of the year a parcel of Fuller's Earth was raised from the Broad Arrow Goldfield, but it is yet too early to learn whether there will be a demand for the product. No further information was available regarding the value of emeralds reported in 1930.

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 1931.

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

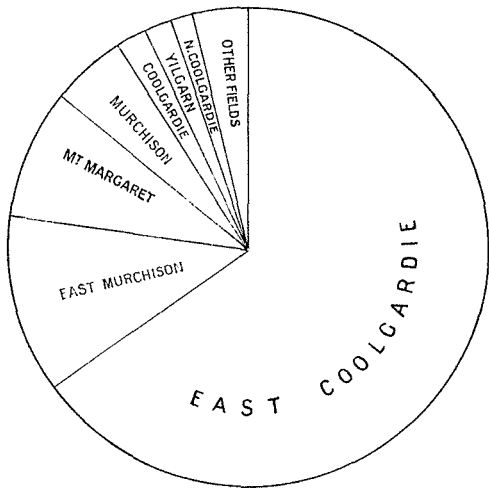


FIG. 2. Gold produced from various Goldfields as given by the Export and Mint Returns.

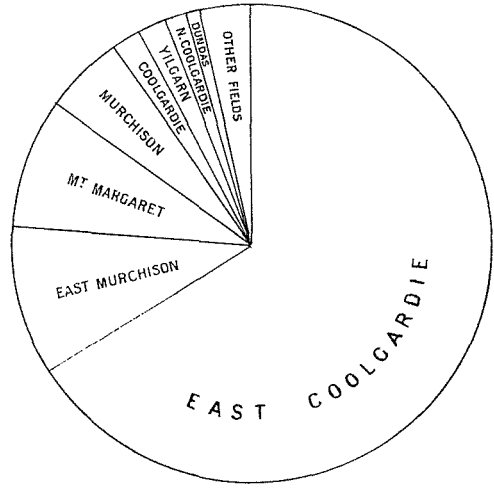


FIG. 3. Value of Gold and other Minerals.

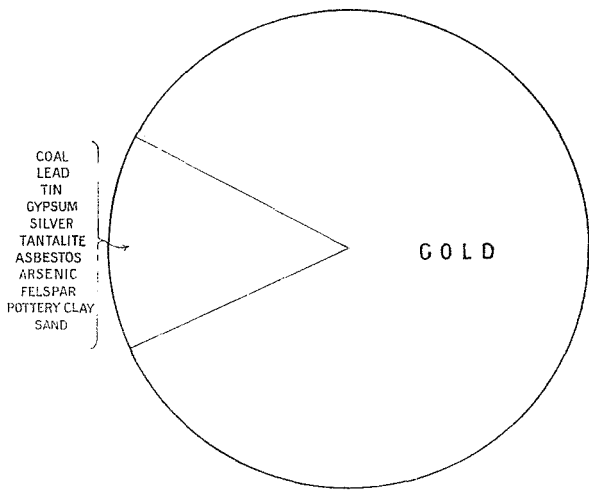


FIG. 4. Value of Minerals other than Gold.

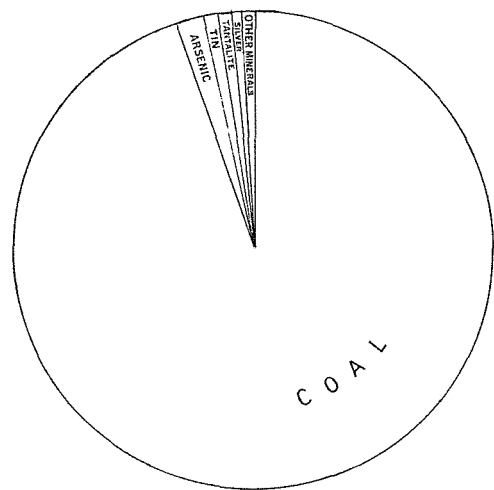


FIG. 5. Areas of Land leased for Goldmining on various Goldfields.

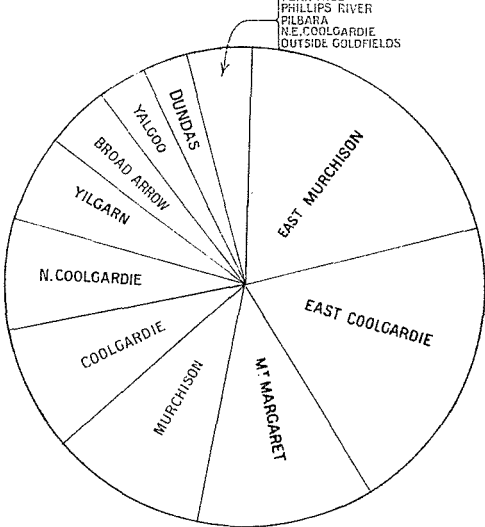
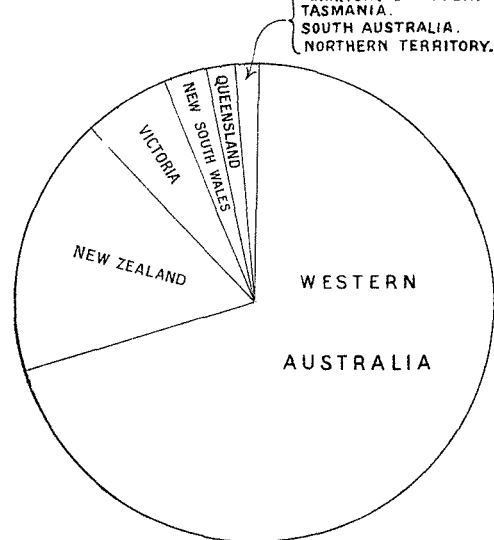
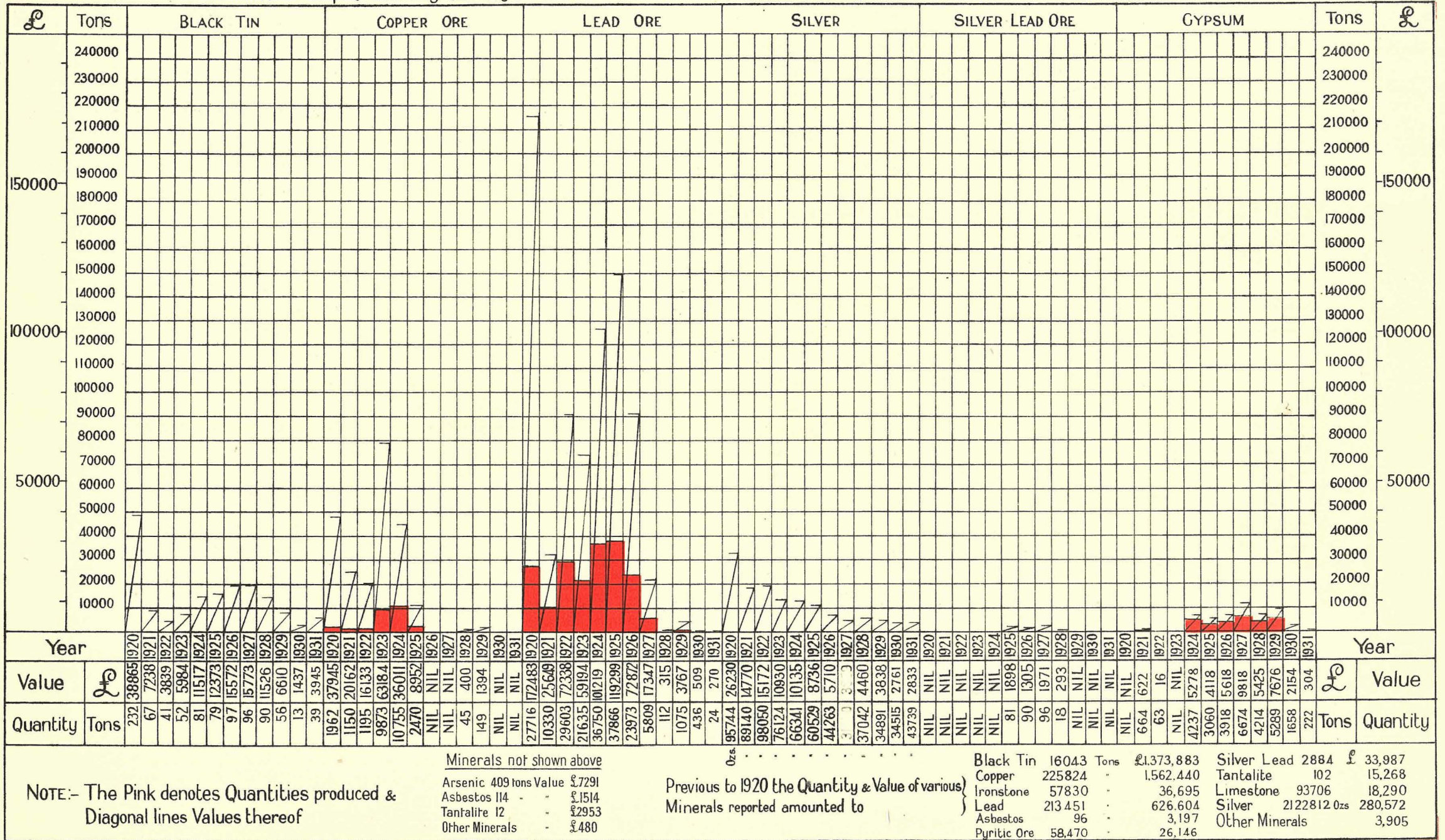


FIG. 6. Output of Gold in the States of Australia and the Dominion of New Zealand.



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



D I A G R A M

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

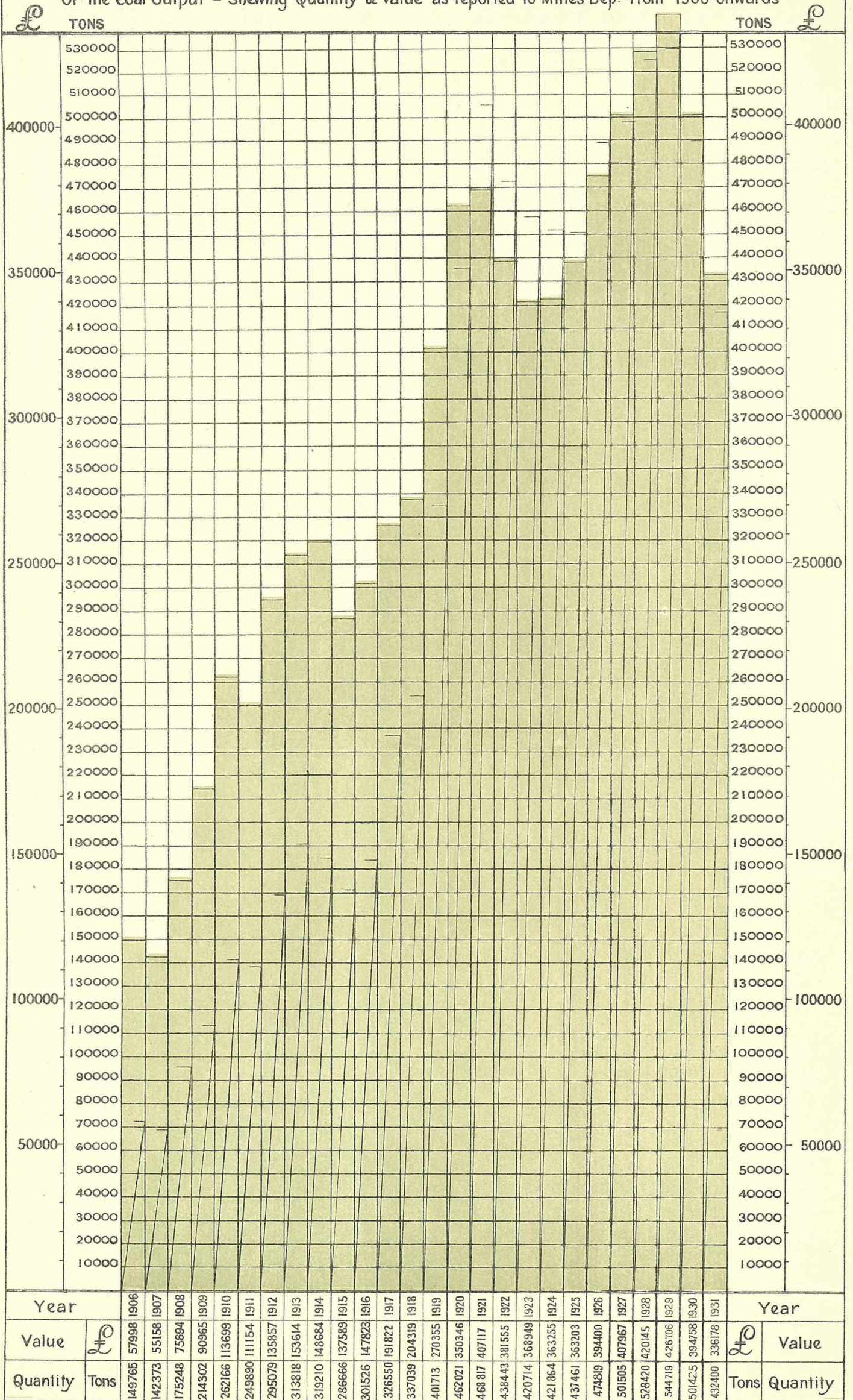


TABLE 8.

Quantity of Coal raised during 1930 and 1931, estimated Value thereof, Number of Men employed, and Output per Man.

Coalfield.	Year.	Quantity raised.	Estimated Value.	Men employed.		Quantity raised.	
				Above ground.	Under-ground.	Per Man employed under-ground.	Per Man employed above and under ground.
		tons.	£			tons.	tons.
Collie	1930	501,425	394,758	210	686	731	560
	1931	432,400	336,178	163	589	734	575

The average number of men employed at the collieries decreased by 144, the output by 69,025 tons, and the value by £58,580. The output per man employed underground and total number employed increased by 3 and 15 tons respectively, but was considerably lower than figures for 1929 and previous years.

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

TABLE 9.

Total Number and Acreage of Leases and Prospecting Areas held for Mining on 31st December, 1930 and 1931.

Description of Leases.	1930.		1931.	
	No.	Acreage.	No.	Acreage.
Gold mining leases on Crown land	373	6,118	408	6,734
" " " private property	2	36	2	48
Mineral leases on Crown land	243	46,849	227	46,168
" " " private property	5	102	5	102
Prospecting Areas	908	35,618	1,750	34,815
	1,531	88,723	2,392	87,867

The total number of leases held for mining purposes increased by 19 and the area decreased by 53 acres, as compared with the year 1930. The number of leases for gold mining increased by 35 and the area by 628 acres. The number of mineral leases decreased by 16 and the area by 681 acres.

For the year 1930 the number of prospecting areas held was 908, the total acreage being 35,618, which included 9 areas of 19,440 acres for coal.

For the year 1931 the number held was 1,750, of a total acreage of 34,815, including 3 areas of 4,419 acres for coal.

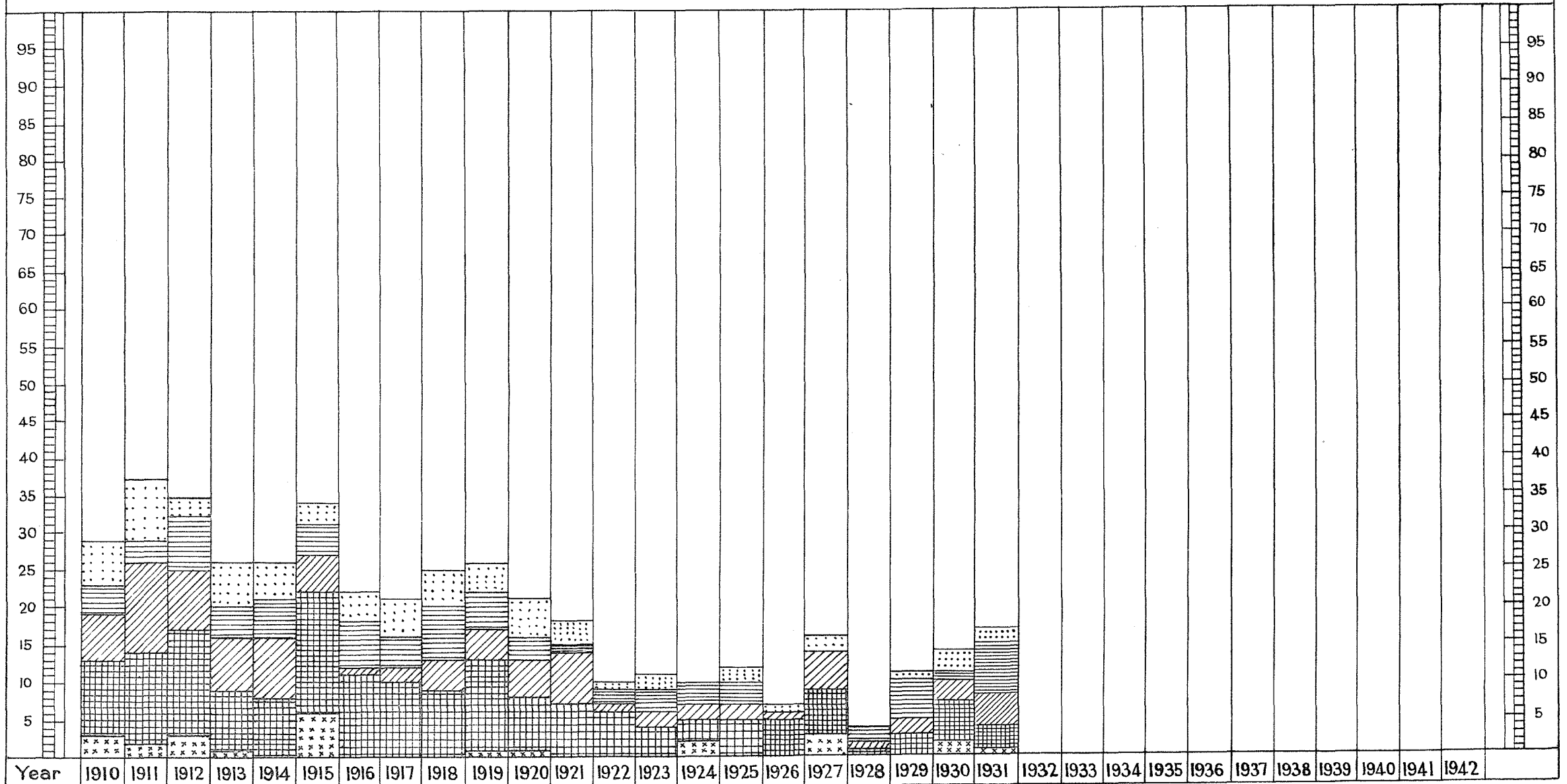
PART IV.—MEN EMPLOYED.

TABLE 10.

Average number of Men engaged in Mining during 1930 and 1931.

Goldfield.	District.	Reef or Lode.		Alluvial.		Total.	
		1930.	1931.	1930.	1931.	1930.	1931.
1. Kimberley ...	...	...	...	4	6	4	6
2. Pilbara ...	Marble Bar ...	65	109	8	16	73	125
3. Ashburton ...	Nullagine ...	4	13	4	3	8	16
4. Gascoyne ...	...	2	6	...	4	2	10
5. Peak Hill ...	...	...	...	2	12	2	12
6. East Murchison ...	Lawlers ...	29	48	4	2	33	50
	Wiluna ...	19	30	4	5	23	35
	Black Range ...	485	654	...	...	485	654
	Cue ...	59	141	...	4	59	145
7. Murchison ...	Meekatharra ...	91	128	...	...	91	128
	Day Dawn ...	182	233	8	5	190	238
	Mt. Magnet ...	37	69	...	...	37	69
8. Yalgoo ...	...	85	154	...	2	85	156
	...	103	291	...	...	103	291
9. Mt. Margaret ...	Mt. Morgans ...	30	28	...	...	30	28
	Mt. Malcolm ...	330	357	1	3	331	360
	Mt. Margaret ...	28	66	...	...	28	66
	Menzies ...	80	106	3	2	83	108
10. North Coolgardie ...	Ularring ...	16	40	1	...	17	40
	Niagara ...	16	36	...	1	16	37
	Yerilla ...	62	77	...	...	62	77
11. Broad Arrow ...	...	126	207	7	6	133	213
12. North-East Coolgardie ...	Kanowna ...	27	46	3	2	30	48
	Kurnalpi ...	16	22	1	1	17	23
13. East Coolgardie ...	East Coolgardie ...	1,996	2,303	39	39	2,035	2,342
	Bulong ...	27	44	3	2	30	46
14. Coolgardie ...	Coolgardie ...	123	282	73	240	196	522
	Kunanalling ...	30	56	1	1	31	57
15. Yilgarn ...	...	145	272	...	1	145	273
16. Dundas ...	...	59	73	...	1	59	74
17. Phillips River ...	...	10	10	...	...	10	10
State generally ...	...	2	60	2	25	4	85
Total—Gold Mining ...		4,284	5,961	168	383	4,452	6,344
MINERALS OTHER THAN GOLD.							
Tantalite ...	Marble Bar ...	6	9	...	...	6	9
	Marble Bar ...	2	...	12	11	14	11
Tin ...	Greenbushes ...	12	6	...	...	12	6
	Yilgarn ...	4	...	...	...	4	...
Copper ...	Phillips River ...	3	...	...	...	3	...
Coal ...	Collie ...	896	752	...	...	896	752
	Marble Bar ...	17	3	...	...	17	3
Asbestos ...	Nullagine ...	2	2	...	...	2	2
	West Pilbara ...	13	2	...	...	13	2
	Yilgarn ...	4	3	...	...	4	3
Gypsum ...	State Generally ...	10	...	...	...	10	...
Emeralds ...	Cue ...	9	...	...	...	9	...
Lead Ore ...	Northampton ...	...	15	...	...	...	15
Total—Other Minerals ...		978	792	12	11	990	803
GRAND TOTAL ...		5,262	6,753	180	394	5,442	7,147

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 V.—ACCIDENTS.

TABLE No. 11.

MEN EMPLOYED IN MINES KILLED AND INJURED IN MINING ACCIDENTS DURING
1930 AND 1931.

A.—According to Locality of Accident.

Goldfield.	Killed.		Injured.		Total Killed and Injured.	
	1930.	1931.	1930.	1931.	1930.	1931.
1. Kimberley ... ..	...	...	...	...	...	...
2. West Kimberley ... ..	...	...	...	...	...	...
3. Pilbara ... ..	...	...	...	...	...	...
4. West Pilbara ... ..	...	...	...	...	...	...
5. Ashburton ... ..	...	...	...	...	...	...
6. Gascoyne ... ..	...	...	...	...	...	...
7. Peak Hill ... ..	...	...	...	...	...	...
8. East Murchison ... ..	...	2	53	71	53	73
9. Murchison ... ..	...	...	19	14	19	14
10. Yalgoo	1	...	...	1	1	1
11. Mt. Margaret	3	1	27	30	30	31
12. North Coolgardie ... ..	...	...	2	1	2	1
13. N.E. Coolgardie	1	...	...	...	1	...
14. Broad Arrow ... ..	...	...	...	3	...	3
15. East Coolgardie	9	13	115	169	124	182
16. Coolgardie ... ..	...	...	1	...	1	...
17. Yilgarn ... ..	...	...	1	1	1	1
18. Dundas ... ..	...	...	...	...	...	...
19. Phillips River ... ..	...	...	...	...	...	...
MINING DISTRICTS—						
Northampton ... ..	...	...	...	...	...	...
Greenbushes ... ..	...	...	...	...	...	...
Collie ... ..	...	1	114	118	114	119
Swan ... ..	...	...	16	13	16	13
Total	14	17	348	421	362	438

From the above table it will be seen that the total number of fatal accidents for the year 1931 was 17 as against 14 for 1930. The number injured shows an increase of 73 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.

	1930.		1931.		Comparison with 1930.	
	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.
1. Explosives	2	10	1	17	— 1	+ 7
2. Falls of Ground	5	36	3	37	— 2	+ 1
3. In Shafts	3	4	4	11	+ 1	+ 7
4. Miscellaneous Underground	1	172	7	244	+ 6	+ 72
5. Surface	3	126	2	112	— 1	— 14
Total	14	348	17	421	+ 3	+ 73

Sixteen fatal accidents occurred in gold mines, and one in a coal mine. The death rate per 1,000 men employed in gold mines was 2.68 as against 3.26 in 1930.

PART VI.—STATE AID TO MINING.

STATE BATTERIES.

The number of State Batteries existing at the end of the year was 23.

From inception to the end of 1931, gold and tin to the value of £6,556,042.96 have been recovered from the State plants; 1,587,268 tons of auriferous ore have been treated and have produced £5,301,066 by amalgamation, £885,950 by cyanidation, £265,266 by slimes treatment, £9,354 worth from residues, and 81,786 tons of tin ore produced tin to the value of £93,834, and in addition a sum of £572 was recovered from residues.

During the year the gold ore treated was 63,428.5 tons for 36,751.85 ozs. of bullion by amalgamation, producing 34,477.75 tons of payable tailing yielding 10,222.55 ozs. and 19,153 tons of unpayable tailing yielding 1,475.75 ozs., making a total of 53,630.75 tons for 11,698.3 ozs.

The working expenditure for all plants for the year totalled £52,970 4s. 9d. and the revenue £51,609 5s., which shows a loss of £1,360 19s. 9d. 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 from Consolidated Revenue. The cost of administration for the year was £2,865 18s. 11d. as against £2,109 5s. 8d. for 1930.

The working expenditure from inception to the end of the year exceeds the revenue by £185,931 5s.

GEOLOGICAL SURVEY.

For the past year the field inspections of the Geological Survey of Western Australia have not been as numerous as in previous years, mainly due to the fact that the Government Geologist was on his long service leave for four months of the year; Mr. Feldtmann engaged almost entirely on the survey of the Kalgoorlie mines; and Mr. Forman on a prolonged trip to the Warburton Ranges.

The following inspections, however, were made during the year and reports or maps on same submitted:—

1. Inspection of the Geological Features of the Denmark and Nornalup Farming Areas, with special reference to the "Wasting Disease" in the Cattle on the Denmark Area.
2. Inspection of the Proposed Weir Site on the Murray River.

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 3,676, as against 3,627, total for the preceding year, showing an increase, after all adjustments, of 49 boilers.

Of the total 3,676 useful boilers 2,081 were out of use at the end of the year; 1,458 thorough and 44 working inspections were made, and 1,459 certificates were issued.

Permanent condemnations totalled 7, and temporary condemnations 28. There were no conversions or transfers beyond the jurisdiction of the Act.

3. Inspection of the Yiniding Gold Find, Toodyay.
4. Investigations of the Lime Sand Deposits of the Coastal Areas of the South-Western Division.
5. A Map was prepared of the Collie Field for the Royal Commission on Coal Mining.
6. Inspection of a Tin Discovery nine miles south-west of Greenbushes.
7. Inspection of the Royal Flush Gold Mine, Westonia.
8. Inspection of the Wongamine Gold Find, Toodyay.
9. Further investigations on the Alunite Deposits of the Lake Brown System.

ASSISTANCE UNDER MINING DEVELOPMENT ACT, 1902.

The following statement shows the sums advanced during the year 1931 under the Mining Development Act:—

	£	s.	d.
Advanced in aid of mining work and equipment of mines with machinery	910	7	4
Subsidies on stone crushed for public	702	16	3
Providing means of transport and equipment to prospectors	2,242	3	0
	£3,855	6	7

Other assistance granted from the Vote during the year on various matters totalled £26,690 1s. 9d.

The subsidies paid on stone crushed for the public amounted to £702 16s. 3d., 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 6,058 tons.

The receipts under the Mining Development Act, exclusive of interest payments, amounted to £9,811 19s. 4d., and included:—

	£	s.	d.
Refunds of advances	2,893	6	2
Sales of securities	1,073	4	1
Miscellaneous refunds	5,845	9	1
	£9,811	19	4

The total number of machinery groups registered was 9,019, against 8,513 for previous year, showing an increase of 506.

Inspections made total 6,807, and 3,188 certificates were granted.

205 applications for engine-drivers' and boiler attendants' certificates were received and dealt with, and 182 certificates, all classes, were granted as follows:—

Winding Competency (including certificates issued under Regulation 40 and Section 60) 9

First Class Competency (including certificates issued under Regulations 40 and 45 and Sections 60 and 63)	11	Boiler Attendants Competency	60
Second Class Competency (including certificates issued under Regulation 40 and Section 60)	15	Interim	4
Third Class Competency (including certificates issued under Regulation 45 and Section 63)	16	Copies	1
Locomotive Competency	5	Transfers	1
Traction Competency	1	Total	182
Internal Combustion Competency	56		
Crane and Hoist Competency	3		

The total revenue from all sources during the year was £5,501 8s. 7d., as against £5,807 8s. 3d. for the previous year, showing a decrease of £305 19s. 8d.

The total expenditure for the year was £5,354 15s. 1d., as against £5,541 1s. 3d. for the previous year, showing a decrease of £186 6s. 2d.

PART VIII.—SCHOOL OF MINES.

There was again an increase in the number of enrolments during this, the 28th, year of the School's existence. The total of individual enrolments, 258, is the highest figure reached since the year 1920. During the year a re-organisation of the staff was carried out with a view to effecting economy. This involved a reduction of two in the teaching staff and the distribution of their class work amongst the remaining lecturers. This imposed a heavy burden on the latter, but the additional duties were undertaken energetically and enthusiastically, so that the School has been able to meet the altered conditions without appreciably impairing the efficiency of the classes.

In the Metallurgical Laboratory a considerable amount of research work was done to determine the possibility of successfully treating gold ores by volatilisation of the gold as chloride in an atmosphere of chlorine gas with subsequent recovery of the volatilised gold chloride by solution in water. Encouraging results were obtained, but the investigation is still in the preliminary stages. Further tests are intended and an endeavour made to apply the knowledge gained to somewhat larger scale treatment. In

addition, several investigations were carried out at the request of persons interested in the ores tested. The system of free assays for prospectors was continued, a total of 1,483 assays and mineral determinations having been made. This is more than four (4) times the number done in the preceding year.

CONCLUSION.

In dealing with the various activities of the Department, I have commented only 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 1931.

Office of the State Mining Engineer,
Perth, 30th April, 1932.

The Under Secretary for Mines.

Sir,

I have the honour to submit for the information of the Hon. the Minister my report on the operations of this Branch of the Department for the year 1931.

STAFF.

The retirement of Mr. W. M. Deeble at 31st December, 1930, and the difficult financial circumstances compelling us to carry on without appointing another Inspector, it became necessary to transfer Mr. H. P. Rockett from Southern Cross to Cue and to work the Southern Cross Inspectorate from Kalgoorlie. During March, the services of the Assistant State Mining Engineer, Mr. R. C. Wilson, were transferred temporarily to the Broken Hill Proprietary Company, Ltd., for a period of at least a year. Since March, 1930, my staff has been reduced by four officers, *i.e.*, Assistant State Mining Engineer, one Inspector, and two Workmen's Inspectors, and the field work is now being carried out by the Senior Inspector, Mr. W. Phoenix, four Inspectors, Messrs. A. W. Winzar, E. J. Gourley, H. P. Rockett, and J.

McVee, two Workmen's Inspectors, Messrs. L. C. Darcy and R. P. McMennemin, and a newly appointed officer to assist with Dust and Ventilation work, Mr. E. E. Brisbane, B.E., (Melb.).

ACCIDENTS.

During the year, 17 fatal and 421 serious accidents were reported, compared with 14 fatal and 348 serious accidents during 1930, showing an increase of 3 men killed and 73 seriously injured. Thorough investigations were made into all accidents. In comparing these figures, however, the increased number of men employed in mining, as shown hereunder, must be taken into consideration.

Table II, showing locality and causes of fatal and serious accidents, 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 I., Report of the Under Secretary for Mines.)

The table hereunder gives the number of fatal accidents recorded during the last five years, and the death rate per thousand men:—

	1927.	1928.	1929.	1930.	1931.
Fatal accidents to men engaged in mining	16	4	11	14	17
Total men engaged in mining (average)	5,036	4,853	5,159	5,442	7,147
Accident death rate per 1,000 men	3.18	.82	2.13	2.57	2.38

FATAL ACCIDENTS.

Seventeen accidents occurred under the following headings:—Explosives, 1; Falls of Ground, 3; In Shafts, 4; Miscellaneous Underground, 7; Surface, 2. These are briefly referred to:—

Explosives.—A premature explosion caused the death of one miner. Full inquiries were made, and no evidence could be found to show why the explosion occurred sooner than anticipated.

Falls of Ground.—Three accidents came under this heading, one of which occurred at Collie and was due to a fall of coal after firing. Every reasonable precaution was taken, and at the inquest, no blame was attached to anyone.

The two other accidents occurred in gold mines, one being caused by a large fall of ground which came away from two greasy heads. In the other case, the fall was due to a snap which was the result of pressure.

No evidence of negligence could be found in either accident.

In Shafts.—Four men were killed through falling down shafts.

The rope broke while a man was being lowered down an old abandoned shaft for the purpose of sampling it, and he fell 75 feet. The heavy weight hemp rope appeared quite sound. There was no evidence of carelessness.

In attempting to cross a main shaft from east to west by holding on to shaft timbers, a workman was knocked through the end of the shaft into the ladder-way by the descending cage. No evidence was given to show the reason why deceased took this risk.

A trolley was being hauled from surface up to top of dump. The tributer who was pulling the rope fastened to the trolley lost his hold and fell backwards down the shaft 100 feet deep. Medical evidence was given to the effect that, as the condition

of deceased's heart was such as would cause acute heart failure, the accident was considered to be the result of a seizure.

Some piping was being disconnected in a main shaft when a section of the piping slipped through the yokes and struck a timberman who was working further down the shaft.

Miscellaneous Underground.—Seven men lost their lives through various causes underground:—

Two miners were suffocated as the result of inhaling dynamite fumes from shots which had been fired in a wet winze 50 feet deep by the men on the previous shift. When the water at the bottom of the winze was disturbed, eight hours later, the fumes were released. Had the men turned on the compressed air before entering the winze, their lives would have been saved.

An unfortunate accident occurred through a trucker falling into a pass with the ore running. The chute apparently became blocked and deceased was trying to release it when he fell. There were no witnesses of the accident.

A timberman was standing with one foot on a ladderway in a winze in order to guide pass logs that were being lowered by means of a hoist. He had just freed a log, and it is thought that the slack rope caught him, knocking him down the winze on to the crown pass.

A workman was instructed to report whether the sand was running, but it is evident that he attempted

to run the pass by getting inside the railing which was placed around the pass. When the rush of sand came away, he slipped and was smothered.

A prospector was found dead at the bottom of a shaft 50 feet deep. Apparently he had been overcome by the effects of foul air whilst working in a small crosscut in his mine, and tried to reach the ladderway but collapsed before doing so.

The breaking of a drill caused a machine miner to overbalance and fall over the edge of a stope a distance of 65 feet. He had failed to use the safety line supplied to prevent such accidents.

Surface.—An employee, who was in charge of a main engine room, was seen on the stairs in the engine room, and ten minutes later was found unconscious at the foot of the steps. No one was present at the time of the accident.

Two men were on a platform removing worn-out steel plates from the skip tip down to the rock-breaker. Two plates had been thrown down to the surface 30 feet below, and while they were throwing the third it caught, breaking the guard rail. One of the men overbalanced and fell with the plate to the surface.

The following table shows all the fatal and serious accidents reported to this office during 1931, 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 Underground.		Surface.		Total.	
	Fatal.	Seri-ous.	Fatal.	Seri-ous.	Fatal.	Seri-ous.	Fatal.	Seri-ous.	Fatal.	Seri-ous.	Fatal.	Seri-ous.
1.—East Coolgardie	1	4	2	2	2	7	6	109	2	47	13	169
2.—Mt. Margaret	1	...	1	1	2	...	13	...	13	1	30
3.—Murchison	2	...	1	...	7	...	4	...	14
4.—East Murchison	8	...	11	1	1	1	37	...	14	2	71
5.—Coolgardie
6.—Yilgarn	1	...	1
7.—North Coolgardie	1	...	...	...	...	...	...	...	...	...	1
8.—North-East Coolgardie
9.—Broad Arrow	2	...	...	...	...	...	...	...	1	...	3
10.—Dundas
11.—Pilbara
12.—Peak Hill
13.—Yalgoo	1	...	...	...	...	...	...	...	...	...	1
14.—Phillips River
15.—Collie	1	21	...	...	...	78	...	19	1	118
16.—Greenbushes
17.—Northampton
18.—West Pilbara
19.—Swan	13	...	13
20.—Ashburton
Totals for 1931	1	17	3	37	4	11	7	244	2	112	17	421
Totals for 1930	2	10	5	36	3	4	1	172	3	126	14	348

SERIOUS ACCIDENTS.

A large number of the accidents which necessitated men being away from their employment for more than 14 days, and thus being classed as "serious," were really of a minor nature. The more serious accidents, such as breakages of bones, permanent injury to limbs and injuries which would cause lasting disabling effects were very closely investigated by the Inspectors of Mines.

WINDING MACHINERY ACCIDENTS.

Eleven accidents to winding machinery, which included eight skip derailments, two overwinds, and one breakage of rope, were reported during the year.

Skip Derailments.—Various theories were put forward to establish the causes of these accidents. Several of the derailments were considered to be due to large stones falling off the skip on to the track. After one derailment an examination of the road disclosed

a short kink in the track where the wheels left the rails. In other cases there was not sufficient evidence to form a definite opinion as to the cause.

Overwinding.—In one case an overwind occurred when ore was being hauled, and the safety appliances operated successfully, only slight damage being done to the winder buildings.

In the other instance the north cage was used as a balance and the south cage was being hauled empty to the surface when the engine-driver found difficulty in reversing the lever.

Breakage of Rope.—Considerable damage was caused when a skip caught on the shaft, resulting in the rope giving way and the empty skip in the other compartment falling to the bottom of the shaft.

All accidents to winding machinery were very carefully investigated.

ADMINISTRATION.

Amendments of Acts.

"The Mines Regulation Act, 1906."—Amending the districts under which appointments were made of Workmen's Inspectors in accordance with Regulation 15, Part 2, Clauses 2 and 3. (Gazetted 27th March, 1931.)

"The Mining Development Act, 1902-1924."—Amending Regulation 7 of the Regulations under which ore will be crushed and tailing purchased at State Batteries. (Gazetted 21st August, 1931.)

"The Coal Mines Regulation Act, 1902-1926."—Amending Regulation 28 under Part 1—"Accident Relief Fund." (Gazetted 27th November, 1931.)

Prosecutions.

Under the Mines Regulation Act, Section 14, Subsection 6, two men were prosecuted for driving friction winches without having the necessary permits to do so, and were fined £1 and 3s. costs. The employer of one of the men was also fined £2 and 3s. costs.

Under the Coal Mines Regulation Act, two men were fined £2 and costs for a breach of Section 43, General Rule 55. A manager was injured through walking into a bord in which a shot was lit and which exploded when he turned to go out.

Exemptions.

Owing to the increased mining activity on the Eastern Goldfields, thirty-one certificates were issued, in accordance with the provisions of Section 31 (4), for exemptions from the provisions of Section 31, Subsection 1 (b) of the Mines Regulation Act, 1906.

Sunday Labour.

During the year, no permits were granted for carrying out Sunday work.

Loans and Subsidies.

The following monetary assistance was given to the mining industry:—Advances towards development work and equipment of mines, £910 7s. 4d.; providing transport and general assistance to prospectors, £2,242 3s.; cartage subsidies paid to prospectors on ore treated at State Batteries, £12,955 11s. 4d.; rebates on State Batteries crushing charges (for low-grade ores), £3,919 1s. 11d.; free crushings at State Batteries, £3,223 5s.; water supplies, £385 13s. 5d.; subsidies paid to privately owned batteries, £702 16s. 3d.; miscellaneous expenditure, £768 5s. 11d. The total expenditure was £25,107 4s. 2d., compared with £59,137 17s. 3d. during 1930 and £84,825 15s. 2d. during 1929. (Appendix No. 1.)

No expenditure was incurred during the year on "Diamond Drill Boring" or "Advances on Ores."

MINING.

Kalgoorlie Mines.—It is pleasing to note that development work in the most important mines was actively undertaken during the year. In seven mines, the total amount of driving done was 16,640 feet, crosscutting 5,588 feet, winzing 5,083 feet, rising 231 feet, shaft stripping 1,272 feet, and diamond drilling 13,170 feet; total 41,984 feet.

The most active programme was effected by the Lake View and Star Limited, whose development footage was 16,326, and diamond drilling 10,698 feet. Work in connection with the completion of the wet treatment plant to a stage when 30,000 tons a month can be treated was continued.

Electric pumps are now used in the Horseshoe Main Shaft, at 3,300, 2,000 and 1,000 ft. levels for handling the inflow of water. This shaft will eventually be used for ventilation as an upcast, assisted by a fan. Electric locomotives, battery driven, are used for transporting ore through main haulage ways at the 24 and 33 levels between Ivanhoe and Horseshoe workings. Chaffers Shaft is being stripped and converted into four compartments, two for hauling ore, one for a cage and one for a counterweight and manway. Methods of drilling and blasting have been standardised by this company with good effect, and many other improvements have been made.

The erection of a wet treatment plant was commenced at the Boulder Perseverance Ltd., where the bromo-cyanide process will be employed. The first unit will have a capacity of 250 tons a day and it should not be long before the plant is ready to commence operations.

Sons of Gwalia, Ltd.—This Company continued an active development programme throughout the year, the following being a summary of underground footage:—driving 1,436 feet, crosscutting 1,241 feet, winzing 1,344 feet, shaft sinking 33 feet, total 4,054 feet. Sinking in the Main Inclined Shaft was resumed during November and had reached a depth of 4,083 feet. I understand that No. 26 level will be opened up at a depth of 4,050 feet when the shaft has been sunk to 4,200 feet. Several winzes have been sunk below the 25 level in good grade ore. The ore bodies above the 25 level have developed satisfactorily, and have been got ready for stoping. The stopes are kept well filled and safe. The bottom levels and workings have been kept in healthy and cool condition by means of fans and other ventilating appliances and devices. The skipways in the Main Inclined Shaft are being repaired and relaid with new 45 lb. rails at week ends. Considerable progress has been made.

The surface plant operated well. A new 750 h.p. six cylinder gas engine direct coupled to an alternator and a new waste heat boiler were installed. Alterations were also made to the producer plant. Ample power is now available for all operations on surface and underground. It is pleasing to note the sound position this mine has assumed as a result of a bold development policy. 121,368 tons of ore were mined and treated and 28,916 tons of sand were re-treated. Profits made during the year enabled the company to repay a substantial portion of loans advanced by the Government, and to carry out an extensive development programme.

Wiluna Gold Mines, Ltd.—The treatment plant was put into commission before the end of the first quarter of the year, and the company has mined and treated approximately 26,000 tons a month since.

Certain mechanical and metallurgical difficulties arose, and although they caused some anxiety at the time, most of them have been already overcome. The last report issued by the company shows that the dilution of ore in stoping the east lode was greater than anticipated. An active development programme, at the 625ft. and 800ft. levels is being pushed ahead in order to provide more stoping places as soon as possible. Recent developments have revealed a new lode west of what is known as the West Lode, a most valuable and important discovery. During the year, approximately 13,558 feet of driving and crosscutting and 3,193 feet of sinking were completed. Careful attention has been given to the safety and ventilation of the workings by the mine staff and departmental officials with satisfactory results.

Various Districts.—There was a marked revival in gold mining throughout the goldfields, and increases in the gold yield from the various districts were recorded. Batteries were erected by various leaseholders in several places remotely situated, and in other instances closed plants were overhauled and put into commission once again. Not less than a dozen additional crushing plants were brought into operation during the year. The high price of gold enabled many abandoned mines to be reworked by small parties, and a large number of prospectors have been searching for new mines. Many small new reefs and lodes have been located, and although a few of them show promise of developing well, there has not been a new discovery of outstanding importance. It is very satisfactory that such a large number of men are engaged in prospecting the goldfields, because there is always a chance of a valuable lode being discovered while the search continues.

The great impetus given to the gold mining industry through the high price of gold, is reflected in the improved conditions of the mines. The big mines are developing and working ore which was previously unpayable, and in some notable instances are improving treatment plants, machinery and equipment, with the object of lowering costs and bringing lower grade reserves within the sphere of profitable handling in the future.

Dust and Ventilation, etc.—During the year, more care has been exercised by mine officials in the control of blasting. Records obtained during the past six years confirm our previously stated opinions that dust from blasting is extremely dangerous to the health of underground workers. Despite the improvement in the control of blasting, my officers and I are of the unanimous opinion that times for blasting should be controlled by regulations, which, it is hoped, will be enforced in the near future.

Very careful attention was given by our staff to the ventilation and sanitation of mines during the year. We have received better co-operation from mine officials and workers, and the result has shown a general improvement. Direction of air currents and keeping airways open to full capacity have claimed much attention. There is still a tendency towards lack of supervision in connection with the maintenance of airways, but gradually the importance of such work is being more fully realised and appreciated.

Temperatures have been fairly good, except in a few isolated places. There are necessarily some places not so well ventilated as is desirable during the progress of development work. Such places, however, receive good ventilation as soon as connections are made with main airways.

It is pleasing to note that mine officials and workers are gradually appreciating the fact that mining can be carried on under healthy conditions underground. It is a fact that conditions relative to ventilation are constantly improving, and much valuable information is being gathered by Inspectors of Mines, all of which leads to further improvements.

The medical examination of miners employed on the Boulder Belt and surrounding districts has been continued steadily. It was most unfortunate that workers in outlying districts were not examined last year, on account of the failure of the Federal Department controlling the matter, to find the necessary staff. We have been promised that an examination of workers in all districts will be made this year, and it should be seen that work of such vital importance to the industry should not be shelved again. Once previously the workers in outlying districts were not examined.

COAL MINING.

The output of native coal from the Collie Coalfield was 431,179 tons for the year, a considerable falling off when compared with an output of 501,425 tons during 1930. The decrease was the direct result of falling off in demand due to the difficult circumstances prevailing.

Towards the end of the year the Westralia Colliery, the most westerly mine at the northern end of the field, was closed down on account of its operations having become unprofitable.

The collieries are equipped and developed to produce at least double the existing demand. Much development has taken place in the mines during the past year or two and very careful attention has been given to their safety, ventilation and sanitation.

A new Central Power Station was installed and started operations during the year. It is situated a handy distance from the gantry at the Co-operative Mine. Coal is conveyed on a belt from the mine and is used in two watertube boilers in pulverised form, the Lopulco Unit System having been installed. Each boiler is capable of maintaining continuously an evaporation of 30,000 lbs. and is operated at a pressure of 250 lbs. per square inch. Turbo alternators produce current at 6,500 volts pressure, which is transformed at necessary points. At each mine controlled by the Amalgamated Collieries of W.A., Ltd., the engine-room equipment contains transformers, reducing the pressure of the alternating current to 2,200 volts for use in motors driving winding engines. Current used underground is passed through motor converters giving direct current at 550 volts.

GENERAL.

There were no earth tremors reported during the year, although slight movements in the lower workings of some of the gold mines have taken place, and some flaking of the rock, particularly where it is most silicified, has been noted.

Metal and mineral markets were particularly weak during the year. In consequence of the low prices prevailing, local production of base metal ores was very small.

The outlook for the gold mining industry is particularly favourable and it is most encouraging to see companies of great financial strength examining properties with a view to acquirement. There seems no doubt that the yield of gold will continue to increase.

A. M. HOWE,
State Mining Engineer.

APPENDIX No. 1.

MINING DEVELOPMENT EXPENDITURE.

			£	s.	d.				£	s.	d.
Advances outstanding 31st December, 1931—						Interest paid prior to 1931			18,717	4	5
Advances authorised prior to 1931 ..	237,995	9	6			Interest paid during 1931			3,364	18	9
Advances authorised during 1931 ..	665	8	6						£22,082	3	2
Total authorised	£238,660	18	0			Interest outstanding at 31st December, 1930			19,503	19	4
Principal Moneys Advanced—						Interest outstanding at 31st December, 1931			18,847	16	6
Prior to 1931	211,042	13	9			Principal Moneys Advanced			211,997	2	6
During 1931	954	8	9			Less Principal Moneys repaid	£42,908	13	9		
	£211,997	2	6			Less Bad Debts written off	32,915	7	10		
Principal Moneys repaid (including Sale of Securities)—									75,824	1	7
Prior to 1931	39,574	1	6			Principal outstanding at 31st December, 1931			136,173	0	11
During 1931	3,334	12	3			Interest outstanding at 31st December, 1931			18,847	16	6
	£42,908	13	9						£155,020	17	5
Bad Debts written back and amounts transferred—											
Prior to 1931	21,760	0	3								
During 1931	11,155	7	7								
	£32,915	7	10								

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, 30th April, 1932.*The Under Secretary for Mines.*

Sir,

The Annual Report of the Board of Examiners for 1931 is submitted for the information of the Hon. Minister for Mines.

Examinations for Certificates.

No applications were received for the April examination.

Three candidates presented themselves for the examination for Second Class Certificates of Competency which took place at Collie on the 14th and 15th October, 1931. Two of the candidates were successful in gaining Second Class Certificates, but the other candidate failed to obtain the requisite number of marks.

First Class Certificate (without examination).—Mr. James Gillespie made application to be granted a First Class Certificate on his corresponding English one. After being orally examined and submitting testimonials, he was granted a First Class Certificate under the West Australian Act.

A meeting of the Board was held on 20th October, 1931, the April meeting being cancelled.

A copy of the papers set for the Second Class examination held in October is attached to this report.

We have the honour, etc.,

A. M. HOWE,
State Mining Engineer,
Chairman.T. BLATCHFORD,
Government Geologist,
Member.J. McVEE,
Inspector of Mines, Collie,
Member.V. RUSSELL,
Secretary.

THE COAL MINES REGULATION ACT, 1902-1926.

Examination for Second Class Certificate of Competency as Under-Manager or Overman.

SUBJECT: ARITHMETIC.

Wednesday, 14th October, 1931: 9 a.m. to 11 a.m.

Possible
Marks.17 (1) The area of a pillar of coal is 7,087.5 square yards and its length is $3\frac{1}{2}$ times its breadth. Find the length of the sides and the length of a crosscut from corner to corner.

17 (2) A seam of coal is 3ft. 6in. thick and is worked longwall. The walls are 50 feet long and the cost of brushing the roads is 8s. per fathom. Find the cost per ton. (30 cubic feet equals one ton.)

- 17 (3) A pump ram has a diameter of 5 in. and a stroke of 16 in. What is the displacement per stroke? If the diameter be doubled, and the stroke remains the same, what would be the displacement?
- 17 (4) If 5 men can produce 850 cubic yards of ballast in 17 shifts, how many men would it take to produce 2,000 cubic yards in 20 shifts? What is the cost per cubic yard if the men earn 10s. per shift?
- 15 (5) The total weight of a cage and loaded skips is $3\frac{1}{2}$ tons. The coal is one-third of the total weight and the skips two-fifths of the weight of the coal. What is the weight of the empty cage?
- 17 (6) A pair of headings 10 yards apart are driven 200 yards. Headings are 9 feet wide, and 6 feet high, and are connected every 35 yards by cut-throughs 6 feet wide. How many cubic yards have been taken out, also how many tons? (A cubic foot weighs 80 lbs.)

 100

SUBJECT: COAL MINES REGULATION ACT,
1902-1926.

Wednesday, 14th October, 1931: 11 a.m. to 1 p.m.

 Possible
Marks.

- 25 (1) Under what conditions may shots be fired on a main haulage road which is dry and dusty?
- 25 (2) State the requirements of the Act relative to timbering working faces.
- 25 (3) State the requirements of the Act relative to the appointment of persons in charge of machinery.
- 25 (4) State the duties of an examining deputy making an inspection before the commencement of work.
- 25 (5) State the provisions of the Act concerning a place approaching workings likely to contain a dangerous accumulation of water.
- 25 (6) What procedure is necessary for the establishment of special rules?

 150

SUBJECT: ROADWAYS.

Wednesday, 14th October, 1931: 3 p.m. to 5 p.m.

 Possible
Marks.

- 25 (1) Describe with sketches the "main and tail rope" system of working, and say under what circumstances it can be usefully applied.
- 25 (2) In a main roadway the bars have become low and there is a considerable quantity of loose debris lying on them. Describe in detail how you would renew the timber. The work must be done on night shift, and the road must be ready for work next day.
- 25 (3) Make a sketch showing a device at the bottom of a self-acting incline, to prevent a full set being sent on its journey before the empty set is attached to the rope.
- 25 (4) Electricity is used underground for haulage motors, pumps and coal cutters. What precautions are necessary to guard against dangers on main roads, at haulage and pump rooms, and at the working face?

- 25 (5) Under what conditions would a syphon aid in the drainage of a mine, and what is about the limit at which it will act effectively?
- 25 (6) A seam dips regularly from the outcrop at the rate of 5 inches per yard. Give some general idea as to the kind of haulage to adopt. The main headings have to extend two miles and the side roads, each one mile.

 150

SUBJECT: MINING OF COAL.

Thursday, 15th October, 1931: 10 a.m. to 1 p.m.

 Possible
Marks.

- 25 (1) Write down your views relative to the duties of a shot firer. What precautions should be taken in charging, stemming and firing shots?
- 25 (2) A pillar working place 8 yards wide and 12 yards long has been finished and the timber has to be withdrawn. Illustrate by a sketch how to start and continue drawing the timber.
- 25 (3) State the dangers of shooting off the solid in dry and dusty mines, and what precaution should be taken to prevent accidents. Describe and illustrate by a dimensioned sketch a well prepared shot in a bord 14 feet wide and 7 feet high.
- 25 (4) In a mine with the bord and pillar system of working, the immediate roof of 2ft. 6in. is very much intersected with "slips." Describe with sketches the method of timbering recommended to give the faces and wheeling roads the utmost security.
- 25 (5) What changes are observed near faults and dykes? What method would you adopt to find the continuation of a seam which has been dislocated by a fault?
- 25 (6) Show by sketches how to set wooden chocks in a seam 5 feet thick where the seam is dipping 1 in 5—
(a) where they are to be withdrawn and reset;
(b) where they are put in permanently and filled with dirt.
- 25 (7) Compare the long wall and bord and pillar systems of working a coal seam. What conditions control the selection of one system in preference to the other?
- 25 (8) A district of bord and pillar workings is being worked between abandoned workings of two old mines—one on the rise and one on the dip side. What are the dangers likely to be encountered in each case, and what precautions should be observed?

 200

SUBJECT: VENTILATION AND DANGEROUS
GASES.

Thursday, 15th October, 1931: 2 p.m. to 5 p.m.

 Possible
Marks.

- 25 (1) If 20,000 cubic feet of air per minute give a water gauge of half an inch, what will the gauge register if the quantity of air is increased to 45,000 cubic feet?
- 25 (2) Describe how to find the quantity of air circulating in a main airway which is 12 feet wide by 8 feet high.

- 25 (3) In a dry and dusty mine, with shot firing, state your opinion relative to stone dusting and watering. Treat the matter fully in order to make shot firing as safe as possible.
- 25 (4) A shaft partly sunk has been abandoned for some time and it is now proposed to resume sinking. There is no water. What precautionary work should be done before the men resume work?
- 25 (5) If it became necessary to use a boosting fan, where should it be placed underground? The face workings are $1\frac{1}{2}$ miles from the outlets. Electricity is available for driving purposes.
- 25 (6) State the principal properties of gases met with in coal mines.
- 25 (7) Briefly describe the arrangements necessary for producing, and conveying, an air current from the surface to the face workings of a mine and back to the surface atmosphere.
- 25 (8) How is the air in a mine tested for fire-damp with the ordinary safety lamp? Are there any other means for doing this safely? If so, describe them.
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- 200
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DIVISION III.

Report of the Superintendent of State Batteries.

The Under Secretary for Mines.

I have the honour to submit for the information of the Hon. Minister my report on the operations of State Batteries for the year 1931.

A rather extraordinary increase in State Battery activities was experienced. In no year since the inception of the system has there been such a marked rise in the tonnage of ore forthcoming. In 1930 a sharp rise occurred, the total tonnage handled rising by 17,635.25 tons to 49,778.75 tons, but in the year under review the total tonnage treated increased by 50,964½ to 100,743½ tons.

GRADE OF ORE.

The increased price for gold due to the exchange and sterling premium permitted ore of lower grade to be mined, and the average fine gold value of the ore decreased.

The average value for 1931 was 57s. 9d., as against 68s. 9d. in 1930.

VALUE OF PRODUCTION.

The estimated value of bullion produced by amalgamation at State Batteries for 1931 was 36,751 ozs. valued at £132,316. Tailing treatment produced 7,211.90 ozs., worth £45,588 with premium. The estimated value of the production in Australian currency, taking an average premium rate for the year at 35 per cent. on bullion recovered by amalgamation, was £224,214.

REVENUE AND EXPENDITURE.

(1930 figures in brackets.)

Expenditure amounted to £52,970 4s. 9d. (£30,558 11s. 8d.); Revenue £51,609 5s. (£24,138 14s. 6d.).

The loss on working was £1,360 19s. 9d., as against a loss of £6,419 17s. 2d. in 1930, and £9,215 15s. 3d. in 1929.

MILLING.

Three 10-stamp and eighteen 5-stamp, wholly controlled State Mills, and three leased mills were in operation. The State plants, including the re-opened and re-constructed mills at Laverton, St. Ives and Yarri, and the new 5-head at Yalgoo, crushed 63,428½ tons at a cost of 12s. 8.2d., a decrease over 1930 fig-

ures of 2s. 7.21d. per ton. Revenue per ton was 9s. 7.9d., a slight increase on the previous year's figure of 5.32 pence.

The total expenditure on milling was £40,256 15s. 3d., or £9,616 16s. 2d. above the revenue received.

Increased tonnages were handled at all batteries, the most noticeable being as follows, with 1930 figures in brackets: Coolgardie 11,741.5 tons (7,173.75), Meekatharra 4,356.75 tons (2,292.25), Norseman 4,927.25 tons (2,049.50), Peak Hill 6,116.50 tons (1,444.50), Wiluna 3,540.25 tons (597.50).

The best milling costs per ton were obtained at Peak Hill 9s. 3.7d., Yalgoo 9s. 5.3d., and Coolgardie 10s. 0.2d.

Repairs and Renewals.—Expenditure under this heading was heavy and was charged against milling. The sudden call on old plants lying practically idle for years, and the necessity for working full time, Sundays included, at times, the revival and reconstruction of Laverton, Mt. Ida, and St. Ives plants, the cost of which was all charged against milling as Repairs and Renewals, increased our ordinary cost per ton considerably.

Duty per Stamp.—In later years the quantity of quartz forthcoming has decreased, and owners have been working more schistose material, which gives a higher stamp duty. As against this, the Department has reverted to 900-mesh screens in lieu of 800-mesh.

The average duty per stamp for 24 hours was 4.23 tons, the highest duties being obtained at Peak Hill 5.38 tons, and Ora Banda 5.24 tons.

TAILING PRODUCTION AND TREATMENT.

Production.—The estimated tonnage of tailing produced was as follows:—

Over 2 dwt. 8 grs. in value 34,477¾ tons containing 10,222.55 fine ozs.

Under 2 dwt. 8 grs. in value 19,153 tons, containing 1,475.76 fine ozs.

Total 53,630¾ tons, containing 11,698.31 fine ozs.

The average value of tailing produced was 4.36 dwt. and percentage of tailing under 2 dwts. 8 grs. approximately 36.

Our tailing plants erected to treat normal quantities of tailing were found in a good many cases inadequate to handle increases of over 100 per cent., and

accumulations at State Batteries have increased. Additions have been made to the Cue and Ora Banda plants, and at time of writing new plants have been installed at Norseman, St. Ives, Jimble Bar, Laver-ton and Yalgoo.

Treatment.—37,315 tons were treated for a yield of 7,211.90 ozs., valued with premium at £45,588.

Cost per ton dropped from 7s. 11.16d. in 1930, when 20,334 tons were handled, to 6s. 9.8d.

Revenue per ton was 11s. 2.8d. as against 10s. 2.30d. in 1930 due to the premium received on our ordinary treatment charges.

The total Expenditure was £12,718 10s. 2d. and Revenue £20,958 1s. 11d., showing a net profit of £8,239 11s. 9d.

The cost per ton of 6s. 9.8d. is good, as it includes all administration, insurance and reconstruction charges as well as repairs and renewals.

Extraction.—A slight falling off in extraction is due to our endeavouring to keep plants running through the winter months and the consequent handling of material not as dry as could be desired. This has also added to the cost of handling.

Comparative Synopsis of Results at State Batteries for 12 Months ended 31st December, 1930 and 1931.

	1931.			1930.		
	Tonnage.	Expenditure.	Revenue.	Tonnage.	Expenditure.	Revenue.
Milling	63,428½	12/8·2	9/7·9	29,285½	15/3·41	9/2·58
Tailing Treatment ...	37,315	6/9·8	11/2·8	20,334	7/11·16	10/2·30
Tin Treatment ... ..	...	...	...	159	14/5·16	3/4·24

Receipts and Expenditure.

	Tonnage.	Expenditure.	Revenue.	Profit.	Loss.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.
Milling	63,428½	40,256 15 3	30,639 19 1	...	9,616 16 2
Tailing Treatment ...	37,315	12,718 10 2	20,958 1 11	8,239 11 9	...
Tin Treatment ... ..	...	Cr. 5 0 8	11 4 0	16 4 8	...
	100,743½	52,970 4 9	51,609 5 0	8,255 16 5	9,616 16 2
			Less Profit ...	...	8,255 16 5
			Net Loss ...	...	£1,360 19 9

ADMINISTRATION.

Administration costs have been kept as low as possible in common with the general economy in the Service.

Owing to the general reduction in salaries since July 1st, Head Office salaries showed a reduction, but there was a general increase, as to be expected, in other items, especially insurance.

Comparative figures are as follow:—

	1930.		1931.	
	£	s. d.	£	s. d.
Salaries	1,606	16 10	1,481	19 11
Insurance	194	8 5	945	2 8
Inspection	189	10 5	220	19 1
Printing	30	9 0	92	16 6
Postage Stamps ..	50	0 0	60	0 0
Other	38	1 0	65	0 9
Total	£2,109	5 8	£2,865	18 11

Administration cost per ton was 5.03 pence, a decrease of 50 per cent. on 1930 cost.

STAFF.

The appointment of a Junior Clerk was the only addition to Head Office Staff.

The Goldfields Staff was increased from seven Managers and an Erection Engineer to thirteen Managers and Assistant Managers. The Erection Engineer was part of his time in charge of Jimble Bar,

and the services of Mr. Griff Williams were engaged for the erection of the Yalgoo Battery.

Considering the number of new appointments and the average tonnage handled by each Manager, nearly 8,000 tons per man, the results have been exceedingly good, and I have nothing but praise for these officers, whose devotion to duty has been commendable.

I have also to thank the Head Office Staff for the loyal co-operation, and their work is reflected in the administration costs and the smooth running of the office under difficulties.

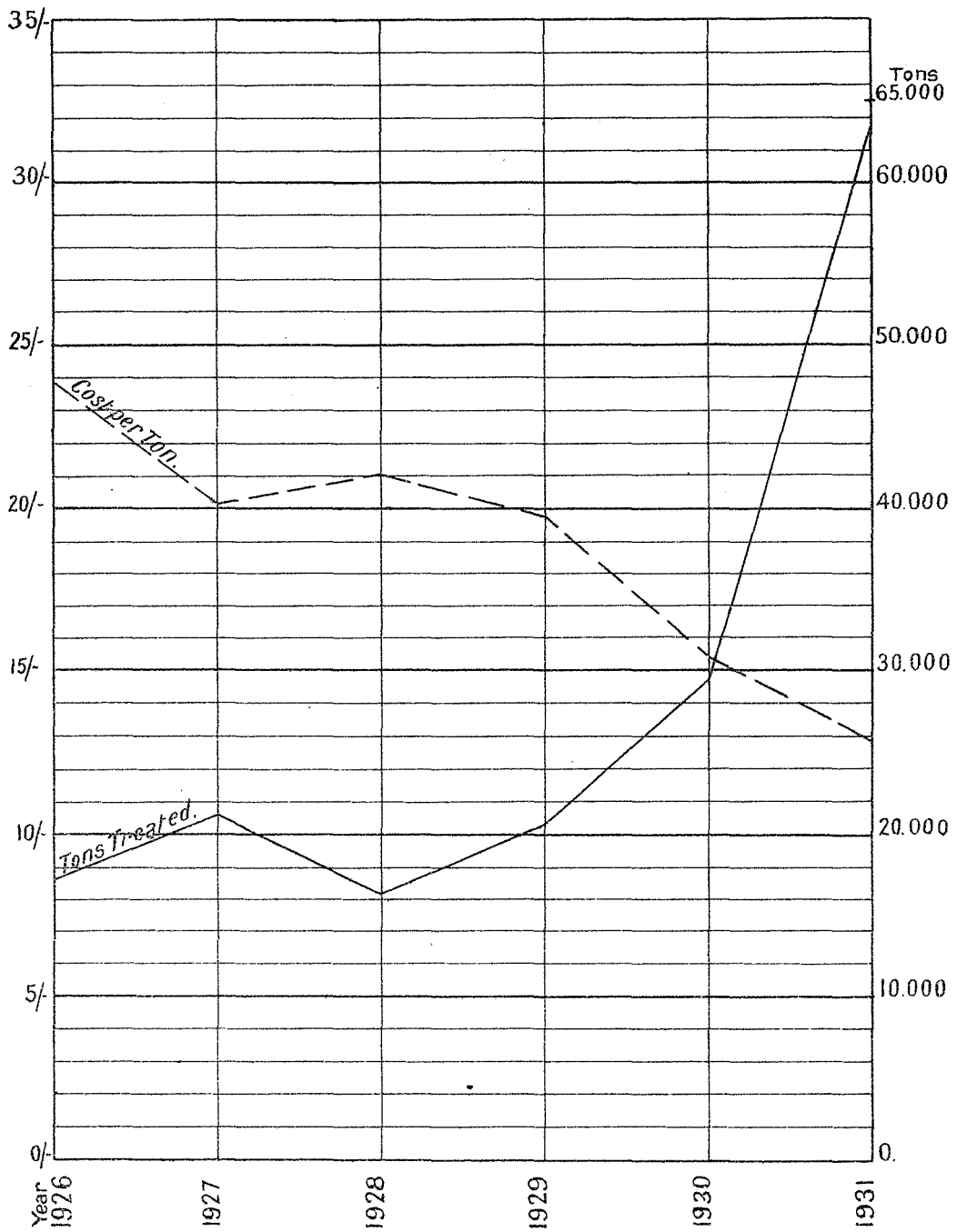
I have also to place on record my appreciation of the assistance given by the Government Mineralogist and Assayer and his staff.

ASSISTANCE FOR DEVELOPMENT OF MINING AND ASSISTANCE TO GOLD MINING INDUSTRY.

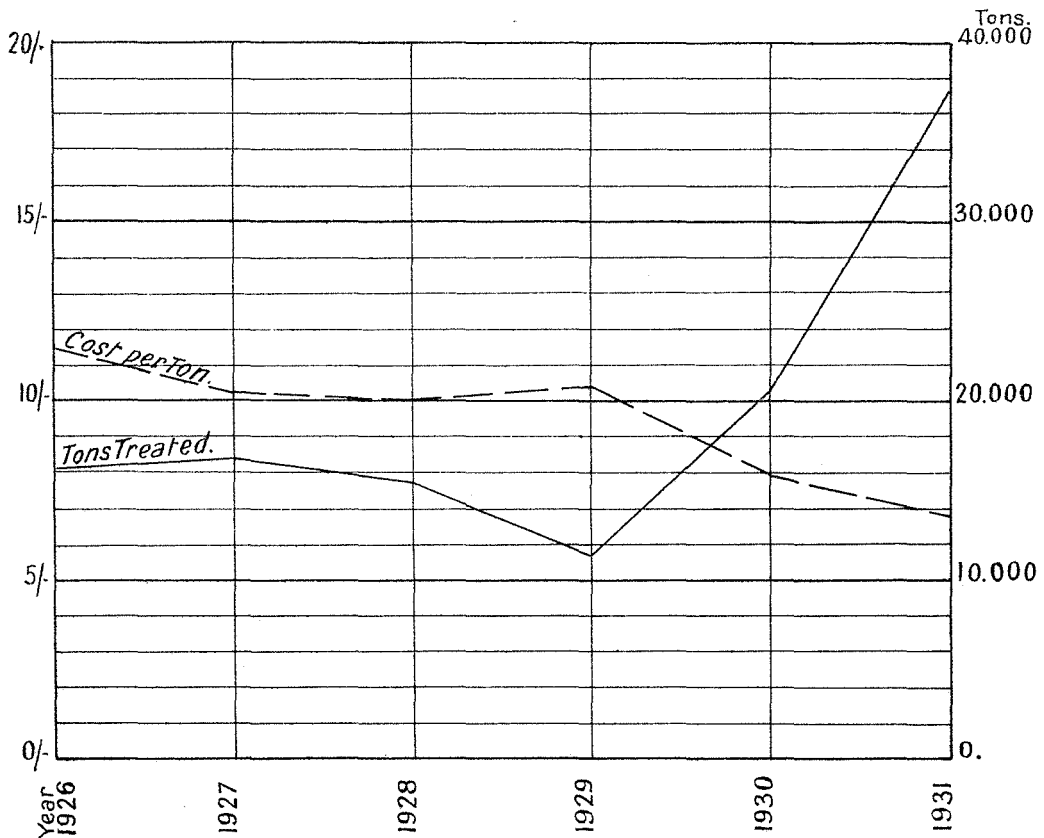
The increased activity was reflected in the amount paid on account of free crushings, low grade rebates and cartage subsidies, which for the year amounted to £20,097 18s. 3d., made up as follows:—

	£	s. d.
Free Crushings	3,223	5 0
Low Grade Rebates	3,919	1 11
Cartage Subsidies	12,955	11 4
Total	£20,097	18 3

MILLING TONNAGE & COST.



TAILING TONNAGE & COST.



As the tonnage has been growing steadily, the cost of these concessions became prohibitive, and it was decided that free crushings and low grade rebates should be suspended whilst gold was worth over six pounds per ounce, and the suspension took place from the 15th November.

The cartage subsidy rate was reduced from 8d. to 6d. per ton per mile as from the same date, and even at the present lower rate the estimated cost for the present year will approximate £10,000.

Erection (from the above Vote).

	£	s.	d.
Yalgoo	3,286	2	10
Lake Darlot	95	4	8
Yarri	825	0	0
	<u>£4,206</u>	<u>7</u>	<u>6</u>

GENERAL REMARKS.

At the close of the year the congestion at certain batteries had been considerably relieved with the exception of Cue and Coolgardie. The erection of the Yalgoo battery and rail concessions to customers at Tuckanarra and other centres to permit ore to go to Meekatharra and Boogardie relieved Cue, and like concessions to Ora Banda and Norseman and the rebuilding of the 10-head plant at Laverton kept the ore booked at Coolgardie within reasonable bounds.

Concessions to customers crushing at private plants also assisted.

At the time of writing there is no congestion at Coolgardie owing to the starting up of our Kalgoorlie plant, and erection of a new 10-head plant at Cue is being proceeded with in order to relieve the pressure there.

The working cost has been assisted by the general reduction in rate of wages for the last half of the year and the increased tonnage, and Revenue has been increased by the higher tailing treatment receipts due to the existing premium.

Fuel supplies have generally cheapened as the result of the depression and calling of tenders through the Tender Board in lieu of obtaining local quotes.

Increases have taken place in the price for water supplied by the Goldfields Water Supply, insurance, and the price of all imported articles.

During the year the policy of using Australian, and especially West Australian, goods has been adhered to; though in some cases the results have not proved economical, there is a general tendency to improvement.

The Oils Committee of the Tender Board, of which I have attended most meetings, has resulted in excellent standard of lubricants being obtainable at remarkably good prices, and no complaints have been received of trouble from faulty lubrication.

The installation of electric lighting equipment at all new plants has been carried out, and as funds permit and opportunity offers the older plants will be fitted.

The installation of electric-driven pumping plant at Jimble Bar was most successful, and where possible the expensive petrol-driven engines on water supplies should be replaced by motors or crude oil engines.

The general revival on the Fields and consequent increase in the number of men on productive work has been mainly made possible by the presence of State batteries, combined with the cartage subsidies by road and rail.

Moribund districts like Sandstone, where 200 prospectors are reported to be working, and Laverton are instances.

The prospects for the coming year are even brighter than at the same time last year, and with a better knowledge of prospecting and estimation of values attained by the new chums, value as well as tonnage is improving.

D. F. BROWNE,

Superintendent of State Batteries.

3rd June, 1932.

SCHEDULE I.

Return showing the number of tons crushed, gold yielded by Amalgamation, average per ton in shillings, and total value for year 1931.

Battery.	Tons Crushed.	Gold Yield Bullion.		Value per ton in shillings.		Total Value.
		Fine ozs.				
Bamboo Creek	1,391·70	1,512·95	79	1·58	5,446·62	
Boogardie	2,559·50	1,367·50	38	5·61	4,923·00	
Coolgardie	11,741·50	6,893·15	42	3·21	24,815·34	
Cue	5,908·75	4,774·10	58	2·06	17,186·76	
Darlot ... ..	...	...	...	...	...
Jimble Bar	1,562·25	842·85	38	10·12	3,034·26	
Laverton	1,392·50	724·40	37	5·45	2,607·84	
Linden ... ..	...	...	...	...	...
Marble Bar	574	957·95	120	1·92	3,448·62	
Meekatharra	4,356·75	3,843·95	63	6·29	13,848·22	
Mount Ida	216·25	158·70	52	10·06	571·32	
Mount Keith ... ..	...	...	...	...	...
Mount Sir Samuel ... ..	...	...	...	...	...
Norseman	4,927·25	1,920·10	28	0·67	6,912·36	
Ora Banda	5,984·25	3,483·00	41	10·87	12,538·80	
Payne's Find	735·75	392·45	38	4·85	1,412·82	
Peak Hill	6,116·50	2,006·25	23	7·39	7,222·48	
Sandstone	2,782·25	2,076·75	53	8·90	7,476·30	
St. Ives	3,346·75	1,055·60	22	8·42	3,800·26	
Tuckanarra ... ..	...	...	...	...	...
Warriedar	2,940·75	1,054·65	25	9·84	3,796·74	
Wiluna	3,540·25	1,367·20	27	9·67	4,921·92	
Yarri	1,691·50	1,588·55	67	7·41	5,718·78	
Youanmi	558·75	238·15	29	11·66	857·34	
Yalgoo	1,101·25	493·60	32	3·24	1,776·96	
Total	63,428·45	36,751·85	41	8·64	132,316·74	

SCHEDULE 2.

Tailings Treatment for 1931.

Battery.	Tonnage.	Yield.		Value.	Premium.
		Fine ozs.	£		
Bamboo Creek	1,456	650·19	2,761·35	1,504·34	
Boogardie	1,315	371·72	1,578·69	231·13	
Coolgardie	8,800	1,319·65	5,604·55	2,724·38	
Cue	5,073	1,087·32	4,617·85	2,013·14	
Jimble Bar	360	117·73	499·99	300·01	
Meekatharra	3,515	669·08	2,841·58	1,564·89	
Norseman	2,999	498·59	2,117·51	512·46	
Ora Banda	4,806	846·28	3,594·85	1,841·98	
Peak Hill	2,436	437·18	1,856·70	1,146·56	
Sandstone	1,440	436·69	1,854·62	820·84	
Warriedar	1,632	204·70	932·36	817·56	
Wiluna	1,404	310·45	1,318·48	683·79	
Yarri	1,782	262·32	1,114·07	735·05	
Total	37,018	7,211·90	30,692·60	14,896·13	

SCHEDULE 3.

Return showing Number of Parcels treated and Tons crushed at State Batteries for Year 1931.

No. of Parcels Crushed.	Battery.	Tons Crushed.	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.	ozs. dwt. grs.	dwt. grs.	£ s. d.										
29	Bamboo Creek	1,391 ³ / ₄	1,512	19	0	1,282	9	5	526	9	13	1,808	18	18	26	0	5	10	4
96	Boogardie	2,559 ¹ / ₄	1,367	10	0	1,159	3	10	557	9	20	1,716	13	6	13	10	2	17	0
297	Coolgardie	11,717 ¹ / ₄	6,893	3	0	5,843	0	14	1,787	17	19	7,630	18	9	13	1	2	15	5
96	Cue	5,727 ¹ / ₄	4,774	2	0	4,046	16	0	1,245	10	23	5,292	6	23	18	12	3	18	7
13	Jimble Bar	1,562 ¹ / ₄	842	17	0	714	9	0	376	11	13	1,091	0	13	13	8	2	16	8
37	Laverton	1,392 ¹ / ₄	724	8	0	614	0	21	275	0	11	889	1	8	12	19	2	14	4
19	Marble Bar	574	957	19	0	812	0	5	80	17	15	892	17	20	33	3	7	0	9
82	Meekatharra	4,333 ³ / ₄	3,843	19	0	3,258	7	0	772	10	20	4,030	17	20	18	14	3	19	0
6	Mt. Ida	216 ¹ / ₄	158	14	0	134	10	10	172	16	9	307	6	19	23	10	6	0	9
79	Norseman	4,927 ¹ / ₄	1,920	2	0	1,627	11	13	803	8	18	2,431	0	7	9	21	2	1	11
84	Ora Banda	5,879 ¹ / ₄	3,483	0	0	2,952	7	12	1,190	19	19	4,143	7	7	14	2	3	0	3
21	Payne's Find	735 ³ / ₄	392	9	0	332	13	6	53	3	2	385	16	8	10	12	2	4	7
40	Peak Hill	6,117 ¹ / ₄	2,006	5	0	1,700	12	3	574	10	16	2,275	2	19	7	10	1	11	5
89	Sandstone	2,782 ¹ / ₄	2,076	15	0	1,760	7	9	638	8	11	2,398	15	20	17	6	3	13	3
26	St. Ives	3,300	1,055	12	0	894	10	2	577	0	16	1,471	10	18	8	22	1	17	10
44	Warriedar	2,925 ³ / ₄	1,054	13	0	893	14	2	790	9	6	1,684	3	8	11	12	2	8	10
71	Wiluna	3,700 ¹ / ₄	1,367	4	0	1,158	18	7	797	11	16	1,956	9	23	10	11	2	4	3
40	Yarri	1,671 ¹ / ₄	1,588	11	0	1,346	10	19	262	13	9	1,609	4	4	19	6	4	1	10
11	Youanmi	558 ³ / ₄	238	3	0	201	17	9	83	3	0	285	0	9	10	4	2	3	2
26	Yalgoo	1,041 ¹ / ₄	493	12	0	418	8	1	131	13	5	550	1	6	10	14	2	4	7
1,206	Total	63,114 ³ / ₄	36,751	17	0	31,152	7	4	11,698	6	21	42,850	14	1	13	14	2	17	8

SCHEDULE 4.

Direct Purchase of Tailings for Year 1931.

	Tons.	Amount.
		£ s. d.
Bamboo Creek	843½	1,543 15 4
Boogardie	1,645	1,298 17 10
Coolgardie	5,446	3,073 14 0
Cue	3,139	3,018 16 1
Jimble Bar	1,049¾	653 10 10
Laverton	35½	43 5 4
Meekatharra	2,057¼	1,480 16 1
Norseman	2,839½	1,441 11 10
Ora Banda	3,968¾	2,551 5 3
Payne's Find	30½	16 2 8
Peak Hill	1,163	615 18 4
Sandstone	1,187¼	1,356 1 7
St. Ives	1,827	971 12 6
Warriedar	1,522	1,079 14 8
Wiluna	1,533	1,147 5 9
Yalgoo	293½	93 16 1
Yarri	437¼	289 1 1
Youanmi	64½	6 17 11
Total	29,082½	20,682 3 2

SCHEDULE 5.

Return showing Tailing payable and unpayable and Gross Contents for Year, 1931.

Battery.	Tailing payable.		Tailing unpayable.		Totals.	
	Tons.	Gross Contents.	Tons.	Gross Contents.	Tons.	Gross Contents.
		ozs. dwts. grs.		ozs. dwts. grs.		ozs. dwt. grs.
Bamboo Creek	876½	502 17 1	307	23 12 12	1,183½	526 9 13
Boogardie	1,405¾	496 16 21	757¼	60 12 23	2,163	557 9 20
Coolgardie	5,234¼	1,398 19 12	4,724¾	388 18 7	9,959	1,787 17 19
Cue	3,442¼	1,138 13 4	1,422¾	106 17 19	4,865	1,245 10 23
Jimble Bar	1,087¾	359 12 21	239¼	16 18 16	1,327	376 11 13
Laverton	1,122½	269 0 7	61	6 0 4	1,183½	275 0 11
Marble Bar	172½	53 0 3	315½	27 17 12	488	80 17 15
Meekatharra	2,184¾	647 8 10	1,499	125 2 10	3,683¾	772 10 20
Mt. Ida	183½	172 16 9	...	...	183½	172 16 9
Norseman	3,173	731 1 19	1,013¾	72 6 23	4,186¾	803 8 18
Ora Banda	4,155¼	1,118 0 5	848	72 19 14	5,003¼	1,190 19 19
Payne's Find	139¼	24 11 19	487	28 11 7	626¼	53 3 2
Peak Hill	1,376¾	328 19 10	3,821¼	245 11 6	5,198	574 10 16
Sandstone	1,344½	551 5 7	1,019	87 3 4	2,363½	638 8 11
St. Ives	2,153	517 10 5	652	59 10 11	2,805	577 0 16
Warriedar	2,279½	771 9 21	207¾	18 19 9	2,487	790 9 6
Wiluna	2,501¼	749 13 15	643¾	47 18 1	3,145	797 11 16
Yalgoo	354¼	89 12 17	529	42 0 12	883¾	131 13 5
Yarri	1,102	240 2 6	319	22 11 3	1,421	262 13 9
Youanmi	189¼	60 19 4	286	22 3 20	475¼	83 3 0
	34,477¾	10,222 11 0	19,153	1,475 15 21	53,630¾	11,698 6 21

SCHEDULE 6.

Statement of Receipts and Expenditure for Year ended 31st December, 1931.

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.									
Bamboo Creek	1,391-75	166	13	0	564	10	3	490	5	1	1,221	8	4	17	6-6	295	16	1	59	14	9	1,576	19	2	22	7-0	734	7	1	10	6-6	...	842	12	1		
Boogardie	2,559-5	193	2	0	639	12	10	473	4	11	1,325	19	9	10	4-3	102	3	5	125	6	2	1,553	9	4	12	1-6	1,276	19	8	9	11-7	...	276	9	8		
Coolgardie	11,741-5	279	10	5	2,283	16	11	2,234	5	1	4,897	12	5	8	4-1	398	4	10	584	4	1	5,880	1	4	10	0-2	5,635	9	9	9	7-2	...	244	11	7		
Cue	5,908-75	298	0	10	1,594	11	9	1,441	6	6	3,333	19	1	11	3-4	43	1	1	305	5	11	3,682	6	1	12	5-5	3,029	7	7	10	3-0	...	74	15	2		
Jimble Bar	1,562-25	187	14	4	588	9	11	206	19	0	983	3	3	12	7-0	135	18	9	75	19	8	1,195	1	8	15	3-6	1,120	6	6	14	4-1	...	74	15	2		
Laverton	1,392-5	168	7	1	566	18	6	284	16	11	1,020	2	6	14	7-8	...	...	...	171	8	6	1,191	11	0	17	1-4	625	19	0	8	11-9	...	565	12	0
Linden	15	15	2	15	15	2	
Marble Bar	574	90	16	6	262	1	0	241	1	8	593	19	2	20	8-3	233	7	9	101	10	8	928	17	7	32	4-4	298	15	3	10	4-9	...	630	2	4		
Meekeatharra	4,356-75	124	13	10	1,242	14	2	964	17	8	2,332	5	8	10	8-5	310	11	4	213	1	10	2,855	18	10	13	1-3	1,843	17	0	8	5-6	...	1,012	1	10		
Mt. Ida	216-25	71	15	2	231	16	4	80	2	5	383	13	11	35	5-8	2	14	8	5	4	0	391	12	7	36	2-6	133	12	3	12	4-3	...	258	0	4		
Norseman	4,927-25	291	15	2	1,516	13	6	1,131	19	8	2,940	8	4	11	11-2	38	11	0	208	6	5	3,187	5	9	12	11-2	2,423	4	8	9	10	...	764	1	1		
Ora Banda	5,984-25	217	17	10	1,629	16	8	847	16	3	2,695	10	9	9	0-1	217	11	5	358	3	3	3,271	5	5	10	11-2	2,342	15	10	7	9-9	...	928	9	7		
Paynes Find	735-75	107	8	1	253	0	6	269	9	0	629	17	7	17	1-46	79	4	0	75	8	8	784	10	4	21	3-2	388	7	7	10	6-7	...	396	2	9		
Peak Hill	6,116-5	168	16	11	1,472	3	4	833	5	5	2,474	5	8	8	1	111	11	6	262	5	11	2,848	3	1	9	3-7	2,671	15	11	8	8-8	...	176	7	2		
Sandstone	2,782-25	219	9	4	891	19	10	546	7	10	1,657	17	0	11	11	68	6	6	122	8	1	1,848	11	7	13	3-4	1,404	18	8	10	1-2	...	443	12	11		
St. Ives	3,346-75	246	0	8	1,128	13	9	950	0	2	2,324	14	7	13	10-6	410	10	4	134	11	4	2,869	16	3	17	1-8	1,676	11	7	10	0-2	...	1,193	4	8		
Tuekanarra	25	18	6	25	18	6	
Warriedar	2,940-75	184	15	11	745	1	9	458	18	11	1,388	16	7	9	5-3	109	17	2	154	8	0	1,653	1	9	11	2-9	1,530	11	2	10	4-8	...	122	10	7		
Wiluna	3,540-25	160	10	0	885	1	2	511	9	1	1,557	0	3	8	9-5	585	6	1	189	0	6	2,331	6	10	13	2-0	1,813	13	5	10	2-9	...	517	13	5		
Yalgoo	1,101-25	79	5	6	294	17	1	67	17	7	442	0	2	8	0-3	33	8	7	44	11	4	520	0	1	9	5-3	528	0	4	9	7-0	...	8	0	3		
Yarri	1,691-5	156	2	2	611	9	0	457	13	10	1,225	5	0	14	5-8	64	2	9	106	1	2	1,395	8	11	16	6-0	858	16	0	10	1-8	...	536	12	11		
Youanme	558-75	26	0	0	174	3	3	56	19	0	257	2	3	9	2-5	17	12	8	16	12	9	291	7	8	10	5-1	249	16	2	8	11-3	...	41	11	6		
Pinjin	10	0	0	10	0	0	
Mulwarrie	1	0	0	1	0	0	
Tin Plants—	63,428-5	3,438	14	9	17,697	11	6	12,548	16	0	33,685	2	3	10	7-4	3,258	0	0	3,313	13	0	40,256	15	3	12	8-2	30,639	19	1	9	7-9	60	13	11	9,677	10	1
Greenbushes	...	...	...	34	0	10	...	2	10	0	36	10	10	...	...	Cr. 47	16	6	6	5	0	Cr. 5	0	8	...	11	4	0	...	16	4	8	...	...	
	63,428-5	3,438	14	9	17,731	12	4	12,551	6	0	33,721	13	1	10	7-4	3,210	3	6	3,319	18	0	40,251	14	7	12	8-2	30,651	3	1	9	7-9	76	18	7	9,677	10	1

SCHEDULE 7.

Statement of Receipts and Expenditure for Year ended 31st December, 1931.

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.									
Bamboo Creek	1,456	33	4	0	295	10	4	59	6	7	105	10	4	493	11	3	6	9-3	27	5	9	35	11	6	556	8	6	7	7-7	1,636	11	2	22	5-7	1,080	2	8	
Boogardie	1,396	97	11	10	221	11	2	52	11	10	157	1	10	523	16	8	6	7-9	...	...	...	50	6	6	579	3	2	8	3-6	949	10	6	13	7-2	370	7	4
Coolgardie	8,800	186	1	8	1,771	6	9	91	10	5	505	7	10	2,554	6	8	5	9-6	10	15	4	285	14	3	2,850	16	3	6	5-7	4,455	8	5	10	1-5	1,604	12	2	
Cue	5,073	102	0	0	739	8	11	62	14	0	296	3	4	1,200	6	3	4	8-7	3	7	8	189	3	9	1,392	17	8	5	5-9	2,793	2	2	11	0-1	1,400	4	6	
Jimble Bar	369	15	6	3	81	11	8	6	4	11	150	4	11	1	50	4	11	8	4-1	10	10	9	160	15	8	8	11-2	300	0	0	16	8-0	139	4	4
Meekeatharra	3,515	77	1	6	673	4	0	68	5	5	192	11	10	1,011	2	9	5	9-0	11	10	2	95	14	7	1,118	7	6	6	3-0	1,776	11	2	10	3-3	658	3	8	
Norseman	2,999	102	1	11	507	17	2	75	4	7	232	10	10	917	14	6	6	1-4	65	4	11	92	8	9	1,073	8	2	7	2-0	1,281	19	4	8	6-6	206	11	2	
Ora Banda	4,887	177	12	0	898	18	11	64	13	1	314	6	1	1,455	10	1	5	11-5	26	9	1	155	15	0	1,637	14	2	6	8-4	2,530	19	2	10	4-3	893	5	0	
Peak Hill	2,436	35	19	6	497	13	8	20	18	7	122	6	4	676	18	1	5	6-7	10	19	7	53	8	2	741	5	10	6	1-1	1,636	9	6	13	5-2	895	3	8	
Sandstone	1,440	91	0	0	199	4	11	28	15	9	114	18	6	433	19	2	6	0-3	90	0	3	42	10	8	566	10	3	7	10-4	1,282	8	0	17	1-4	665	17	9	
St. Ives	135	...	...	...	...	...	...	5	2	1	39	1	7	92	3	8	13	7-9	77	4	9	3	0	6	172	8	11	25	6-5	...	...	...	...	...	172	8	

*Annual Progress Report of the Geological Survey of Western Australia
for the Year 1931.*

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DIVISION IV.

Annual Progress Report of the Geological Survey of Western Australia for the Year 1931.

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 1931.

STAFF.

The personnel of the Staff has not changed from that of the previous year, and consists of two field officers, a technical assistant and a messenger.

FIELD WORK.

Government Geologist.—In addition to ordinary office duties, during the first months of the year my time was largely occupied in making a number of inspections and reports on various geological problems, a list of which may be seen on the covering page of this report.

A pleasing feature in the year's work is the increasing number of inquiries from members of the public for information regarding mining, and the greater demand for bulletins and published reports which are surely, in both instances, true indications of a revival in mining activities.

F. R. Feldtmann, Field Geologist.—During the year the greater part of Mr. Feldtmann's time was taken up with work connected with the Kalgoorlie Survey. This included the preparation of a large number of cross sections of the Great Boulder, Ivanhoe, Golden Horseshoe and Enterprise mines; detailed geological plans of various levels of the Enterprise and Chaffers mines; the linking up of the geological features of the different mines at various levels, and other work connected with the survey of the area. As a result of this work, which is now nearly completed, much light has been thrown on the relationships of the lodes of the different mines, the structural features controlling the occurrence of the ore-shoots, the existence of faults previously undetected and their effects on the lodes, and the relationship of the various types of altered rock to the ore channels.

During the month of October several days were spent in the examination of the Wongamine Gold Find and two reports on that area, accompanied by a sketch map, were prepared. This area is the subject of a separate report.

F. G. Forman, B.Sc.—In January Mr. Forman made a short field trip to South Champion for the purpose of sampling M.C. 103H for alunite.

During the latter portion of this month he was engaged in helping Mr. Feldtmann in the preparation of plans in connection with the Kalgoorlie Survey.

From February to May he helped me both in the field work and plotted the map of the Collie Coalfield. This work was undertaken at the special request of

Dr. Herman, who was acting as Royal Commissioner at a Commission on Collie coal.

During the months of May to October Mr. Forman was attached as geologist to a Lands survey party working between Laverton and the Warburton Ranges.

The month of November was taken up mostly in cutting rock sections, examining specimens, and preparing maps, etc., of the Warburton area.

In December a start was made by him in a general correlation of the artesian bores in the vicinity of Perth. The necessity for a more intensive study of the artesian water supplies of the metropolitan area has long been felt, and when the present work has been completed I anticipate that a closer conception of the conditions of the underground water supplies will be realised. This work is still in progress.

Two other short field trips were also taken by Mr. Forman, one to give advice as to water supply for the camp for unemployed at Hovea, the second to inspect boring operations for oil at Quinn's Rocks.

F. Armstrong, B.Sc.—Owing to a greatly increased number of inquiries from the public more of Miss Armstrong's time than usual has been taken up in attending to this section of her duties. There has also been a steady increase in the number of rock sections to be cut and rocks requiring a petrological determination.

Her other work, other than the usual clerical, has been a continuance of the card catalogue of the rock and mineral specimens of our collection and additions to the library. During my absence she undertook and carried out successfully the assembling of the gold exhibit for the Agricultural Show at Claremont. While on my leave she was in charge of the office.

Petrological.—With the exception of individual rock determinations no petrological work has been carried out during the past year. The main reasons for the retirement of the late Petrologist was that the petrological work had been so reduced that there was insufficient work. I trust that the revival in mining will increase to such an extent that it will be found necessary, at no distant date, to refill this position.

The full reports of the work done by the members of the Staff are also attached, except those which were written for Departmental purposes only.

In conclusion I take this opportunity to express my appreciation of the work and loyal support of each member of the staff during the past year.

T. BLATCHFORD,
Government Geologist.

14th April, 1932.

1.—REPORT ON THE GEOLOGICAL FEATURES OF THE DENMARK AND NORNALUP FARMING AREAS, WITH SPECIAL REFERENCE TO THE "WASTING DISEASE" IN THE CATTLE ON THE DENMARK AREA.

(T. Blatchford, B.A.)

General Remarks.

For some considerable time past there has been a constant loss in the dairy herds of the farms of the Denmark area and extending as far west as Group 116. These losses have been confined mainly to the young stock, particularly to the calves after reaching an age of about three months. Young heifers are also affected to a less extent. On removing the affected stock to unaffected blocks they usually recover and on reaching maturity are, as a rule, immune. The loss in stock due to this cause has become so pronounced of late that the position of the dairy men settled on affected blocks has become more and more acute. Furthermore, as the disease appears to be spreading in the Denmark areas the danger became still more serious owing to the opening up of the western areas at Nornalup.

Realising the seriousness of the situation and to ensure that no avenue of investigation should be neglected, the Hon. the Minister for Lands requested a geological inspection of both areas to ascertain whether a study of the geological conditions might throw some light on the cause of the complaint, such as was done in the case of the "Bush Sickness" in New Zealand.

Geology.

The general geological features of the coastal areas extending from Denmark to Nornalup are extremely simple and are briefly as follows:—

From the shore line extending inland for usually not more than a very few miles we find a series of comparatively recent sand dunes, which no doubt have been formed from the beach sand blown inland by the ocean winds.

In places these sand deposits are calcareous, the origin of the lime being no doubt due to concentration from the fragments of sea shells included in the sand. Occasionally this concentration has gone far enough to create limestone deposits, "cap limestones" sufficiently high in lime contents to be of commercial value, where the difficulty of transport is not prohibitive.

Lying in the hollows between the sand ridges it is not uncommon to find accumulations of organic matter in sufficient quantity to form peaty swamps, and in one or two instances beds of brown coal have formed, the most noteworthy being that on the north-western edge of Nornalup Inlet. All these recent coastal deposits are shallow and rest directly on an underlying gneissic floor. To illustrate their extent a map* is attached showing how they occur in the vicinity of Nornalup.

Leaving these low-lying coastal deposits and passing inland a few miles from the seaboard, we find a series of irregular hills and ridges of considerably greater altitude. Sometimes these ridges are connected, but more often they occur as isolated groups, separated by valleys or level strips of low-lying country.

Without exception these hills are composed of some form of granite, the prevailing type being a gneissic variety. Very occasionally narrow dykes of a more basic nature may be seen cutting through the granite, but these are so rare and small as to be negligible.

Much of the slopes, particularly towards the bases of the hills, is covered with ironstone gravels.

The Granites.—In hand specimens many of the granites show a gneissic or schistose structure, particularly when slightly weathered. On the other hand, some are true augen gneissés. These differences from a normal granite are purely structural and arise from the re-arrangement of the component minerals into bands, due either to pressure or flow structure during consolidation. There need be no difference in the chemical composition of the three rocks—granite, gneiss, or gneissic granite. Under the microscope the following minerals have been recognised:—

Quartz, biotite mica, orthoclase, microcline and plagioclase felspars with minor quantities of the accessory minerals, hornblende, garnet, apatite and the oxides of iron.

All these are very commonly occurring minerals of the granite family throughout the world. Some little confusion, I find, was caused by concentrations of the mica in certain restricted areas, being confused with basic dykes. These basic segregations are very common in most granite areas and only indicate a preponderance of black mica—biotite.

In an investigation in New Zealand of the "Bush Sickness," which has many characteristics of the Wasting Disease in Denmark, some very close work has been done as regards the soils of their infected areas, particularly with regard to the physical qualities; it being claimed that healthy and unhealthy areas can be differentiated by investigating the texture of the soil.

I take the opportunity here to discuss briefly the characteristics of the New Zealand affected areas with those of our State. In New Zealand the affected soils may consist of granite wash (?), dune sands or punice soils. When they contain less than 5 per cent. of clay that soil is considered to be near the danger zone of being "sick." All "sick" soils in New Zealand are almost devoid of clay particles; they range from fine gravelly sandy silts to coarse sands.

So far, most of the "sick" farms in Denmark are on the crests or upper slopes of the granite hills. There has been no sorting of the rock waste, the pastures are on soil the result of the decomposition of the rock *in situ*. Three analyses of typical soils, taken from some of the blocks at Nornalup, all gave satisfactory clay results when compared with the unaffected New Zealand soils. (Appendix 3.) These samples should be representative of most if not all of the farms under consideration.

As the principal virtue of clay in soil is its power to conserve surface waters, the rainfall should also be considered. It will be seen from Appendix 2 that, on the average, rain falls every month of the year, both at Nornalup and Denmark.

Therefore, if the New Zealand experience regarding the physical conditions of soils be used as a criterion for comparison with those of Denmark and Nornalup, there is only one conclusion to arrive at, which is that the soils in the latter localities should not be affected.

* Map not published.

Ironstone Gravel or Laterites.—The only other rock type found on the farms situated on the hilly country is laterite.

Laterite deposits are fairly common throughout, particularly on the lower portions of the slopes, near the crests of the hills they assume a character more of the nature of gravel beds, but on the lower portions the laterite mantle is distinctly massive. From the analyses of two typical samples (Appendix 4), it appears that at least some of these laterites are aluminous, though not to the extent to justify their being classified as bauxites.

The origin of these iron-bearing deposits is generally recognised as being due to the soluble ferrous salts rising by capillarity to the surface and there becoming oxidised to the corresponding insoluble ferric form. In the present case the iron oxides would have been derived from the decomposing biotite.

From the pastoral standpoint they play two important parts at Denmark. In the first place, under two conditions they would be a source of soluble iron salts for plant life: (1) in the presence of acid waters; (2) when subjected to acid generated during the decomposition of organic matter during the formation of humus in the soils. This would occur, no doubt, to a greater extent where the laterite is broken down into more or less gravel beds such as already referred to, as being the condition on the higher ground. On the lower portions of the slopes, where the laterites are more solid, they might very easily act in the same way as a "hard pan" and prevent the rainwaters soaking into the underlying weathered rock. I advance this as a possible cause for the karri timber growing on the crests and upper slopes in these areas, which is not its usual habit in other localities, on account of the soils containing more moisture there than in the lower slopes, where jarrah predominates.

Chemical Composition of the Soils.

Generally speaking, granites are not rich in all the mineral ingredients necessary for the development and maintenance of plant life. They, however, usually carry minerals which, on decomposition will liberate quite appreciable amounts of potash, iron, with lesser amounts of lime and phosphorus.

Of the potash-bearing minerals, biotite and orthoclase and microcline are the most important and are found in fair quantities in the Denmark granites or gneisses. There is a limited amount of lime-bearing felspar but the phosphorus-bearing mineral—apatite—occurs comparatively only in very small quantities. No mineral which could on weathering produce a deleterious ingredient was discovered in any of the samples collected.

Except that the soil may be a little shallow on portions of some of the farms, my investigations are to the effect that the soil is a typical granite variety, well constituted to hold moisture and should retain limited amounts of natural potash, iron oxides, with minor quantities of phosphate and lime. By the addition of top dressings the cleared land has already produced excellent results.

Attached as Appendix 5 are several analyses of the soils of the Denmark farms, which have been taken by officers of the Agricultural Department. In con-

nection with these analyses I would like to draw the attention of the agricultural chemists to the importance attached to the pH values in soils, set out in a lecture by Professor Prescott of the Waite Agricultural Research Institute, at the meeting of the Australian Association for the Advancement of Science held in Hobart, 1928, entitled "The Agricultural Significance of Soil Reaction" in case the article has been overlooked.

Water.

The stock water supplies of both affected and non-affected farms are derived from wells, running streams, soaks and water catchments. The list of analyses in Appendices 6-9 does not clearly show to what extent any particular water has been used for stock on the individual farms.

Generally speaking there are two points to note regarding the analyses. In the first place the total solids in no instance exceeds the limit set for stock water for cattle. In fact they are far below that factor. The pH value of the waters, however, calls for careful thought, and though I admit that I am not in the position to give an opinion on what the effect of slightly acid waters would have on stock, I wish to draw attention to the fact that in the attached list the waters on the affected farms have a low pH value, whilst with one exception—the well water on the State Farm—the waters on the non-affected farms have a much higher value, and have been classified as neutral.

Summary and Conclusions.

1. In summing up the foregoing evidence there appears to be no doubt that the soils of the infected farms are solely derived from the weathering of granites and gneisses in situ. Consequently there has been no sorting of the material as in river flats or similar deposits.
2. Compared with the unaffected areas in New Zealand the physical conditions, particularly the percentage of clay in the soil, are very satisfactory.
3. Although of minor importance, there is a strong probability that natural useful plant minerals, such as potash, iron, with minor quantities of lime and phosphoric acid, still exist in the soil.
4. The waters used for stock purposes carry low salt contents, but on some of the affected blocks show slight acidity. This requires further investigation.
5. Statistics show an average monthly rainfall throughout the year, as seen in Appendix 2.
6. Some of the main difficulties which present themselves are the following:—
 - (a) How two adjoining farms on apparently the same class of soil can be one affected, the other clean;
 - (b) Why stock transferred from the first to the second recover;
 - (c) Why the disease is gradually increasing.
7. In my opinion none of these difficulties can be attributed to the properties of the soils, which should remain constant in either case.

8. I therefore suggest that the cause of the Wasting Disease may be found in investigating—

- possible malnutrition—in some cases at least this might be lack of both fodder and water;
- the slight acidity of some of the stock waters;
- exposure, particularly to the young stock;
- a close study of the fodder, particularly as the complaint is said by some to be more pronounced at certain times of the year;
- some disease, hitherto not diagnosed;
- a possible deficiency in the fodder supplied to the stock.

AFFECTED HOLDINGS—DENMARK AREA—WASTING DISEASE—*continued.*

Group.	Loc.	Settler.	Remarks.
...	2627	Bidwell and Woolterton	Red Gum and Jarrah fringes, (recently affected)
...	4329	Parker ...	Karri, Red Gum and Jarrah
116	1702	E. Pascoe	Karri and Tingle, and little Red Gum and Jarrah (heifers affected)
...	1694	L. S. W. Boast ...	Karri and Tingle, Red Gum fringes, (heifers affected)
...	1706	H. Boast ...	Karri and Tingle, Red Gum fringes, (heifers affected)
93	4326	A. C. Swan ...	Karri, Red Gum and Jarrah fringes
41	551	F. C. Smith ...	Karri, Red Gum and Jarrah fringes
...	469	E. Thomas ...	Karri, Red Gum and Jarrah fringes, (heifers affected)
42	552	H. Harris ...	Karri, Red Gum and Jarrah fringes, (heifers affected)

AFFECTED HOLDINGS—DENMARK AREA—WASTING DISEASE.

Group.	Loc.	Settler.	Remarks.
41	553	Taylor ...	Karri, Red Gum and Jarrah
...	419/39	Mohr ...	High Karri mostly
...	463	Garland ...	Karri land, Red Gum and Jarrah fringes
...	436	J. Hsley ...	Karri land, with moist depressions
...	469	G. Osborne ...	Karri land, (calves affected)
...	461	A. Watson ...	Karri land, Red Gum and Jarrah fringes
42	455	A. Holder...	Karri, Red Gum and Jarrah fringes
...	460	E. Bastiani ...	Karri, Red Gum and Jarrah fringes (calves affected)
...	574	Pearce ...	Karri and Jarrah, moist depressions
...	476	Burgoyne ...	Red Gum and Jarrah fringes
58	662/3/4	Narcanon ...	Red Gum and Jarrah fringes (heifers under two years affected)
93	2615	Lethlian ...	Karri, Red Gum and Jarrah fringes
...	2616	Hodgson ...	Karri, Red Gum and Jarrah fringes

APPENDIX 2.

AVERAGE MONTHLY RAINFALL.

	Normalup.	Denmark.
	points.	points.
January ...	143	116
February ...	209	154
March ...	247	235
April ...	349	348
May ...	700	590
June ...	769	709
July ...	835	759
August ...	747	665
September ...	569	531
October ...	447	464
November ...	235	190
December ...	161	141
Yearly average ...	5,411	4,901

APPENDIX 3.

Report on Six Samples of Soil taken at Normalup, W.A.

Marks :—Block	10185,	depth	0 — 6in.
...	10185	„	6 — 12in.
„	10107	„	0 — 3in.
„	10107	„	3 — 11in.
„	10211	„	0 — 6in.
„	10211	„	6 — 12in.

Results of Analysis :—

Lab. No.	5335.	5336.	5337.	5338.	5339.	5340.
Depth	0—6 in.	6—12in.	0—3 in.	3—11 in.	0—6 in.	6—12 in.
	%	%	%	%	%	%
Roots	—	—	4.0	2.5	—	—
Stones above 2 mm.	15.0	—	8.0	16.0	60.0	58.0
Fine soil below 2 mm.	85.0	100.0	88.0	81.5	40.0	42.0
Mechanical Analysis of — 2mm. samples :						
Loss on ignition	10.2	7.6	9.2	7.3	4.4	4.3
Moisture	3.8	3.0	3.9	2.6	1.3	0.9
Loss on acid treatment	3.1	1.9	4.2	2.4	1.1	1.0
Coarse sand (2 — 0.2 mm.)	35.4	34.5	28.3	29.8	45.3	39.9
Fine sand (0.2 — 0.02)	25.5	25.0	36.6	36.2	37.8	40.4
Silt (0.02 — 0.002)	11.2	10.2	10.0	9.4	3.6	4.5
Clay (below 0.002)	15.3	23.4	11.5	16.3	5.7	8.1
Chemical Analysis of — 2 mm. samples :						
Water soluble salts	0.082	0.050	0.262	0.050	0.066	0.05
Sodium chloride calc. from chlorine	0.020	0.017	0.100	0.017	0.008	0.013
Reaction, pH.	6.08	6.17	5.86	6.28	5.98	5.78

(Sgd.) EDWARD S. SIMPSON,
Government Mineralogist and Analyst.

APPENDIX 4.

Report on two Samples from Nornalup.

Lab. No.	...	...	...	...	5333/30	5334/30
Reg. No.	...	...	...	...	1/5028	1/5040
Acid Soluble Alumina (Al ₂ O ₃)	...	...	...	...	13.94	25.57
Acid Soluble Iron Oxide (Fe ₂ O ₃)	...	...	...	...	39.69	10.13

NOTE.—These laterites are too low in soluble alumina to be classed as bauxites.

(Sgd.) EDWARD S. SIMPSON,
Government Mineralogist and Analyst.

APPENDIX 5.

Material: Eight samples from the Denmark District—(1) Soil, Burgoyne, Group 42. (2) Subsoil, Burgoyne. (3) Soil, Osborne, Group 42. (4) Subsoil, Osborne. (5) Soil, Kingdon. (6) Subsoil, Kingdon. (7) Soil, Marwick. (8) Subsoil, Marwick.

Lab. No.	...	...	1571/28	1572/28	1573/28	1574/28	1576/28	1577/28	1579/28	1580/28
			(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
			Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.
			Burgoyne (476).		Osborne (469)		Kingdon.		Marwick.	
Soil reaction, pH	...	...	6.0	5.2	5.6	6.4	6.2	6.8	6.2	7.0
Total sol. salts	...	...	% 0.68	% 0.27	% 0.23	% 0.31	% 0.17	% 0.37	% 0.03	% 0.13
Sodium chloride	...	...	0.66	0.26	0.13	0.19	0.09	0.12	0.01	0.12
Acid Soluble:										
Iron, Fe	...	...	7.68	3.25	2.98	2.03	3.05	2.44	5.41	1.01
Lime, Ca	...	...	0.25 N	0.13	0.13 L	0.13	0.21 L	0.11	0.25 N	0.29
Phosphoric oxide (P ₂ O ₅)	...	...	0.07 L	0.11	0.06 L	0.09	0.20 G	0.12	0.15 N	0.20
Potash, K ₂ O	...	...	0.42 R	0.09	0.19 N	0.40	0.04 P	0.05	0.14 L	0.08

(Sgd.) EDWARD S. SIMPSON,
Government Mineralogist and Analyst.

APPENDIX 6.

Material:—Twelve samples of Water in connection with the Denmark Cattle Disease marked as below.

Results of Analysis.

Lab. No.	Sample No.	Block No.	Condition.	Reaction pH.	Sodium Chloride.	Total sol. salts.	Iron, Fe. Parts per million.
					Grains per Gallon.		
66/30	1	512	...	6.8 Neutral	52.60	60.76	9
67	2	503	Healthy	7.0 do.	103.84	124.02	8
68	8	Kingdon	do.	6.8 do.	29.02	41.16	10
69	10	S.S.F.	do.	6.8 do.	64.84	80.36	6
70	11	Scotsdale Creek	do.	6.8 do.	34.47	42.28	7
71	12	S.S. Farm well	do.	5.0 weakly acid	35.82	48.72	4
72	3	454	Affected	5.4 do.	22.67	32.48	15
73	4	Burgoyne, 476...	do.	5.0 do.	8.61	13.72	8
74	5	648	do.	4.6 do.	16.32	24.36	3
75	6	Bastiani, 460	do.	4.8 do.	19.50	28.28	7
76	7	Holder, 455	do.	5.6 faintly acid	11.34	16.80	11
77/30	9	Mohr, 439	do.	4.8 weakly acid	11.79	18.76	4

(Sgd.) EDWARD S. SIMPSON,
Government Mineralogist and Analyst.

APPENDIX 7.

Material.—Two samples of water marked—(1) Kingdon, Denmark ;
(2) Marwick, Denmark.

Lab. No.	1575/28	1578/28
Result of Analysis :—	(1)	(2)
	Kingdon.	Marwick.
	%	%
Calcium oxide, CaO	0·0024	0·0008
Sodium chloride (from chlorine)	·0073	·0219
Silica	·0016	·0006
Iron and aluminium oxide	·0032	·0006
Potash, K ₂ O	trace	trace
Phosphoric acid	unable to detect a weighable quantity	
Reaction pH.	7·4	7·5

(Sgd.) EDWARD SIMPSON,
Government Mineralogist and Analyst.

APPENDIX 8.

Material.—Thirteen Samples of water in connection with Denmark Cattle Disease, marked as below.

Result of Analysis.

Lab. No.	Source.	Condition.	Reaction pH.		Total Sol. Salts.	
			January.	May.	January.	May.
					(Grains per gallon.)	
1628/30	Crellin, soak ... ..	...	6·8	6·4	60·8	30·8
1629/30	Deal, soak	Healthy	7·0	6·6	124·0	99·4
1630/30	Kingdon, soak	do.	6·8	6·3	41·2	57·4
1631/30	State Farm Creek	do.	6·8	6·5	80·4	88·2
1632/30	Scotsdale Creek	do.	6·8	6·3	42·3	44·8
1633/30	State Farm, well	do.	5·0	6·3	48·7	126·0
1634/30	Russell, soak	Affected	5·4	6·1	32·5	29·4
1635/30	Holder, soak	do.	5·0	5·6	13·7	9·8
1636/30	Osborne, well	do.	4·6	6·1	24·4	15·4
1637/30	Bastiani, soakage	do.	4·8	5·5	28·3	32·2
1638/30	Burgoyne, soakage	do.	5·6	6·4	16·8	21·0
1639/30	Mohr, spring	do.	4·8	5·8	18·8	9·8
1640/30	State Farm, tank	do.	...	6·6	...	2·1

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APPENDIX 9.

Material.—Two samples of water marked—(1) N. Kingdon, Denmark ; (2) W. Marwick, Denmark.

Two samples of pasture grass.

Result of analysis :

Waters :—	Kingdon.	Marwick.
Iron, Fe (grains per gallon)	0·005	0·022

Both samples smelt strongly of hydrogen sulphide combined with a putrid smell probably due to dirty tomato sauce.

Pasture grasses.—Percentage of constituents in ash and dry material.

Lab. No.	116/28	117/28	118/28	119/28
	Kingdon.		Marwick.	
	Ash.	Steam dried material.	Ash.	Steam dried material.
Total ash ... ..	...	17·66	...	14·05
Lime, CaO	22·20	3·92	22·24	3·12
Magnesia, MgO	3·53	0·62	4·66	0·65
Potash, K ₂ O	28·68	5·07	27·86	3·91
Soda, Na ₂ O	1·27	0·22	3·23	0·45
Iron, Fe	0·275	0·048	0·300	0·042
Phosphoric oxide, P ₂ O ₅	5·10	0·90	4·52	0·64
Chlorine, Cl	9·31	1·64	8·92	1·25

(Sgd.) EDWARD S. SIMPSON,
Government Mineralogist and Analyst.

2.—REPORT ON SOME SUGGESTED DAM SITES ON THE MURRAY RIVER.

(T. Blatchford, B.A.)

General Geology.

The Murray River in its upper course through the Darling Ranges passes through gorges cut out of granite rocks which are partly normal biotite granite, partly biotite gneiss. Numerous basic dykes intrude these granite matrices and form a broad network, the dykes striking in no regular directions. Their occurrence is similar in every respect to the dykes in the reservoir catchments at Mundaring, Canning, etc. The only other rock types are the weathered products of the granites and dykes, which, owing to the steep incline of the river banks and the narrow valley are of no great extent.

Suggested Dam Sites.

Several possible sites had previously been chosen by Mr. Dumas, but by mutual consent we reduced the number to three as being the most promising for the purpose required. To avoid possible confusion these three sites have been marked by the letters A. B. C., the first being the furthest up stream. Before going further with this report, I would like to make it clear here that nothing up to the present has been done in the way of accurate surveying or testing of the sites suggested. The whole scheme is still in the preliminary stage, and my observations are only to be taken as a help from a purely geological aspect in choosing what appear on the surface to be the most likely sites on which to concentrate by the usual engineering methods of testing out before actual construction is undertaken.

Site A.—This site is in a comparatively narrow section of the gorge and where there is high granite bottom and fairly steep sides, particularly the north bank.

The water at present is flowing through a narrow channel close up to the north bank.

North Bank.—This bank shows massive granite outcrops with very little covering. As usual the granite is jointed, but the joints are not numerous and appear to have a prevailing course parallel to the stream.

Bottom.—With the exception of the narrow portion above referred to the bottom as a whole is on massive granite with few joints.

South Bank.—This bank is not so massive or steep as the north bank. It has very little covering, however, and has the appearance of being massive.

At the base of the south bank a narrow basic dyke outcrops and apparently strikes more or less parallel with the river. This dyke is of no great width and as far as can be seen at present makes a close contact with the granite.

Geologically the main points are:—

- (a) The north bank is steep and apparently massive.
- (b) The south bank, though not so steep, has no great covering and will probably prove massive at no great depth.
- (c) The only dyke and the main joints run parallel with the stream.

Site B.—This site is also in a narrow section of the gorge.

North Bank.—This bank is probably the most massive granite in any of the sections and presents a bare granite face, free from external joints. The only testing required would be for internal "flaking."

South Bank.—Unfortunately this bank is more broken than usual. It has a steep slope, however, with comparatively little earth covering. There is no reason to doubt that the rock will not become massive at a reasonable depth below the surface.

The Bottom.—The bottom is quite solid, and though mixed with a little dyke material, the two rocks are found to be "frozen" together, so there is no difficulty in that direction.

As in the case of Site A, a narrow dyke occurs at the base of the south bank and apparently strikes parallel to the water course.

The advantages of this site are:—

- (a) Though lower than Site A it is considerably higher than Site C.
- (b) The north bank appears to be almost ideal, while the south bank is fairly satisfactory and the bottom quite good.

It compares favourably with Site A, except that its base would be several feet lower.

Site C.—This site differs geologically from the first two in that a weir would be set on a very broad basic dyke which crosses the river more or less at right angles to the stream.

At the surface the dyke is very much jointed, and it would depend entirely on these joints going down too deep as to whether this site would be suitable. This, and the fact that the site is considerably lower than the first two, appear to me the controlling factors, for otherwise the bottoms, walls and span would all be satisfactory.

Conclusions.

I consider that any of these three sites chosen by Mr. Dumas would probably be suitable for the erection of a concrete dam, but recommend that before a final choice is made the usual testing out by sinking trial holes, etc., be first carried out. The choice will also largely depend on a survey of the sections and estimate in each case of the quantity of water impounded.

I would very much like to make another visit when this preliminary work has been completed.

3.—REPORT ON AN ALLUVIAL GOLD FIND ON YINIDING CREEK EIGHT MILES SOUTH-WEST OF TOODYAY.

(T. Blatchford, B.A.)

General Remarks.

Gold was first found by Prospector Brown near Yiniding Creek on Block 198, when he was looking for tin. He followed up the creek obtaining traces of gold as far south as his P.A. 44.

Since the discovery other prospectors have located gold on the sides of the hills flanking the creek, the reported recoveries now amounting in all to about 20 ozs.

As there is no water available for sluicing, the gold is recovered by passing the dirt through dry blowers or shakers.

Geology.

Although the slopes of the hills are largely covered with surface soils, there are sufficient rock outcrops and shafts to show that the country rocks consist of several types, amongst which the most important are normal granites, with their accompanying pegmatitic veins, epidiorite dykes, fine silky micaceous schists, quartzites and andalusite schists. With the exception of the first two, the remainder are old sedimentary types, which have been metamorphosed into their present form. These sediments are without doubt of Pre-Cambrian age and are possibly counterparts of the same rocks which occur in the Yilgarn, Coolgardie, N.E. and N. Coolgardie Goldfields, and which in many instances carry gold-bearing lodes and reefs.

The area had previously been examined by Professor Clarke, who has also mapped a narrow strip of country containing the same types, lying west of the Midland railway line and extending from Moora north to Mingenew.

Origin of the Gold.

The origin of the gold is, in my opinion, due to two sources: (a) ironstone leaders, (b) quartz leaders or reefs.

In a shaft sunk by Brown near the boundary of P.A. 45 he has cut through a series of ironstone leaders, one of which he assured me gave traces of gold sufficient to indicate that this is undoubtedly one of the sources. The shaft has been sunk near the edge of a heavy laterite covering in a rock which has every appearance of a weathered granite, though it may possibly be a gritty arkosic sediment. The frequent occurrence of quartz floaters and vein quartz in some of the other shallow shafts would suggest these as a second possible source of the gold, though so far no one seems to have found quartz veins carrying gold.

Occurrence of the Gold.

As far as could be ascertained, small quantities of gold are scattered over quite a considerable area, so far mostly on the hill slopes on the southern bank of Yinding Creek. I am led to believe that the richest claim is in the creek bed. Gold has also been reported as occurring on a branch creek which passes through P.A. 51.

The gold I saw was what is usually termed "rough shotty," that is, fairly coarse angular pieces from a few grains in weight up to a reported piece of two ounces.

In comparison there is apparently very little fine gold.

The gold-bearing dirt on the slopes of the hills is shallow and lies on a clay or rock bottom. So far no deep ground has been found on the slopes. In the bed of the creek the wash is sometimes deeper, but owing to the steep sides has no great width.

As there are many on the field who have had little experience in mining, it would perhaps be as well to sound a note of warning as to the disabilities which will arise when the rainy season commences. In the first place it will not be practicable to use the dry-blowers or shakers, for the loam containing the gold has quite a large quantity of clay contents and will not readily dry sufficiently to be suitable for this treatment. If there is any intention of sluicing the

material in the creek bed, the dirt should be thrown out before the creek commences to run, otherwise it will be found very difficult to work.

There is still another point that may be useful to the prospector. It is evident that nothing big in the way of alluvial gold will be found on the slopes or the upper reaches of Yinding Creek itself, but if the gold found on the slopes is indicative of what may have been washed away in the past ages, there is at least a chance of richer accumulations occurring in the more extensive alluvial flats lower down the stream, and possibly in the Avon River itself. I therefore advise those who hold unpayable claims and who wish to continue prospecting, to try out the lower ground on a possibility, rather than continue where there is little or no hope of success.

Conclusions.

There is no doubt that small quantities of surface or alluvial gold occur over a considerable area at the head of Yinding Creek, and I consider there is just a possibility of deeper auriferous alluvial ground being found on the flats lower down the creek, or in the Avon River.

There is also, of course, a chance of finding ironstone or quartz leaders carrying payable gold.

At present the number of men, 102 on the day of our visit, is excessive, and till something more promising is found, further prospectors should be discouraged from going on to the field.

4.--REPORT ON THE COASTAL LIME-SANDS.

(T. Blatchford, B.A.)

Owing partly to a discovery of a lime sand deposit near Quininup Brook which yielded a result of 84 per cent. lime carbonate, and partly the need for soluble lime compounds for agricultural and pastoral purposes, an investigation of this deposit was required, which eventually led to several other coastal lime sand deposits being examined, the results of which are as follows:—

Geology.

Lime sand dunes occur right along the fringe of the western coastline from Augusta on the south to at least as far north as Geraldton on the north.

The origin of these heaps is no doubt due to the breaking up of marine shells by wave action against the beaches, and winds mixing these fragments with sand and heaping the particles up into dunes and ridges.

In all instances the composition is essentially the same though the proportions of sand and shell vary very considerably; the former—sand—apparently predominating near the mouths of rivers—for example, at Bunbury and Fremantle. At the base of some of the heaps, and particularly on the shoreline, black sand (magnetic iron oxide) and titaniferous iron are evident, but not in the main heaps themselves, which are relatively free of these heavier fractions.

Quininup Brook Deposit.

The Quininup Brook deposit lies a short distance in from the coast and seven miles south of Yallingup.

The deposit forms a fringe on the southern edge of the high ground north of the brook.

Systematic sampling was started by sinking shafts to depths of 4-8 feet at 5-chain intervals. After opening out some 14 of these holes it was evident that the deposit would not contain a large tonnage of high-grade lime sand, also that over most of the deposit was a covering, varying from 1 ft. 6 ins. to 4 ft., and that in many cases the lime sands were lumpy and at times contained bands of hard limestone. Investigations here were therefore stayed and a search further afield was made for larger deposits free from lumps and bands and closer to railway communication.

Sand Dunes south of Quininup Brook.

Some half-mile south-west of the deposit already referred to is a large sand dune which extends from the back of the old homestead right to the ocean beach.

A grab sample from this sand heap yielded 78 per cent. total carbonates.

This deposit would be a far more promising deposit than the first examined, despite the fact that it is slightly lower grade, for it is very much larger, more accessible, and the grains of sand are free and clear of rubbish. The great objection was that it did not lie close to an existing railway line.

Boranup Sand Dune.

The lime sands at Boranup form a huge sand dune several miles in length and in width, with a depth in places of at least 200 feet. The sands are free of lumps and veins, but as it has buried a forest the trunks and branches of the trees will be found on excavating the heap. The eastern edge of the deposit lies quite close to the existing railway running from Busselton to Augusta.

Samples taken from the face near the railway gave an average of 85.23 per cent. total carbonates.

Material: Two samples of calcareous sand from the Boranup Sand patch:—

Lab. No.	...	...	...	...	...	...	1607/31 (1) Top.	1608/31 (2) Side.
Acid soluble calcium oxide, CaO	...	...	...	...	...	...	45.00%	45.00%
equivalent to calcium carbonate, CaCO ₃	...	...	...	...	...	...	80.30	80.30
Acid soluble magnesium oxide, MgO	...	...	...	...	...	...	3.30	3.62
equivalent to magnesium carbonate, MgCO ₃	...	...	...	...	...	...	6.90	7.75
Acid soluble phosphoric oxide, P ₂ O ₅	...	...	...	...	...	...	0.11	0.10

The two sands are both excellent materials for lime dressing of sour soils. For agricultural purposes the comparatively low magnesium carbonate is of equal value to the calcium carbonate, and should be added to it to arrive at the total neutralising and base-exchange value of the sands.

Material: Lime sands from Boranup Sand Patch :—*

Lab. No.	...	...	...	...	1979/31 (1)	1980/31 (2)	1981/31 (3)	1982/31 (4)
Calcium oxide	...	...	...	...	41.61	46.53	45.75	43.59
equivalent to calcium carbonate	...	...	...	...	74.26	83.04	81.66	77.80
Magnesium oxide	...	...	...	...	3.105	3.423	3.303	3.150
equivalent to magnesium carbonate	...	...	...	...	6.50	7.16	6.91	6.59
Total carbonate	...	...	...	...	80.76	90.20	88.57	84.39
Phosphoric oxide	...	...	...	...	trace	trace	trace	trace

- *Locations: (1) South-East corner of Boranup sand patch.
 (2) Sample from top of dump, 200 yards North of (1).
 (3) Half-way down slope, same locality as (2).
 (4) Bottom section, same locality as (2).

The favourable features of this deposit are its high grade in carbonates, accessibility, very large tonnage, and its uniformity in texture.

As it lies but a few chains from an existing railway the capital outlay would be relatively small, if any considerable quantity of the deposit was to be transported.

Busselton Deposit.

In the vicinity of the Busselton Cemetery, and at the terminus of the railway yards, a considerable quantity of lime sand can be found lying between the beach and the cemetery fence.

The average carbonate contents (70.7 per cent.) of this deposit are lower than the two previously referred to. By picking, a grade of 75 per cent. could be obtained but not in very large quantities. On the other hand, capital outlay would be unnecessary unless large quantities were required, and railway freight would be considerably reduced when compared with the Boranup deposit, for the use of the sand for all localities north of Busselton.

Fremantle Deposits.

Samples taken from the sand dunes near Robbs Jetty were very low, the total acid soluble carbonates being only 40-45 per cent. Some two to three miles further south and in the vicinity of the bathing sheds the grade is considerably higher, reaching 70.57 per cent.

On very reliable information I am led to believe that the grade still increases as you go further south, till eventually it rises, in the vicinity of Rockingham, to 90 per cent. This would be at the terminus of the old private timber line from Mundijong and distant from that station about 15 miles.

If this class of lime is required in quantity for centres such as Waroona, the orchards round about Perth, Harvey, etc., this deposit would no doubt be worthy of consideration provided cheap transport could be obtained over the private line.

Appended are certificates of analyses of the Boranup, Quininup, Busselton, and Fremantle samples:—

Material: Samples of Lime Sands from Quininup Sand Hill:—

Lab. No.	...	...	1854/31 (1)*	1855/31 (2)*	1856/31 (3)†	1857/31 (4)*	1858/31 (5)†	1859/31 (6)*
Calcium oxide, CaO	...	...	39.60	47.67	48.90	47.52	25.44	48.09
equivalent to calcium carbonate, CaCO ₃	...	...	70.66	85.06	87.25	84.79	45.37	85.81
Magnesium oxide, MgO	...	...	3.61	3.12	3.27	2.93	1.49	2.88
equivalent to magnesium carbonate, MgCO ₃	...	...	7.56	6.52	6.83	6.14	3.12	6.03
Total carbonate	...	...	78.22	91.58	94.08	90.93	48.49	91.84
Phosphoric oxide, P ₂ O ₅	...	...	.128	.087	.124	.809	.111	.165

NOTE.—* (1), (2), (4) and (6) from surface to 3 feet.
(6) is an average of 11 samples from surface to 3 feet.
† (3) and (5) from 3 to 6 feet.

*Material: Samples of Lime sands from Busselton.**

Lab. No.	3059/31 (1)	3060/31 (2)	3061/31 (3)	3052/31 (4)	3063/31 (5)	3064/31 (6)	3065/31 (7)	3066/31 (8)	1983/31 (9)	1984/31 (10)
Calcium oxide	36.30	35.94	37.68	36.74	35.10	35.07	38.70	38.25	37.65	38.91
equivalent to calcium carbonate	64.78	64.14	67.24	65.56	62.64	62.58	69.06	68.26	67.20	69.42
Magnesium oxide	2.74	2.78	2.70	2.96	2.84	2.77	2.80	2.83	3.204	2.910
equivalent to magnesium carbonate	5.73	5.82	5.65	6.20	5.93	5.79	5.86	5.92	6.70	6.09
Total effective carbonates	70.51	69.96	72.89	71.76	68.57	68.37	74.92	74.18	...	...
Insoluble in acid	28.34	28.87	26.45	26.49	29.22	29.71	23.56	23.22	73.90	75.51

*Locations.—(1) to (5) Depth 1 to 4 feet }
(6) and (7) Depth 4 to 8 feet } Near Esplanade Hotel ... P₂O₅ trace trace
(8) Beach sand }
(9) Opposite Esplanade Hotel.
(10) Near North-West corner of Cemetery.

Material: Lime Sands from Sand heap near Bunbury Jetty:—

Lab. No.	...	...	...	...	...	1985/31
Calcium oxide	...	...	...	...	...	14.82%
equivalent to calcium carbonate	...	...	...	...	...	26.45
Magnesium oxide	...	...	...	...	...	1.044
equivalent to magnesium carbonate	...	...	...	...	...	2.18
Total carbonate	...	...	...	...	...	28.63
Phosphoric oxide	...	...	...	...	...	trace

Material: Lime Sands from near Robbs Jetty, Fremantle :—*

Lab. No.	...	...	...	...	3122/31 (1)	3123/31 (2)	3124/31 (3)
Calcium oxide	...	...	...	...	23.16	21.51	36.84
equivalent to calcium carbonate	...	...	...	...	41.33	38.38	65.73
Magnesium oxide	...	...	...	...	1.35	1.24	2.31
equivalent to magnesium carbonate	...	...	...	...	2.82	2.59	4.84
Total effective carbonates	...	...	...	...	44.15	40.97	70.57
Insoluble in acid	...	...	...	...	54.24	57.13	27.94

*Locations: No. 1.—Opposite Robbs Jetty.
No. 2.—From where sand was taken for making sand bricks.
No. 3.—Three miles south from Robbs Jetty, near bathing shed opposite delicensed hotel.

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Government Mineralogist and Analyst.

5. REPORT ON DISCOVERY OF TIN NINE MILES SOUTH-WEST OF GREENBUSHES.

(T. Blatchford, B.A.)

Geology.

Although the underlying rocks are almost completely covered with a mantle of laterite there are sufficient outcrops and shallow workings to show that the country rock consists of either a granite or a gneiss, through which have intruded typical tin-bearing pegmatite dykes. It would therefore appear that this area is a continuation of the Greenbushes mineral belt. In all cases the rocks were too weathered to examine in detail.

The Occurrence of the Tin.

Apparently tin (*i.e.*, black tin or tin oxide) was found in small pieces, lying at the surface, by J. Donovan, who informed me he was really prospecting for gold, not tin, in the hilly country lying between Nannup and Greenbushes.

The present discovery is in a narrow watercourse running in an east-south-easterly direction.

The prospectors have recovered quite an appreciable amount—224 pounds—from a trench in this watercourse and quite good prospects can still be obtained from shallow shafts sunk deeper in the bottom of this trench.

Following up the tin on the northern bank of the creek by a series of workings in the form of shallow costeens and shafts from 12 to 15 feet deep, the tin has been located for a distance of over 100 yards. I attach a sketch plan* showing the relative positions of the more important of these workings. There were only traces of tin in shaft marked A, but samples taken from B and C yielded 0.76 and 0.05 per cent. of tin oxide respectively.

In shaft C there is a distinct footwall to the tin-bearing material, which dips to the east. This footwall rock is without doubt a gneissic form of granite.

*Plan not published.

The material which carries the tin consists of a very much weathered pegmatite, the width of which has not yet been determined in the northern workings, but appears in the trench in the creek to be at least several feet. The pegmatite is very much weathered but the presence of irregular patches of clear quartz and books of partially weathered muscovite mica must be considered as positive evidence of its nature.

Future Prospects.

At the present time the market for tin stands at about £105 per ton, making the value of tin oxide about ninepence per pound.

Taking the average of the two samples from B and C shafts and the estimate of five pounds per yard recovered from the treated material from the trench, the best return which could be expected would not exceed about 8 shillings per ton.

By puddling and sluicing the weathered product a small profit over working expenses might be made, but when the unoxidised zone is reached and deeper mining becomes necessary there is little doubt that the deposit could not be profitably worked unless the market for tin rose again to an abnormal price.

Mr. Donovan informed me that he could find practically no tin above the trench in the creek and very little immediately below, but at intervals lower down small quantities occur which suggest that there are other tin-bearing pegmatites crossing the watercourse. About 400 yards south of the camp a second party is working on a very narrow vein showing a good prospect of tin but too small to be worked with profit.

Tin has also been "specked" at the surface in several other spots, which indicates that other tin-bearing pegmatites occur which are not exposed at the surface.

Conclusions.

The conclusions to be arrived at from the evidence at present available are that—

1. Tin-bearing pegmatites occur, which are most unlikely to be payable under existing mining conditions and the present price of tin.
2. That there is a probability of the Greenbushes Mineral Belt extending much further south than the present recognised boundaries.

6.—GEOLOGICAL REPORT ON THE ROYAL FLUSH GOLD MINE.

(T. Blatchford, B.A.)

Locality.

The Royal Flush Gold Mine is situated in the Westonia mining area in the Yilgarn Goldfield and lies 70 chains due south of Weston's Reward Gold Mine.

Geology.

The country rocks of the Westonia area comprise the following groups in relative chronological order, commencing with the oldest:—

1. Sedimentary metamorphics (non-auriferous).
2. Massive basic rocks (greenstones), plutonic, auriferous.

3. Gneiss—Edna May Gneiss (intrusive), auriferous.
4. Granite, massive, plutonic, non-auriferous.
5. Ultra acid pegmatites—probably apophyses of the gneiss—lodes—highly auriferous.
6. Basic greenstone dykes, non-auriferous.
7. Quartz reefs, auriferous.
8. Granite intrusive pegmatites, felsites, etc., apophyses of the massive granites of Group 4, non-auriferous.
9. Recent sediments, rarely auriferous.

The rocks of the Royal Flush area consist essentially of the massive basic greenstones, massive granites, quartz reefs (auriferous), apophyses of the massive granites and two minor examples of prototypes of the gneiss, occurring at the Battler and Hill Mines, and possibly unrevealed basic dykes.

The Greenstones (massive).—A careful investigation of the various types of the massive greenstones has reduced the various facies to two main groups:—

- (a) Foliated felspar hornblende rocks.
- (b) Non-felspathic hornblendic rocks.

In the Royal Flush Mine the wall rocks of the lode are composed of the second group and may be classified as hornblende schists. These schists, however, may be found merging into less foliated rock which at times approaches the stage of an epidiorite. The second facies is, however, found in the lease lying to the north of the Royal Flush and closer to the granite where granular felspar quartz amphibolites have been recognised.

Granites (massive and non-auriferous).—This rock type is important in that it has been instrumental in causing both a physical and chemical change in the greenstones—physical in causing foliation, and chemical in probably affecting a mineral alteration of the greenstones, particularly near the contacts with the main mass.

Granite apophyses.—These consist of dykes varying very much both in size and form. Sometimes they occur as very narrow veins less than an inch in thickness, at others they have a thickness of several feet. In composition they vary from fine-grained felsites to coarse-grained pegmatites. These dykes are no doubt off-shoots from the granite and intruded the greenstones, after the lodes were formed. They have no bearing whatever on the gold contents of the lode. When occurring in any appreciable size they may materially diminish the quantity of ore in the stopes, the amount being dependent on the thickness and angle at which they cut through the ore channel.

In the Royal Flush Mine some of the dykes are more or less horizontal, though there is a decided tendency for them to dip to the north-east, *i.e.*, towards the granite. This is what might be expected, also that more dykes of this nature will be found if the mine is developed vertically.

The Lode.—The ore body consists of a lenticular quartz vein which varies from a few inches to several feet in thickness. The vein is continuous at the No. 2 level from near the main shaft for a distance of 232 feet east, but is very small in the eastern face

on this level. At the No. 3 level at the western end of the mine a rather large granitic dyke has disturbed the lode and, according to the mine sampling, regular gold values do not commence on the level until a point 126 feet east of the shaft is reached. From that point for a distance of 168 feet the estimated values are 66s. over a width of 60 inches. In the east face of the No. 3 level (340 feet east of the main shaft) the size of the vein is small (3-4 inches only) and the gold values low.

There seems little doubt that the Royal Flush reef continues into the lease lying immediately to the east and continues for a considerable distance in that direction, though I was unable to obtain details as to size, etc., owing to the workings being inaccessible.

What has happened to the reef in the western end of the mine is not so clear. At the No. 2 level the values and apparently the lode have practically cut out near the shaft, and, as already pointed out, the values at the No. 3 level do not become payable until a distance of 126 feet is reached east of the shaft. Faulting in the Westonia field is not uncommon and has usually been associated with the occurrence of granite dykes, *e.g.*, the thrust fault along one of these dykes at the 225 level of the Edna May and Edna May Central mines. In the western end of the Royal Flush Mine I would suggest the possibility of thrusting being induced by the large granite arm lying to the south-east of the main shaft and a movement of the southern end of the lode to the north-west, presumably along the rather extensive granite dyke which crossed the No. 3 level at a point 82 feet east of the main shaft.

The sheared nature of the wall rock at the end of the north-west crosscut, 55 feet east of the main shaft, is further evidence that the main shear zone lies in this direction.

In searching for a continuance of the reef in the west end I would therefore suggest lengthening the crosscut referred to, or the north-west crosscut 65 feet west of the shaft, until at least the sheared zone has been passed through.

Possibilities as regards the permanency of the lode.
—When considering this question the main points to observe are the nature of the country and the length and size and value of the lode. As far as can be seen the country rock is definitely foliated and therefore there is every reason for believing that the sheared zone in which the quartz reef occurs, and therefore the quartz also, might continue to a considerable depth. There is little doubt that the lode continues for a considerable length east of the shaft, and there appears to me to be a reasonable chance of eventually finding it extending west.

The occurrence of the granite dykes, as already explained, need not be feared except in that when present they will increase mining costs by diminishing ore reserves.

The intrinsic value of the lode is a more difficult problem. So far 2,305 tons of ore have been reported crushed for a return of 1,027 ozs., valued at £4 1s. 6d. per ounce, with two and a half to three dwts. in the tailings. This is an average of 49s. per ton, which is considerably below the estimate from sampling. In addition to this the tailings dump appears to contain much more than 2,300 tons, which would bring the average still lower. On the other

hand the average grade of the stone sent to the battery by the prospectors from the upper levels was very much higher than 49s. Judging from the stopes left open the stone broken by the prospectors was quartz only, whereas the company has taken too much from the walls.

As the discrepancy between estimates and returns is being at present thoroughly investigated by the mine officials no further comment on my part is necessary.

7.—REPORT ON THE WONGAMINE GOLD FIND.

Lands and Surveys Department Lithos 27/80,
27A/40.)

(F. R. Feldtmann.)

Introduction.

Two visits were paid to the Wongamine gold find during the second half of October. At this find 24 prospecting areas had been pegged within an area of about 14 square miles. The main group comprised 14 prospecting areas, including the area applied for as Reward G.M.L. 8PP. The other areas were situated at various distances, up to nearly three miles, from the main group. Owing to the limited time available my examination was confined to the main group of prospecting areas and the immediately surrounding country.

As the exact location of the prospecting areas was uncertain the positions of a number of the stakes were fixed approximately by traverse, and a fairly detailed examination was made of rock outcrops and of the localities from which samples assayed were said to have shown gold. Several samples of likely-looking material were taken for assay.

Location.

The Wongamine gold find is situated about 80 miles from Perth by rail.

The main group of prospecting areas is about 9½ miles north-east of Toodyay and about 14 miles north-west of Northam, as the crow flies. From Northam it is about 16½ miles by road. The road through Northam is said to be better than the shorter road through Toodyay. The Northam-Bolgart road passes about half a mile east of the main group.

The main group of prospecting areas is situated on the Midland Railway Company's subdivisional lots M498, M499, M513, and M39. Other prospecting areas have been taken up on lots M513, M514, M502, and M491.

Topography.

In general, the surface of the district is fairly strongly undulating, markedly so in the neighbourhood of the main group of prospecting areas, where much of the ground is very rough. The hills are not high, but are dissected by steep narrow gullies.

The highest point in the locality appears to be south of the middle of Lot M513, and from it there is a general fall east and south-east, interrupted by the small ridges on which the main group of prospecting areas is situated. The area is drained by two main creeks which run through Lot M499 in an easterly direction.

North of the more northerly creek and a short distance north of the northern boundary of Lot M499 is a low ridge striking north-east. This ridge is smooth in outline in the western portion of Lot M498 but becomes rough in Lot M513 where P.As. 79PP and 91PP are situated, and also in the middle of Lot M498 where P.As. 90PP and 82PP are situated. From this ridge two small spurs run in a south-easterly direction, the more easterly being situated at the south-eastern corner of P.A. 80PP, the other in the north-eastern corner of P.A. 78PP.

Between the two creeks the ground is hilly near the western corner of lot M499, but in the middle of that lot rises more gradually to a sandy flat from which there is a gentle easterly fall.

Immediately south of the more southerly creek the ground rises steeply to form a laterite-capped hill bounded on the south by a steep breakaway near the south-western corner of the Reward Claim.

The prospecting areas are mostly situated on the rougher country, in which gold-bearing veins are more likely to occur.

The greater portion of the eastern half and the extreme southern portion of Lot M499 have been cultivated, and the western portion of Lot M498 has been cleared. The north-western portion of Lot 499 and the small portion of Lot M513 examined are fairly thickly timbered with wandoo suitable for mining purposes. Much of the higher ground is covered by a dense growth of low scrub, making prospecting operations difficult.

Geology.

Rock outcrops are fairly common on the higher ground but consist of completely weathered and partly laterised rock. On part of the higher ground, however, in the southern portion of Lot M498 and on the flat in Lot M499 between the two creeks the rocks are obscured by sand or ironstone gravel.

Alluvium covers most of the lower lying ground, and on the sides of the gullies the rocks are largely obscured by a coating of detrital material washed down from the higher ground.

The true character of the underlying rocks is difficult to determine. They appear to be highly sheared and to have a gneissic or schistose structure. The grain is variable, but is generally fine. The strike ranges from north-west to east but is usually nearly due north. The dip is mainly east at varying but usually steep angles.

Bands of ferruginous and probably graphitic rock, about 20 feet in width, occur in and west of P.A. 79PP in Lot M513, immediately north of the boundary of Lot M499. These bands are highly schistose and appear to dip in an easterly direction at a fairly flat angle. Other outcrops of ferruginous material occur on P.A. 90PP in Lot M498 and on P.As. 80PP, 78PP, and 69PP in Lot M499, as well as in the north-eastern corner of the Reward Claim in the same lot. With the exception of these the rock outcrops are mostly pale in colour and consist largely of kaolinic material.

On the high ground at the south-western corner of the Reward Claim on Lot M499, south of the two main creeks, and a short distance west of the corner, are jagged outcrops of a peculiar white rock, partly

laterised, which appears to consist mainly of silicified kaolin. The rock contains numerous minute flakes of graphite in threadlike veinlets and isolated flakes.

Viewed broadly, the outcrops of the northern portion of the area examined are much more ferruginous than those of the southern portion, and where laterite is present it consists of dense iron ore. South of the more southerly creek the rocks are mostly almost white in colour, with the exception of a small outcrop of ferruginous schist with a few boulders of dense lateritic iron ore at the southern corner of P.As. 70PP and 71PP.

The occurrences of graphitic rock seen all occur in a belt running south from P.A. 79PP to a short distance west of the south-west corner of the Reward Claim.

Small pegmatite dykes and veins appear to be extremely numerous. They mostly follow the planes of schistosity of the older rocks, but in places appear to be connected by small veins at right angles or diagonal to the planes.

No epidiorite dykes were seen, but if completely weathered, such dykes might easily escape notice.

Quartz occurs mainly in narrow veins, in places associated with iron ore, and in thread-like veinlets. The veins are probably of no great length.

Such gold as occurs appears to be associated with the quartz veins.

With the exception of the pegmatites the outcrops seen in this area are unlike the usual appearance of the weathered portions of the igneous rocks of the goldfields and of the Darling Range. They more probably represent an extension of the ancient metamorphosed sediments of the Jimperding series occurring south-west of Toodyay.

Gold Prospects and Mining Operations.

Mining operations in the area examined have been mainly confined to trenches and potholes on outcrops or floaters of likely-looking material from which assays, mainly, it is said, by private firms, are stated to have shown gold.

The deepest working examined was a shaft, 32 feet in depth when last visited, but since deepened, it is said, to more than 40 feet, in the south-eastern portion of P.A. 79PP and 370 feet west of the southern corner of Lot M498. This shaft is just east of the eastern (hanging wall) side of an outcrop of ferruginous and graphitic schist which can be traced on the surface for a distance of 200 feet south of the shaft. Adjoining the eastern side of the shaft is a deep trench in which is a narrow steeply dipping formation from which a sample was said to have assayed 7dwts. 14 grains.

The upper portion of this shaft is in yellowish-brown ferruginous material, some of which was said to carry gold. From 10½ feet to 20 feet on the north side of the shaft, and from 12½ to 22 feet on the south side, is a band of highly schistose purplish-grey to blackish-grey rock, probably graphitic, and also ferruginous in places. This band dips southeast at about 40 deg. A small irregular vein of somewhat

ironstained glassy quartz in the upper portion of the schistose band was said to have assayed 4 dwts., but a sample taken by me and assayed in the Government Laboratory showed no gold. A sample was also taken of purplish-grey schist from an average depth of about 19 feet for which the return was also nil.

Decomposed yellowish rock of gneissic appearance extends for a short distance below the dark schist. Below this on the west side of the shaft is a band of graphitic schist extending to about 30 feet at the north end, the corresponding rock on the east side consisting mainly of laminated sandy quartz, somewhat resembling a sandstone, intruded by irregular pegmatite veins. This band dips east at about 70 or 75 degrees.

Material brought in from the bottom of the shaft since my visit consists of completely decomposed rock of gneissic appearance. The dip at the bottom was stated to be about 85 degrees.

A sample of laminated sandy quartz from a depth of about 27 feet showed no gold when assayed at the Government Laboratory.

On the boundary between P.As. 79PP and 91PP is another band, about 20 feet wide, of highly ferruginous rock, somewhat similar to that near the shaft. A sample, carrying a little quartz, from a point on this band about 250 feet north-north-west of the southern corner of P.As. 79PP and 91PP was said to have assayed 10 dwts.

Running in a north-easterly direction through the south-eastern portion of P.A. 90PP in Lot M498 is a band of ferruginous material; a sample of yellowish-brown ore, with veinlets of glassy quartz, from a pot-hole on this band is said to have assayed between 3 and 4 dwts.

In the south-eastern corner of P.A. 80PP, east of P.A. 79PP, is a small ridge of ferruginous schist with a few pegmatite veins. Three samples of slightly more ferruginous material from the south-western slope of this ridge are said to have assayed respectively 5 dwts., 2 dwts., and a trace. Another ridge of similar rock, forming a southerly spur from the main ridge on Lot M498 is situated in the north-eastern corner of P.A. 78PP to the south. A sample of promising looking brown iron ore and glassy quartz from a band in a costean on the southern slope of this ridge, overlooking the more northerly creek, was assayed at the Government Laboratory but the result was nil.

On the south side of the creek, about 140 feet south-west of the previously mentioned costean, is a trench from which a sample is said to have assayed 5 dwts. The trench is on a vein of ferruginous quartz apparently on a line running a little to the west of that in the costean. A few feet west of the vein is a narrow band of graphitic material.

In the middle of P.A. 69PP, east of P.A. 78PP, is an outcrop, trending east and west, of ferruginous laterite. A little quartz, possibly forming a continuous vein, was noticed in places near the northern edge of the laterite. This might possibly prove to be auriferous.

In the south-western corner of P.A. 76PP, at about 500 feet north-east of the north corner of Lot M39, is a deep trench on a narrow quartz vein enclosed by white kaolinic material. This vein was said to carry

5 dwts. A few feet east of the trench is a small outcrop of dense dark brown to black iron ore of peculiar sinterly appearance.

Near the south-east corner of the same P.A. are two trenches about 330 feet apart, one north-west of the corner, the other south-west. Each is on a narrow band of ferruginous quartz, apparently the same line, striking due north and enclosed by a few feet of slightly ferruginous material. This line is situated a short distance east of the outcrop, previously mentioned, of white graphitic rock.

The stone in the northern trench was said to assay 3 dwts., that in the southern trench 9 dwts. A sample from the northern trench, however, when assayed at the Government Laboratory showed no gold.

Examination was made of the locality near the middle of the Reward G.M.L. 8PP, from which a sample, assayed privately, was said to have given a return of 7 ozs. Two other samples, stated to have come from the same spot, gave returns of 17 dwts. 3 grs. and 15 dwts 6 grs. when assayed at the Government Laboratory. A pothole sunk on the spot where the samples were said to have been obtained was filled in at the time of my visit. Search failed to reveal any line of ferruginous material similar to that sent for assay, small outcrops close to the pot-hole consisting of white schists intruded by pegmatite veins. The pothole is on a slope and the material forming the samples might have travelled some distance from its source.

A short distance north of the southern boundary of Lot M499 is an outcrop, previously mentioned, on which the common southern corner of P.As. 70PP and 71PP is situated. As stated, this consists of ferruginous schist with a few boulders of dense lateritic iron ore. A narrow band of quartz veinlets was noticed near the north-eastern edge of the outcrop. A sample from this band, assayed at the Government Laboratory, showed a trace of gold.

Summary.

The character of the underlying rocks of the Wongamine area could not be definitely determined from the highly weathered exposures examined, but they may prove to be an extension of the Jimperding metamorphic series and in part, at least, of sedimentary origin. Graphite appears to be of common occurrence, probably along defined bands. Small pegmatite dykes, completely weathered at the surface, are numerous.

Oxidation appears to extend to a considerable distance below the surface.

Such gold as occurs in the Wongamine area appears to be in quartz veins or stringers associated with iron ore, or possibly, in places with graphitic material.

The occurrences prospected of material stated to be auriferous are isolated, and at the time of my visits no attempt had been made to link them up or to follow any particular line for any distance.

The results from samples assayed at the Government Laboratory are disappointing.

Of six samples of likely looking material collected by me only one showed a trace of gold. The samples appeared to be fairly representative of the different types of possibly auriferous material.

A return was supplied by the Government Mineralogist and Analyst of 18 samples sent in by prospectors from the Wongamine area. Of these only eight showed any gold, and only three contained gold in payable quantities. Of the last three, two were stated to have been obtained from the pothole on the Reward Claim.

Such auriferous veins as occur in the area are likely to be narrow and of no great length.

8.—PROGRESS REPORT ON THE ALUNITE SURVEY OF THE LAKE BROWN LAKE SYSTEM.

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

I was engaged on field work in connection with this survey from 24th November to 19th December, 1930, and from 5th to 10th January, 1931. The latter period was taken up in a detailed sampling and estimation of quantities of alunite available on M.C. 103H south of Campion.

Alunite occurs in the beds of the Salt Lakes of this district in the form of an extremely tenacious clay which, however, becomes very hard on drying. The clay as exposed on the lake beds is usually light grey in colour, but varies with depth, through various shades of grey and red to almost pure white. It is the dark grey variety of clay which apparently carries the highest percentage of alunite.

Of interest is the fact that in nearly all cases where tested with litmus paper the water of the Lake system was found to be strongly acid in reaction. In the case of Lake Deborah, however, the water was either only very slightly acid or even neutral. As a sample giving a high percentage of alunite (62.8 per cent.) was obtained from Lake Deborah, near Baladjie Siding, where the water was neutral to litmus, it appears that the acidity of the water is not indicative of the formation of alunite. As this statement is made on the evidence of only a single observation, it would be best not to place too much reliance on it until further sampling and testing is carried out in the locality.

The Salt Lake System between Lake Deborah, north of Bullfinch, and Baandee was followed up and sampled wherever there appeared to be a chance of an occurrence of the grey alunite-bearing mud. Sampling was not confined to deposits of large area, even insignificant clay pans being sampled in many instances, the object being to obtain as much information as possible on the distribution of alunite throughout the area.

One sample was also taken from the drainage channel of Lake Seabrook where it crosses the Eastern Goldfields Railway at Yellowdine. Lake Seabrook

itself was not sampled owing to the Utility Truck used for transport being unable to negotiate the rough and sandy track between Yellowdine and the Lake.

The accompanying sketch map* shows the distribution of the samples collected and the percentage of alunite present at each locality. It will be seen that the alunite has a very wide distribution although high percentages are only present in a few localities.

Lake Chandler, south of Campion, was sampled by the Government Geologist in November, 1928, and found to contain large quantities of high grade material.

The upper part of the bed of a lake four miles south of Lake Chandler on which is situated M.C. 103H was found to carry high percentages (55-68 per cent.) of alunite for the first six inches to one foot in depth. Below this depth the amount of alunite present in the clay was found to decrease, being usually between 35-45 per cent.

The beds of two small lakes south of Warrachuppin siding were found to carry values as high as 51.8 per cent., but the values are very patchy and there is much low grade material present.

At Lake Deborah, north of Baladjie Siding, the bed of the lake consists of a very wet grey mud carrying a great deal of crystallised gypsum. As the locality was not thought favourable for the presence of alunite, only one sample was obtained. This sample on analysis yielded 62.8 per cent. of alunite, which is as good as some of the more promising material from Chandler Lake and M.C. 103H. If further work is done in the future it would be well to sample the south arm of Lake Deborah thoroughly, in order to determine the extent of the high values.

The remainder of the samples taken gave disappointing results, but they indicate that the alunite is by no means confined to one or two localities but occurs in small quantities almost all through the Lake System under examination.

M.C. 103H, which was sampled in detail during the second period of field work, was found to contain approximately 181 acres of workable alunite-bearing clay, the first foot in depth of which would average about 61 per cent. alunite. Between the depth of one foot and two feet the material averages about 51 per cent. alunite over an area of perhaps 150 acres; the decreased area being due to the slowly shelving bottom of the lake. In those parts of the lake which contain as much as three feet of clay samples were obtained giving an average of 36 per cent. alunite. The area available of this material is uncertain owing to the uneven nature of the lake floor.

LOCATIONS OF ALUNITE SAMPLES.

Nos. S. 1—S. 7	...	...	From Wolfe's Claim, M.C. 103H, South of Campion.
Nos. S. 8—S. 13	...	...	From Lake Brown North of Loc. 14037: Lands Litho. 35/80.
Nos. S. 14—S. 17	...	...	do. do. Loc. 14215: do.
Nos. S. 18—S. 25	...	...	From two lakes South of railway at Warrachuppin on Locs. 338-337 and 382: Lands Litho. 35/80.
No. S. 25	...	...	From Lake Deborah, North of Baladjie Siding.
Nos. S. 27 & S. 28	...	...	From Lake Deborah at the Peninsula, North of Bullfinch.
No. S. 29	...	...	From lake crossing the railway, two miles East of Yellowdine.
Nos. S. 30—S. 32	...	...	From Loc. 15629: Lands Litho. 25/80.
No. S. 34	...	...	From M.C., 28 Hines Hill.
No. S. 35	...	...	From lake on Loc. 11159: Lands Litho. 34/80.
No. S. 36	...	...	From lake on Loc. 14195: Lands Litho. 34/80 (North-East of Nungarin).
Nos. S. 37 & S. 38	...	...	From Western end of Lake Brown, near Eaglestone Hill.
No. S. 39	...	...	From lake on Loc. 9155, South of railway, between Baandee and Doodlakine.
Nos. S. 40 & S. 41	...	...	From lake on Reserve A17247, South of railway, near Baandee.
Nos. S. 42—S. 50	...	...	From Wolfe's Claim, M.C. 103H, South of Campion.

* Map not published.

ANALYSES.

Lab. No.	Mark.				Water soluble, SO ₃ .	Soda soluble, SO ₃ .	Approximate percentage of Alumite.	
		ft.	in.	ft.	in.	%	%	%
5290/30	S. 1 Bore No. 1—0	0	to 1	0	...	.24	1.66	4.3
5291/30	...	1	0	2	0	.39	5.37	13.9
5292/30	...	2	0	4	0	.38	4.54	11.7
5293/30	S. 2 Bore No. 2—0	0	1	0	...	.39	26.54	68.5
5294/30	S. 3 Bore No. 3—0	0	1	6	...	.42	25.84	66.7
5295/30	S. 4 Bore No. 4—0	0	1	6	...	.30	26.58	68.6
5296/30	S. 5 Bore No. 5—0	0	1	9	...	.40	23.41	60.4
5297/30	...	1	9	2	0	.31	12.07	31.1
5298/30	...	2	0	3	6	.27	19.67	50.7
5299/30	...	3	6	4	6	.15	1.36	3.5
5300/30	S. 6 Bore No. 6—0	0	1	0	...	.37	23.83	61.5
5301/30	...	1	0	3	3	.39	20.76	53.6
5302/30	...	3	3	4	2	.29	5.21	13.4
5303/30	S. 7 Bore No. 7—0	0	1	0	...	.36	26.52	68.4
46/31	S. 8	...	0	1	0	.46	1.05	2.71
47/31	S. 8	...	1	0	2	.48	.59	1.52
48/31	S. 8	...	2	8	4	.45	1.28	3.30
49/31	S. 8	...	4	0	4	.42	1.48	3.92
50/31	S. 9	...	0	0	2	.46	1.63	4.28
51/31	S. 9	...	2	9	5	.32	1.88	4.85
52/31	S. 10	...	0	0	3	.44	2.01	5.19
53/31	S. 11	...	0	0	1	.51	3.13	8.08
54/31	S. 12	...	Red clay 9in., then grit	...	...	.57	3.99	10.29
55/31	S. 13	...	0	to 7	6	.55	2.39	6.17
56/31	S. 14	...	0	0	2	.40	3.20	8.3
57/31	S. 14	...	2	3	3	.31	1.09	2.8
58/31	S. 15	...	0	0	3	.44	2.50	6.5
59/31	S. 16	...	0	0	2	.49	3.57	9.2
60/31	S. 17	...	0	0	1	.41	3.32	8.6
61/31	S. 17	...	1	6	3	.37	1.33	3.4
62/31	S. 18	...	0	0	1	.30	11.01	28.4
63/31	S. 19	...	0	0	0	.42	12.18	31.4
64/31	S. 20	...	0	0	0	1.42	10.91	28.1
65/31	S. 21	...	0	0	0	.36	4.32	11.1
66/31	S. 22	...	0	0	0	.49	19.84	51.2
67/31	S. 22	...	0	6	1	.40	9.86	25.4
68/31	S. 23	...	0	0	0	.73	20.06	51.8
69/31	S. 24	...	0	0	3	.53	14.02	36.2
70/31	S. 25	...	0	0	2	.38	6.32	16.3
71/31	S. 26	...	...	...	...	13.04	24.33	62.8
72/31	S. 27	...	...	...	...	6.62	1.92	4.9
73/31	S. 28	...	...	...	...	5.13	1.10	2.8
74/31	S. 29	...	...	...	...	.88	.53	1.4
75/31	S. 30	...	0	0	0	.40	14.63	37.7
76/31	...	...	0	4	1	.41	6.66	17.2
77/31	S. 31	...	0	0	0	.46	13.97	36.0
78/31	S. 32	...	0	0	1	.43	13.62	35.1
79/31	S. 34	...	0	0	0	.56	8.89	22.9
80/31	...	...	0	6	1	.58	12.26	31.6
81/31	...	...	1	6	2	.29	11.82	30.5
82/31	...	...	2	0	2	.36	8.12	20.9
83/31	S. 35	...	3in. gypsum, 1ft. clay, then grit	...	...	3.80	3.57	9.2
84/31	S. 36	...	0	6	to 2	6	11.64	3.72
85/31	S. 37	...	0	0	2	3	27.58	4.56
86/31	S. 38	...	...	...	...	21.92	5.62	14.5
87/31	S. 39	...	...	...	...	9.44	<i>Nil</i>	<i>Nil</i>
88/31	S. 40	...	0	0	2	.72	<i>Nil</i>	<i>Nil</i>
89/31	S. 41	...	0	0	3	.62	.22	.6
90/31	Warrachuppin North Lake	...	...	...	...	.58	3.70	9.5
223/31	S. 42	...	...	...	...	1.04	21.12	54.5
224/31	S. 43	...	...	...	...	.34	24.99*	64.5
225/31	S. 44	...	...	...	...	.29	14.00	36.1
226/31	S. 45	...	...	...	...	.58	24.87	64.2
227/31	S. 46	...	...	...	...	.40	21.68	55.9
228/31	S. 47	...	...	...	...	.40	12.32	31.8
229/31	S. 48	...	...	...	...	.78	24.92	64.3
230/31	S. 49	...	...	...	...	.36	22.97	59.3
231/31	S. 50	...	...	...	...	.31	16.15	41.7
91/31	L.B. 1	...	...	...	...	.32	.10	.3

* Also soda soluble ... K₂O ... 6.90
Na₂O51

Note.—The above analyses were compiled from the original assay certificates issued by the Government Mineralogist and Analyst.

9.—PRELIMINARY REPORT ON A GEOLOGICAL RECONNAISSANCE BETWEEN LAVERTON AND THE WARBURTON RANGES.

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

The writer received instructions in May, 1931, to accompany a survey party from the Lands Department who were preparing to traverse the country between Laverton and the Warburton Ranges. The party left Laverton on the 2nd June and returned on the 7th October.

The country traversed by the present expedition had been previously examined by Messrs. Talbot and Clarke in 1916, who recorded the results of their observations in Geological Survey Bulletin 75.

The preparation of the report on the recent reconnaissance is still in progress, the delay being due to a difficulty in getting a petrological examination made of the rock specimens collected in the field. A satisfactory map cannot be drawn nor can an accurate account of the rock relationships be written until the petrological examination is completed.

The country examined, other than that over which our outward route passed, which is considerably to the north of the route followed by Talbot and Clarke, includes the country between the western end of the Warburton Range and the Barrow Range on the east, and between the junction of the Hughes and Elder Creeks and the Townsend Range on the south, and Spring Granite and Barlee Springs on the north.

All over this block of country numerous signs of prospecting were seen, there being signs of knapping on nearly every quartz reef observed. Judging from the absence of favourable reports by prospectors working in this area, the prospects do not appear encouraging. Mr. Michael Terry and Party, who were met by us returning from the Warburton Range area, reported that they had carried out loaming extensively over the country west and north of the Ranges without encouraging results.

Although the writer was unable to investigate country much removed from the traverses made by the 1916 expedition, he endeavoured wherever possible to make his traverse cover such strips of country which had not been crossed previously by the 1916 party. By this means it has been possible in a number of places to modify the rock distribution as shown on the existing maps.

The greenstones of the Warburton Range Area have been regarded up to the present as counterparts of the auriferous greenstones of the Western Australian Goldfields. The field evidence obtained, during the recent reconnaissance, suggests that the greenstone areas, if they exist at all, can be considerably lessened in extent, and that the greater part of the area is covered by a series of metamorphosed sediments and associated igneous rocks of possibly later age than the Goldfields greenstone, and therefore having less economic possibilities.

10.—THE CORRELATION OF THE ARTESIAN BORES OF THE METROPOLITAN AREA.

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

In November, 1930, the writer received instructions to attempt a correlation of the artesian bores of the Metropolitan area. Owing to the pressure of other work, very little was done until December, 1931. Since then, considerable advance has been made but the work is still incomplete.

At the present stage it appears that there are three distinct artesian water-bearing horizons underlying the Metropolitan area. These three horizons can be identified by water analyses, water temperatures, and the static-heads of the various bores.

Bore cores, obtained at the time the various bores were sunk, are now being studied with the object of confirming by lithological evidence the correlation made by other methods. It is only in a few cases that bore cores have been preserved, and in the majority of cases the only record kept of the strata passed through by a bore is contained in the driller's log. Where the actual core from a bore has been preserved, and a comparison between it and the driller's log is therefore possible, the latter has been found in many cases unreliable. It is for that reason that the correlation is based mainly on other than lithological evidence.

The ultimate object of the present investigation is the production of a plan indicating the probable areal extent of the water-bearing horizons, and the depth below the surface (at any particular point), at which artesian water might confidently be expected. This plan, when completed, should prove of value when the drilling of new bores is being considered in the future.

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DIVISION V.

School of Mines of W.A.

Kalgoorlie,
7th December, 1931.

The Under Secretary for Mines, Mines Department, Perth.

I have the honour to submit, for the information of the Hon. the Minister, my report for the year 1931.

RE-ORGANISATION.

Consequent on the retirement of the Acting Director and Lecturer in Mining, Mr. T. Butement, and of the Lecturer in Physics and Electrical Engineering, Mr. D. McDougall, a re-arrangement of the duties of the Staff became necessary in order to enable the work of the School to be carried on efficiently with the smaller teaching staff and to distribute the class work of the two retiring lecturers among the remaining four members of the Staff. A satisfactory re-distribution of duties was decided upon in consultation with the State Mining Engineer and the Superintendent of Technical Education, although it became necessary at the same time to reduce the time devoted to certain classes and also to hold certain of the advanced classes in alternate years. The imposition of new duties has placed a heavy burden on members of the Staff on account of the necessity of preparing new lecture and practical work, but all the members of the Staff have undertaken their new duties energetically and enthusiastically, so that the School has been able to meet the altered conditions without greatly impairing the efficiency of the classes.

ENROLMENTS.

The individual enrolments during the year numbered 258, which is the highest figure reached since 1920, when there were 312 individual enrolments, the highest enrolment recorded in the history of the School. For the purpose of comparison I attach a statement of individual enrolments for the period 1926-1931, inclusive:—

1926	..	..	..	..	148
1927	..	..	..	..	123
1928	..	..	..	..	113
1929	..	..	..	..	150
1930	..	..	..	..	164
1931	..	..	..	..	258

The class attendances have been well maintained throughout the year although, as is always our experience, there is a certain falling off towards the end of the year, due partly to the inability of some of the students to handle satisfactorily the whole of the subjects for which they have entered and partly also to departures from the district.

REVENUE.

The total revenue for the School year has been over £400, a part of which has resulted from the decision, made at the beginning of the year, to institute a system of fees for experimental investigations conducted in the Metallurgical Laboratory.

METALLURGICAL LABORATORY.

During the year the following investigations have been carried out at the request of persons interested in the ores treated:—

Flotation of Sulphide Ore from the Lancefield Gold Mine, Beria.

Flotation of Tailings from the Bellevue Gold Mine, Mt. Sir Samuel.

Treatment of Tailings from the Floater Gold Mine, Ravensthorpe.

Treatment of Sulphide Slimes from the Tasmania Mine, Beaconsfield, Tasmania.

Cyanidation of Tailings, using Saline Lake Water.

Flotation of Cyanide Residues from Maldon, Victoria.

Re-treatment of Cyanide Sand Residues from the White Hope Gold Mine, Hampton Plains.

In addition, a considerable amount of research work has been carried out from time to time during the year to determine the possibility of successfully treating gold ores by volatilisation of the gold as chloride in an atmosphere of chlorine gas, with subsequent recovery of the volatilised gold chloride by solution in water. This work, undertaken as an independent research by the School has given encouraging results, but as it is still in the preliminary stage, a report has not been issued on the results obtained up to the present. It is intended, if pressure of other investigations permits, to carry out further tests and to endeavour to apply the knowledge gained in this work to somewhat larger scale treatment.

If it were more widely known in the other States that the School is prepared to carry out investigations into metallurgical problems, I feel certain that more work of this kind would be forthcoming. In connection with investigations which have for a number of years been carried out for the mining companies of Western Australia, I have been given to understand that the companies object to the information furnished to them being made public, but as, until this year, no charge has been made for this work, there has been no valid excuse for such an attitude. Now, however, that a charge is made for these investigations, the companies apparently consider that any reports furnished to them should be confidential. Although this attitude is open to grave criticism on account of its effect on the advancement of metallurgical practice, the case might possibly be met by withholding publication of the results of such investigations for a period mutually agreed upon.

The companies appear to have forgotten that it was primarily the experimental work on flotation of gold ores carried out by the School which enabled this method of treatment to be successfully applied on the Lake View and Star and at Wiluna, much of

which work was done at the request of the companies and all without charge. In the same way, some of the experimental work carried out for the Boulder Perseverance by Mr. C. E. Blackett was confirmed in our laboratory, and as a result of all the information obtained by the company a new plant is in course of erection to treat its ore by bromocyanidation.

During the year the number of assays and chemical determinations made in connection with the investigations conducted in the Metallurgical Laboratory has been as follows:—

Gold Assays	1,224
Chemical Determinations	464

Included in this item are a number of check assays made for Wiluna Gold Mines, Ltd., for which a fee has been charged.

The Research Metallurgist, Mr. W. G. Clarke, has carried out the investigations with enthusiasm and skill and has been ably assisted by his cadet, Mr. A. M. Smith.

PUBLIC ASSAY DEPARTMENT.

In consequence of the greatly increased activity in prospecting, particularly for gold, there has been an unprecedented demand for assistance by the conduct of free assays of samples from Crown lands and prospecting areas. During the year the number of free assays and mineralogical determinations conducted for prospectors has been as follows:—

Gold	1,379
Other metals	4
Determinations	100
Total	1,483

This number is almost double the previous highest number of assays, etc., carried out in a year, and has taken up a considerable portion of the time of myself and of the Laboratory Assistant.

Free assays have also been carried out by myself for the Gold Stealing Detection Staff of the Criminal Investigation Branch of the Police Department, although the amount of this work has been somewhat less than in previous years.

PART-TIME INSTRUCTORS.

As a result of the financial stringency it was found necessary to reduce the number of part-time Instructors employed in teaching. Messrs. C. D. Slee and J. B. McNeill have been retained as Instructors in Fitting and Turning and in Engine Driving, and the teaching of Elementary Mathematics was undertaken by the Registrar, Mr. G. M. Lumb, without additional remuneration.

The Gas Engine Class has been conducted for two terms as a self-supporting class under Mr. A. R. E. Bosustow, who has held the position of Instructor for a number of years. To meet the demand for in-

struction in the principles and the management of internal combustion engines it will probably be necessary to conduct this class as a self-supporting class for three terms during 1932 in order that more attention may be given to Diesel engines which have now been introduced in Kalgoorlie.

EXTERNAL STUDENTS.

Several students who secured positions at Wiluna and Gwalia have been encouraged to continue their studies by correspondence with the Lecturers, and this privilege has been enthusiastically availed of by a number of students, who have secured highly creditable results at the recent annual examinations.

GENERAL.

Although the new system has worked fairly well, the efficiency of several classes would be much increased if more time could be devoted to these classes. With the present Staff such an increase of class hours is impossible, and I suggest that if financial conditions permit, serious consideration should be given to the question of the appointment of an Assistant who could assist the lecturers with the teaching of the elementary classes and in the preparation of apparatus for practical classes. The appointment of such an Assistant would remove any disabilities under which certain classes are now being conducted and would greatly increase the efficiency of the School.

I desire to express my appreciation of the whole-hearted manner in which all members of the Staff, both full-time and part-time instructors, as well as the Research Metallurgist, the Registrar, the Laboratory Assistant and the Cadet have undertaken the additional duties imposed on them and for their loyal support and assistance in enabling the School to experience what must be considered as a highly successful year.

I have to record with great pleasure the support given to the School by Mr. J. F. Thorn, General Manager, Lake View and Star, Ltd., not only by finding employment for students of the School but also by insisting on a large number of his employees attending the School. This is a lead which other companies might well follow with benefit both to themselves and to the School. In this connection it is interesting to note that the approximate number of School of Mines students employed by Lake View and Star, Ltd., is fifty, many of whom are holding responsible technical positions where their training at the School is proving of value to themselves and to the company.

Statistics dealing with the enrolment of students and the examination result are forwarded herewith.

B. H. MOORE,
Principal, School of Mines.

DIVISION VI.

The Under Secretary for Mines.

For the information of the Hon. Minister, I submit the report of the Deputy Chief Inspector of Machinery on the administration of "The Inspection of Machinery Act, 1921," for the year ended 31st December, 1931.

A decrease in accidents was recorded and there was only one fatal accident, a most unfortunate and exceptional happening.

The volume of work in this branch of the Department slightly increased and was carried out by a staff of efficient officers. Indeed, I think it right and proper to emphasise the efficient service rendered by the Deputy Chief Inspector of Machinery and members of his staff.

The financial operations of the Branch resulted in a small credit balance. The report contains the details of the work done.

A. M. HOWE,

Chief Inspector of Machinery.

15th April, 1932.

The Chief Inspector of Machinery.

I have the honour to submit my report on the operations of the Act for the year ended 31st December, 1931.

The tabulated returns* submitted show concisely the volume of work carried out during the year, and it will be noted that, taken as a whole, there was a slight increase over last year's figures, instead of a decrease, which might have been expected. There was a serious falling off in the sawmilling areas and tin fields, but it was balanced by increases in the metropolitan area and goldfields.

Each section of our work is treated in detail as below:—

1. Inspection of boilers.
2. Explosions and interesting defects.
3. Inspection of machinery.
4. Accidents to persons from boilers and machinery.
5. Examinations for engine-drivers' certificates.
6. General.

DIVISION I.

The total number of useful boilers which came under the jurisdiction of this Department was 3,676, an increase of 49 over last year's figures. The number of certificates granted was 130 less, and at first sight it would appear that the work was very much less, but for two reasons it was not so, because the time saved there was taken up by increased machinery inspection and the longer time occupied by closer inspection of boilers because of increasing age. Owing

*Tabulated statements not printed.

to the almost prohibitive price of new boilers the old ones are being reconditioned to an extent which would not have been considered a few years ago. Not only does an old boiler for which the owner cannot accept any reduction of pressure require longer to inspect for the purpose of determining the repairs required to bring it up to the strength desired, but frequently further examination and testing before it can be passed as fit. One owner during the year paid about £250 for repairs to a boiler which a few years ago would have been scrapped and replaced by a new one.

Reviewing maintenance, in most cases good feed water is used, but itinerant chaffcutting plants are severely handicapped in that respect. The use of eucalyptus bark and leaves placed in feed-tanks for the prevention of scale, or converting into a form which can be to a large extent passed through the blow-off cock, an old established and useful practice in the bush, is debarred in certain districts where that wood is scarce, but an enterprising boiler owner on the goldfields was persuaded to try sandalwood bark and chips which proved quite successful. On opening up his boiler after a run he found in place of a large amount of scale as experienced previously, only a little scale on flues and sides, and what looked like seed gypsum deposited loosely on the shell bottom at back end, which was easily removed. Old sandalwood camps where the wood is prepared for market should provide lots of chips and bark for this purpose.

DIVISION II.

Explosions and Interesting Defects.

No explosions have occurred, but air-receivers under five cubic feet capacity which are exempt from inspection and which I strongly recommended last year should be brought under the Act are still a source of danger, and another explosion may occur at any time. We are, however, warning and persuading owners of such vessels to fit safety valves not only to prevent explosion of the receiver, but fracture of the air compressor with consequent danger to those in the vicinity. But the fact remains that these small vessels may be working with a very small factor of safety, and there is no check on their strength or subsequent deterioration by internal corrosion.

DIVISION III.

Inspection of Machinery.

The number of useful groups of machinery has been increased by 506; the total number now being 9,019. The number of inspections carried out was 6,807, 144 more than last year. And 305 notices were issued for guards and safety appliances, which meant more work in many of the new groups having to be visited a second time.

The gradual superseding of steam by oil is shown by a decrease of 10 in steam engines, and an increase of 23 in crude oil engines of the Diesel and semi-Diesel types. As these are mainly used for electric power generation we had 488 motors added to last year's figures, which now total 6,342.

There have not been any very large plants erected during the year, and so the new groups scattered in ones and twos in small isolated factories have taken up more time than if in large numbers under one roof.

The depressing conditions of the timber areas and tin fields are happily balanced by pronounced revival in gold mining. State Batteries which had been idle for some years at Mount Ida, Laverton, Yarri and Saint Ives were re-opened for crushing. One new one was installed at Yalgoo and one is in course of erection at Kalgoorlie.

On the Golden Mile the Lake View & Star, Ltd., which includes the Lake View, Star, Chaffers, Horse-shoe and Ivanhoe Mines, has pushed on vigorously with development underground and on the surface. Much of the old plant has been discarded and replaced by new forms of power and new up-to-date plant. Large winding engines have been reconditioned and erected in new positions. Electric cables carrying 3,000 volts have been taken down the Horse-shoe Main Shaft to work electrically-driven pumps and ventilating fan. The large Fraser & Chalmers winder hitherto used for baling from No. 3 shaft being released, probably will be used as an auxiliary winder at Chaffers shaft if an electric winding engine is not installed. Another Crossley engine with compressor of 2,000 cubic feet capacity has been erected on the Ivanhoe Mine, and a Crossley Premier oil engine of 1,100 h.p., driving a 3,000-volt electric generator, nearing completion at Chaffers. The Municipality of Kalgoorlie has increased its electric power plant by a 300 kilowatt generator, and the Kalgoorlie Electric Power and Lighting Corporation have a new turbine-driven generator on order.

The Sons of Gwalia has increased its plant by the installation of a six-cylinder Crossley Premier oil engine to drive an electric generator.

The use of pulverised coal fuel at the Collie Power Plant has proved an unqualified success, and some of the Kalgoorlie mines are making inquiries regarding this form of fuel.

A few new lifts have been installed in the Metropolitan Area, and some old ones reconditioned.

In the pastoral areas we have had no increase of butter factories, but a local company has started a condensed milk factory at Harvey, and another is being erected at Waroona by the Nestles Company.

DIVISION IV.

Accidents to Persons.

The year was a good one as regards immunity from serious accidents caused by machinery or boilers. The total number was 23, eight less than last year, although many more units of machinery were in operation. Only one fatal accident occurred and that was from an appurtenance rather than machinery itself. A tally clerk engaged in counting bags of wheat being delivered into a flour mill from an elevator and chute, elected to sit under the latter. His position was not

noticed by men in the vicinity and it was evident that he did not suspect that any bag would fall off the chute. One did, however, and by strange ill luck from just above him. The impact from the bag on his shoulders caused injury to his spine which resulted in death. A foreman, in evidence at the inquest, stated that he had seen thousands of bags put over the same chute, and the one which caused the accident was the second which had fallen off. It was an inexplicable and most unfortunate choice of position, even if the deceased had not known of wheat bags occasionally falling off chutes.

The remainder of the accidents were mishaps incidental to persons working amongst machinery, who become careless as time goes on and nothing happens. To take an instance as typical, a foreman pattern-maker of the old school, and very many years' experience, who scorned "new fangled" guards, did not insist on that of his buzzer being kept in position. In the end he was the first to suffer, and lost portions of two fingers. It took fifteen years for him to be convinced that a guard, if not always a prevention of accidents, is at least a reminder of danger.

The year's record is a tribute to the work of the Department. Opposition to safe-guards generally comes from old hands and owners of small workshops, but no case has happened of wilful disregard of inspector's instructions which would justify legal action being taken for their enforcement.

DIVISION V.

Examinations for Engine-Drivers' Certificates.

Eleven examinations were conducted during the year. Four in Perth, two each at Kalgoorlie, Leonora and Meekatharra, and one at Bunbury. Fifteen days were spent in actual examinations, 22 in dealing with applications, examining papers, and inquiries into misbehaviour and mishaps reported, such as overwinding, etc., and 25 days spent in travelling. Two hundred and five applications were received, and 182 certificates granted. A very satisfactory increase occurred in winding engine certificates issued; nine against only two last year, and the coming one will add a few more young men to fill the places of many old hands who are thinking of retiring. The increasing use of internal combustion engines which has been noted in other parts of this report is shown by the number of internal combustion engine candidates coming forward. The number of such certificates granted during the year was 56; 33 more than in 1930.

A few cases of overwinding were reported, but considering the large engines, their speed and heavy loads dealt with, combined in most cases with only a few feet of head room, the result is a testimonial to the winding engine drivers of the State.

The mileage covered by the Board was 2,980.

DIVISION VI.

General.

The work of the Staff was fairly strenuous during the year, and fortunately it was not handicapped by illness.

The mileage covered by Inspectors was 3,059 by rail, 36,214 by car and 64 by water—nearly 40,000

altogether. This is about 4,000 less than last year, and reduces the miles per inspection from 5.2 to 4.7. The decrease as compared to the increase of work is explainable by the less travelling in the timber districts, owing to so many boilers being closed down, and greater care being taken to reduce mileage by not visiting groups of machinery and boilers a second time unless urgently necessary.

The research and correspondence connected with the Standards Association were not so much as last year. The Boiler Sub-Committee only had 2 meetings, that for cranes and hoists 2, and lifts 4. The Boiler Code is now printed in book form, but subject to revision, and has not been accepted in its entirety by any State. It is necessary for the State Sub-Committee to watch developments in this connection because a certain section of the Association is apt to forget the interests of the community and to go beyond the strict limits of a Safety Code by insisting on non-essential details applying equally to the power house of a wealthy corporation and a small back-street factory in a country town or isolated mine.

STAFF.

There has been no change in the Staff, and the absence of friction between members shows a fine *esprit de corps*, which I trust will be maintained.

The Senior Inspector is due for long service leave in 1932, and temporary assistance will have to be provided to keep the work up to date.

In conclusion I thank you for consideration and co-operation during the year.

We have, as heretofore, been materially assisted throughout the year by other members of this Department, and Clerks of Courts, etc., throughout the State, and to them my thanks are heartily offered.

B. PRYNN JONES,

Deputy Chief Inspector of Machinery.

9th April, 1932.

DIVISION VII.

Annual Report of the Chemical Branch, Mines Department, for the Year 1931.

The Under Secretary for Mines.

I have the honour to submit, for the information of the Hon. Minister, my report on the work of the Chemical Branch for the year 1931.

General.

The financial and industrial conditions which have led to a serious diminution in the volume of work required of many institutions has had an exactly opposite effect upon the Government Laboratory. The loss of employment and simultaneous rise in the value of gold in terms of Australian currency have stimulated prospecting and gold mining enormously. It is estimated that there are now four times as many prospectors on the goldfields as there were two years ago, resulting in new discoveries of gold and other minerals, and the renewed working of abandoned deposits. Mineral determinations and gold assays have therefore been more greatly in demand than ever before, as well as information regarding

the commercial possibilities of the various minerals that have been found.

At the same time the restricted purchasing power of the Government and various public institutions has greatly increased the demand for careful chemical and physical examination of foodstuffs and other supplies purchased under contract, so that the best value may be got for the money outlaid.

Finally, it has been a record year in regard to toxicological investigations.

The total number of samples registered during the year was 5,754, an absolute record for the laboratory, the previous highest figures being 5,242 in 1930 and 5,235 in 1929. It has only been by working at very high pressure, and reducing investigations to their minimum extent, that the existing staff has been able successfully to cope with the work.

The sources and allocation of the samples are shown in the following table:—

	Foods, Drugs, and Toxicological Section.	Mineralogy Mineral Techno- logy and Geo- chemistry Sec- tion.	Agriculture, Water Supply and Sewerage Section.
Premier's Department ... ..	...	2	19
Department of Mines	47	1,507	62
Department of Agriculture	44	1	863
Department of Health	206	...	3
Department of Public Works	2	...	22
Department of Lands and Surveys ... ..	...	6	1
Chief Secretary's Department ... ..	...	...	3
State Hotels	1	...	...
Forestry Department	4	...	14
Police Department	145	...	...
Government Tender Board	139	...	...
Industries Department ... ..	...	2	1
Treasury Department	204	...	...
State Saw Mills	1	...	...
Tourist Bureau ... ..	...	...	3
University ... ..	...	1	1
Perth Art Gallery ... ..	...	1	...
Collic Coal Commission ... ..	...	7	...
Royal Agricultural Society ... ..	...	...	68
Perth Hospital	10	...	1
Fremantle Hospital	1	...	...
Metropolitan Water Supply and Sewerage Department	1	...	676
Wyndham Meat Works ... ..	...	...	2
Public Pay	28	57	165
Public Free	42	1,383	8
	875	2,967	1,912
Grand Total	5,754		

The most numerous groups of samples dealt with in the Foods and Drugs Section were:—

Revenue stamps	204
Toxicological	136
Milk, human	54
Explosives	38
Oils, lubricating	37
Butter	35

In the Mineral Section:—

Gold battery tailings	1,315
Gold ores (prospectors')	920
Minerals for determination	585
Silver ores	59
Tin ores	35
Tantalum ores	26

In the Agricultural and Water Supply Section:—

Water	.. .. .	814
Soils	.. .. .	619
Wheats	.. .. .	262
Fodders	.. .. .	50
Sewage	.. .. .	45
Fertilisers	.. .. .	31

Departmental Committees.

I continue to act in my official capacity on a number of Governmental committees, all of which have held meetings during the year, and in most cases submitted problems, some of great complexity, for laboratory investigation. These include the State Committee of the Commonwealth Council of Scientific and Industrial Research; Committee on Stock Diseases at Beverley, Denmark and Gingin; Salt Lands Committee; Oils Committee of the Tender Board; Advisory Committee on Food and Drug Regulations; Advisory Committee on Metropolitan Water Supply.

Foods.

An undesirable proportion of the foodstuffs submitted by the Health Department and Tender Board fail to comply with the Regulations and show reprehensible carelessness or deliberate sophistication on the part of manufacturers. One gross case of adulteration was persisted in for some time, viz., from before May up till October, in the Metropolitan area, until it was at last checked, after numerous analyses here, by prosecutions and the imposition of heavy fines. This was the sale as butter of a mixture of approximately 60 per cent. butter with 40 per cent. coconut fat. Incidentally the same mixture was sold in another case as margarine, and in yet another as "edible fat." Of the 24 genuine butter samples examined five did not comply with the regulations in that excess of water was present.

Of the eight samples of margarine analysed, one was nothing more nor less than crude tallow and totally unfitted for human consumption. Two others were deficient in starch, and another two contained excessive water.

Of 26 self-raising flours only 15 were satisfactory. The others yielded less than the required amount of 45 grains of CO₂ per lb., and in addition three contained acid phosphate which was not declared on the label.

A summary of results obtained is as follows:—

—	Samples examined.	Unsatisfactory composition.	Wrong labelling.
Foods	110	49	23
Milk	28	11	...
Condiments and flavours	16	6	7

Prosecutions were instituted by the Health Department in the case of 26 samples investigated.

Drugs.

The drugs examined during the year included a series of liquid paraffins to determine their relative viscosities at body temperature, and their compliance with British Pharmacopœia standards. The Redwood viscosity figure at 98deg. F. varied from 72 to 211. There is no Pharmacopœia standard for this important property, but the Codex suggests a figure not less than 180 at 100deg. F.

A locally manufactured eucalyptus oil was found to contain 70 per cent. of cineol and no phellandrene. It complied in all respects with the Pharmacopœia standard.

A gross case of fraud was disclosed when tablets which were being sold as a cure for blindness were found to contain only powdered buchu, a mild vegetable antiseptic and diuretic. The offender was heavily fined for a collateral misdemeanour.

A proprietary fat-reducer, sold under an attractive name, was found to be a mixture of starch, menthol, and thyroid extract.

A number of samples of ether were tested for aldehydes and peroxides both by the British Pharmacopœia methods (now long overdue for revision), and by more modern methods. Confirmation was obtained of the high purity of most of the ether when purchased, but fairly rapid deterioration once it is opened and exposed to the influence of air and sunlight.

Metropolitan Water Supply.

Reference to Mr. Hoare's report hereunder will reveal the large amount of time and energy devoted to this highly important matter this year. Each month the whole position is reviewed at a meeting of the Advisory Committee. At regular intervals the various reservoirs and sources of supply are submitted to a systematic chemical examination supplemented by bacterial tests in the Medical Department. In this connection it is to be observed that the chlorinating plants at various sources have been regularly proved to be working effectually. Special studies this year were made of the Fremantle wells and bores to locate and shut off the source of an undue proportion of nitrates, which, with a prolonged spell of hot weather, was stimulating the growth of desmids in the Melville reservoir. Another research dealt with the dissolved oxygen content of the Perth supply, and the operation of a trial plant to reduce it to a minimum, so as to eliminate rusty water from the supply.

In order to be able to answer manufacturers' inquiries as to the quality of the water supplied to Perth, samples were taken from the City main on Mt. Eliza at about 10-day intervals throughout the year for partial analysis, every third sample being subjected to a complete mineral analysis. The most important results are shown in the accompanying graph, where the figures for total dissolved salts, sodium chloride, magnesium chloride, hardness and hydrogen ion concentration are traced throughout the year. The last-named figure is artificially kept on the alkaline side of neutrality by the continuous addition of lime. The complete figures are given in the tables attached to Mr. Hoare's report.

Alcoholic Liquors.

Thirty-one liquors were analysed, five of which proved to be adulterated and five others to contain saccharin, a prohibited ingredient. Some samples of wine which were examined were utterly worthless as wines, amongst other faults acetic fermentation having proceeded in some cases far beyond the limit of palatability. The sale of such liquids is a serious detriment to our legitimate wine trade, and a slander on the good name of our many undoubtedly fine wines. Under the existing regulations, however, in some cases no prosecutions can be successfully launched against the unscrupulous vendors. The regulations require altering to meet these conditions.

The undesirable practice of adding undue amounts of liqueurs to sweets has been checked by an alteration of Regulation 44 which reduces the permissible proportion of alcohol to one-half part per cent.

Non-Intoxicating Beverages.

Very little was done on these this year. One hop beer was examined for compliance with the regulations.

Three samples of coffee, three of coffee and chicory, and one of cereal and coffee were analysed and found to be of standard quality.

Twenty-five fresh bovine milks, and three condensed milks were submitted, of which 17 were satisfactory in composition.

Human Milk.

Fifty-four samples of human milk were received for report from various Infant Welfare Centres, presumably all taken because the infants were not thriving. They showed a wide range in composition, the maxima and minima being—

Total solids	9.23—15.57	per cent.
Fat	1.15—6.15	„
Proteids	0.90—2.91	„
Sugars	4.96—8.24	„
Ash	0.16—0.70	„

Edible Seaweed.

An edible seaweed found at Cottesloe was submitted to me in three stages of preparation: (1) the raw red-coloured weed, (2) partly washed and bleached, (3) completely washed and bleached. Appreciable amounts of iodine were present in the first two stages but were absent from the final product, which, however, carried 76.6 per cent. of edible matter, chiefly the carbohydrates pentosan and galactan. These are the chief constituents of commercial agar, the Malayan form of which is derived from the alga *Eucheuma spinosum*, a close relative of the Cottesloe plant which has been identified as *Eucheuma speciosum*. The chief constituents of the prepared Cottesloe plant are—

Carbohydrates	70.7	per cent.
Proteids	1.6	„
Ether extract .. ..	.3	„
Crude fibre	4.6	„
Ash	11.1	„
Moisture	11.7	„
	—	
	100.0	
	—	

With boiling water it makes a stable jelly, and is thus suitable for thickening soups or stews and making sweet or savoury jellies.

It is obvious that a more intensive study of our marine flora would be amply justified.

Wheat.

The experimental wheat mill has been thoroughly overhauled and rendered useful again. 262 wheat samples were received for test, in some cases for partial chemical analysis, in others for more complete analysis and milling test. 13 of the samples were drawn from shipments to be sent overseas, and 68, of which 43 were milled, were for the Royal Agricultural Society, to decide their various competitions. The State Championship was won by a sample of Comeback from Mullewa with a total of 92.75 points. Although this wheat is a consistent prize winner, it is not widely grown, Nabawa, Gluyas and Merredin proving in practice to be better money earners.

As in the previous year, official F.A.Q. standard samples were obtained from New South Wales, Victoria, South Australia and Western Australia, and analysed and milled by an officer who has specialised in cereal investigation. The results, which are strictly comparable, are of great commercial interest and will be found in Mr. Hoare's report hereunder.

174 wheats were submitted by the Department of Agriculture for determination of moisture and protein content in connection with a research into the conservation of nitrogen supply to the crops. In this sulphate of ammonia was applied to part of the crops though no nitrogenous fertilisers are used in local practice. The wheat from fallowed and unfallowed land is practically identical in nitrogen content, but this figure varies greatly in wheat from different localities.

Wheat Products.

In addition to examining the flours from the 43 wheat samples for the Royal Agricultural Show, and the four Australian F.A.Q. samples, investigations were made of the flour from 13 export wheats, and of ten flours already manufactured by local millers. The wet and dry gluten is usually asked for, but in view of the large personal equation in the determination of these, the protein figure is preferred by this laboratory.

Of by-products four brans and three pollards were taken from local mills by inspectors under the Feeding Stuffs Act. Although none of them came up to the standard in every particular, they were all within the permitted limits of variation.

Lubricating and Power Oils.

The physical and chemical properties of all lubricating oils and power kerosenes and spirits used by the Government (except by the Railways) continue to be checked by this Branch. This work is co-ordinated with the activities of the Oils Committee of the Tender Board, with the result that there has been a considerable saving of expenditure and elimination of complaints under this heading.

Various samples of surface oil, borings and spring waters were examined for petroleum, without disclosing any recognisable traces of that valuable commodity. Wherever much humus or other vegetable debris is present in bedded deposits we are almost always able to extract with solvents traces of unsaponifiable waxes, evidently of vegetable origin. The comparative resistance of these to decay in the soil is noteworthy and has an important bearing on the origin of petroleum.

Soap.

A large number of soaps were examined for the Tender Board to determine which were the most economical and best fitted for each of several various purposes. When buying such material by the bar or cake it is of the greatest importance to note the average weight of each block, as this varies greatly between different brands of the same type of soap. For example, of two cakes of abrasive soap one weighed 11.0 ozs., the other 5.6 ozs.; the contents of packets of "extract of soap," each marked "1 lb. net," weighed actually 13 ozs. and 14 ozs.; toilet cakes weighed 1.6, 0.9 and 0.8 ozs.; cakes of carbolised soap, 4.9, 4.3, and 3.7 ozs.; bars of yellow household soap, 47.4, 38.7, 35.2, and 30.1 ozs.

The regulations require that all soaps shall contain not less than 59 per cent. of "fatty acids." In this respect most of the samples have been very satisfactory, but two were exceedingly bad, containing only 33.2 and 34.5 per cent. respectively. This low value was due to the presence of excessive water.

Another faulty tendency noticed in many soaps is to exceed the already over-liberal limit for resin permissible under the regulations. This limit is only justifiable in soaps used for the roughest purposes, such as scouring floors. It should be considerably reduced in laundry soaps and eliminated altogether from toilet soaps.

Ambergris.

Of two samples of supposed ambergris submitted for identification one proved to be the genuine article worth somewhat more per ounce than fine gold. It came from the south coast east of Albany. It is strange that more of this valuable substance is not found on our coasts considering the vast numbers of whales which migrate up and down our west coast. A sharp look-out should be kept for it by all who frequent our beaches. It can be recognised by its waxy consistency, grey colour, penetrating odour reminiscent of "morocco" leather, and ready fusibility.

Fiscal Stamps.

A number of internal revenue stamps were examined for the Treasury and proof obtained that many had been already used on documents and attempts made to renovate them.

Toxicology.

The Toxicologist and his assistant were kept exceptionally busy during the year by the receipt of a

record number of specimens in connection with human poisoning cases. Some interesting details are given in Mr. Stacy's report which is attached hereto.

It is necessary to emphasise that this Department does not undertake the examination of animal viscera for poisons until the animal has been examined, before or after death, by a stock inspector or veterinary surgeon, and certified as having possibly or probably died of poisoning, otherwise we should be deluged with anatomical specimens from stock which have died of old age, neglect, or other cause outside the sphere of a Government Analyst.

Fumes from Motor Vehicles.

Complaints were made of the unpleasant odour and possible toxic effect of the exhaust gases from motor buses on human beings, and more particularly hospital patients on the main traffic routes. The trouble appeared to be at its worst at the western end of St. George's Terrace, where there is a very heavy uphill traffic, with hospitals and physicians' consulting rooms on both sides of the road. On this stretch of road six samples of air were taken closely behind buses, and these were analysed for carbon monoxide, which is generally accepted as the only important poison in the exhaust gases. The results ranged from less than 0.001 per cent. to 0.002 per cent. Such concentrations would have no appreciable physiological effect, and would soon be infinitely diluted in such a wide, wind-swept street. The conclusion reached is the same as that after intensive study of the problem in New York and Berlin, viz. (in terms of the traffic regulations) that whilst some vehicles may be emitting some unburnt or partly burnt oil, causing "an offensive vapour or smell," which may be "an annoyance to the public," there is no evidence of any element of "danger to the public."

Stock Diseases.

A very large amount of intricate work continues to be performed in connection with the wasting disease of cattle at Denmark, braxy-like disease of sheep in the south-western wheat belt, and the wasting disease of lambs at Gingin. In February I visited Denmark with the Hon. Minister for Agriculture and several departmental officers to meet a local committee which was studying the disease, and to obtain firsthand information on several points which appeared obscure in the discussions of the departmental committee.

The laboratory investigations include analyses of soils, pastures, fodders (ensilage, etc.), rumen contents, and blood, particularly with a view to determining a sufficiency or deficiency of some element of known nutritional importance. Whilst successful finality appears to have been reached in the case of the braxy-like disease, mainly through the researches of Dr. H. W. Bennetts, the causes of the other diseases are still obscure, and researches from all angles are being continued. In this connection the following figures for the composition of the blood of two normal sheep and six lambs bred at Gingin are worth recording, as data on this point are few:—

	Total P.	Inorg. P.	Org. P.	Cl.	Na	K	Ca	Mg	Fe
Sheep	0.480	0.087	0.393	3.169	2.603	0.302	0.070	n.d	0.525
Lambs	0.230	0.069	0.170	n.d	2.651	0.202	0.075	0.034	n.d

All figures represent grammes per 1,000.

Farm Water Supplies.

118 farm waters, mostly from trial drill holes, were examined during the year. Those which are obviously palatable to man or only very slightly brackish are usually not submitted for analysis, the taste indicating their adaptability. Many of those submitted were highly saline, the principal compound present in every instance being NaCl. The standards set up for stock waters some years ago are standing the test of time, and so far there has been no reason for modifying them. They define as the maximum soluble salts safe under Western Australian conditions for various kinds of stock on dry feed in hot weather, as:—

Sheep	..	..	900	grains	per	gallon.
Oxen	..	..	700	"	"	"
Horses and pigs	..	..	450	"	"	"

Fungicides and Insecticides.

Only a small number of these were examined, viz., a copper carbonate bunticide; a naphthalene-phenol insecticide, whose physical condition was most unsatisfactory; two pyrethrum concentrates; and eight flysprays consisting mainly of pyrethrin in kerosene.

A new fruit fly lure used recently with great success in Queensland for both Mediterranean and Queensland fly consists of:—

Imitation vanilla essence	..	..	1/2	oz.
Household ammonia	..	..	1/2	oz.
Water	..	..	26	oz.

It should be worth a thorough trial in Western Australia.

Fertilisers.

Only 31 samples were examined, of which fifteen were taken officially by the Agricultural Department, one only being deficient. The superphosphates on the market, which are by far the most important of the

fertilisers, continue to be of consistently good quality, frequently carrying 1 per cent. more water soluble phosphoric oxide than is guaranteed. "Blood and bone," largely used by market gardeners, is still the most unsatisfactory fertiliser on the market by reason of its lack of uniformity, occasionally very low content in nitrogen (its most important constituent), or presence of ammonium salts substituting organic nitrogen. Regulation 10 requires modification to meet this condition.

A sample of septic tank sludge was found to carry 85 per cent. of moisture in its raw state, with 3.0 per cent. N, 0.6 per cent. P_2O_5 and 0.99 per cent. K_2O in the dry matter. Such material is obviously not worth the cost of distribution.

Manganese in Soils.

Great interest was aroused in the State by the increased yield of grain reported from Corney Point, South Australia, from the use of manganese sulphate as a dressing. This question was gone into thoroughly and a report prepared upon it in which it was suggested that some practical experiments be conducted at one of the State farms. In the end a number of experiments were started on several State and private farms, the statistical results of which are not yet reported. It is evident that manganese sulphate will only increase yields when the soil is deficient in that metal or is of such a nature as to render it unavailable to the plant. Excessive carbonates in the soil such as occur at Corney Point, bring about the latter condition. Similar soils are almost unknown in our wheat belt, though a "fluffy" morrel soil from Lake King and a grey powdery soil from Salmon Gums compared as follows with Corney Point soil:—

	Mn_2O_4	$CaCO_3$	H_2O - sol. salts.	Reaction (pH)
Corney Point	0.021	58.9	0.15	7.72
Lake King	0.038	7.6	0.42	8.25
Salmon Gums	0.009	17.1	?	?

The Lake King soil is not deficient in manganese but is of a type to prevent plants absorbing it. The Salmon Gums soil is both deficient in manganese and unfavourable for its absorption. Both would probably benefit by the addition of manganese sulphate.

No less than 99 local soils from 12 different localities were examined for manganese, yielding results from a trace to 0.083 per cent. Mn_2O_4 soluble in acid. Any soil with as much as 0.02 per cent. cannot be considered deficient in manganese, but its composition may require investigation to determine if that manganese is likely to be readily available. Of the 99 samples 39 contained less than 0.02 per cent. Mn_2O_4 , and of these 30 contained less than 0.01 per cent.

The manganese found in four brands of superphosphate on the local market was 0.0022 to 0.0028 per cent. of Mn_2O_4 .

Saline and Acid Soils.

In addition to the 99 soils examined for manganese 520 other soil samples were analysed, chiefly for total soluble salts, NaCl and pH. They included 138 samples of wheat soil from the Lake Brown district,

113 strawberry soils from Bullsbrook, 112 summer forage soils from Capel, and 85 potato and other soils from various parts of the extreme South-West.

Replaceable bases were determined in 16 soils for the Department of Agriculture.

Prospectors Gold Ores.

960 samples were submitted by prospectors for gold assay as against 243 during 1930. This is a direct result of the increasing lack of employment in the towns and the large premium on gold, rising to 75 per cent. by the end of December. A fair proportion of these samples indicated ore which would be payable under present conditions. Though no finds were noted of entirely new gold-bearing districts, many previously unknown reefs and alluvial patches were discovered in or near areas previously known to be gold bearing. Of the latter one may mention Wannaway, 10 miles S.W. of Widgiemooltha, and Nyborgs find 11 miles N.W. of Carbine. Among the former were new rich finds at Goongarrie, Lake Austin, Menzies, Nannine and Southern Cross, all mining fields of about 40 years' standing.

The most sensational discovery was that of the record nugget for the State at Larkinville on January 15th. This was named the "Golden Eagle," measured 26.5 x 11.5 x 2.5 inches, and weighed 1,135 ozs. gross and 1,098.9 ozs. net after melting. In the latter state it assayed 88.25 per cent. gold and 11.15 per cent. silver, and was valued at £4,024 5s. 4d. at par, the value being increased to £5,438 4s. 2d. (Australian currency) by premium and Commonwealth bounty. In the same month three other nuggets were found at Larkinville weighing 114, 29, and 25 ounces Troy respectively. So far no important primary deposits have been opened up on this field.

State Battery Tailings.

With all the State batteries running full time no less than 1,315 samples of tailings were submitted for gold assay. Of these 104 were umpire samples on which my decision as to value is final. The others were subject to adjustment between the owner's valuation and the Government's, the difference being relatively small, or the owners accepting the Government assay without check.

Mineral Determinations.

No less than 585 mineral specimens were received, mainly from prospectors, for identification and report upon their chemical and physical characteristics and possibilities of commercial use. Last year the number received was 433. Amongst this year's samples the following are of outstanding interest:—

Redondite and Leucophosphate, Ninghanboun Hills.—The phosphatic minerals collected by myself in 1930 were examined in detail, with the result that it was found that Redondite (hydrous phosphate of aluminium and iron) was found to be the most abundant. Associated with it was a hydrous phosphate of potassium and iron, a mineral entirely new to science, to which the name Leucophosphate has been given.

Chrysoberyl, Poona and Dowerin.—This gemstone, not previously found in the State, has been unearthed at both Poona and Dowerin. Both places have yielded fragments of gem quality too small for cutting.

Corundum and Margarite, Gibraltar and Nevoria.—Corundum of possible commercial quality has been found in situ at these two places. In both cases it is accompanied by Margarite (calcium mica) a mineral not previously recorded from any part of the State.

Glauconite, Donnybrook.—A greensand carrying about 23 per cent. of glauconite (silicate of potassium and iron) has been struck at a depth of 100 ft. in a bore eight miles S.W. of Donnybrook. This mineral is used in parts of England, France and the United States as a cheap potash fertiliser. It is further of interest because of its occasional association with petroleum.

Cassiterite, Lake Nabberu.—Specimens of albite-pegmatite carrying cassiterite were received from Lake Nabberu. This is 200 miles from Poona, the nearest previously known tin field.

Rutile, Dangin.—This natural oxide of titanium, a minor article of commerce, was obtained near Dangin for the first time.

Allanite, Waddouring.—This silicate of cerium, aluminium, calcium and iron was found in small quantities in pegmatite veins on Waddouring Hill, south of Bencubbin.

Cumingtonite, Ninghanboun and Dowerin.—The presence of this rare limeless amphibole was proved in greenstone schists collected by myself at the two places mentioned.

Chrysotile, Meilga.—A new find of this valuable type of asbestos has been made on Meilga Station in the Ashburton watershed. This is about 180 miles from the nearest previously known deposit.

Coal.

In February I gave evidence before the Royal Commission on Collic coal in regard to the quality of the coals from the various mines at Collic. This evidence was based upon the records already existing in the Department supplemented by a fresh series of analyses and calorific value determinations on coal from the six mines now being worked.

Base Metals.

The common commercial base metals are not being mined at present owing to low prices, and little attention is being given to them by prospectors. Assays for them included cobalt, 2 samples; copper, 16; iron, 7; lead, 7; manganese, 1; mercury, 3; nickel, 2; tin, 35; titanium, 4; tungsten, 1.

Tantalum.

Western Australia continues to supply the major portion of the world's requirement of tantalum ore. The centre of the industry is Wodgina, in the Pilbara goldfield. During the year the main sources of supply have been Wodgina itself and McPhees Range about 20 miles to the east. The occurrence of tantalite here was first recorded by A. Gibb Maitland in 1906 under the place name of Mt. York. Since then the locality has passed under a whole string of aliases.

Alunite.

Following on the discovery by this Branch of the presence of lacustrine alunite in the salinas of the Lake Brown valley a number of further samples of "lake" muds were collected by Mr. Forman of the Geological Survey up and down the valley from Lake Deborah to Eaglestone Hill. These were analysed here and in many instances yielded appreciable proportions of alunite. Chandler Lake, one of the first salinas to be tested, still remains the most important repository of this useful mineral. As the result of intensive sampling and analysis Mr. Bowley has been able to prepare the accompanying plan of this salina showing the distribution of the various grades of mineral in the deposit.

Ceramic Materials.

Now that the white ware, cream-coloured ware, and tile industries are fairly well established in the State, much less time is devoted to this matter. We continue, however, to look for white ware clays, especially ball clays, of superior quality and more conveniently situated in regard to the factories. Two white clays of outstanding quality were received from Wagin and Mt. Helena, the former of the china-clay type, the latter a ball clay. Details are given in Mr. Bowley's report hereunder. In November I sampled and measured up the important deposit of white semi-ball clay at Stink Well, Goomalling.

Publications.

The following papers were published unofficially:—

E. S. Simpson: Contributions to the Mineralogy of Western Australia, Series VI. Jour. Roy. Soc. W.A., Vol. XVII.

- E. S. Simpson: The Use of Manganese in Agriculture. Daily Press.
- E. S. Simpson: The Origin of Gold Nuggets (Abstract only). Daily Press.
- D. G. Murray and F. E. Chapman: The Occurrence of Rubidium, Caesium and Thallium in some Western Australian Micas. Jour. Roy. Soc. W.A., Vol. XVII.
- H. E. Hill: Chemical Investigation of the Extractives of two Western Australian Woods. (1) Oleoresin of *Myoporum serratum*. (2) Oleoresin and Colouring Matter of *Acacia acuminata*. Jour. Roy. Soc. W.A., Vol. XVIII.

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SECTION I.—TOXICOLOGY, FOOD AND DRUGS.

By C. E. STACY, A.A.C.I.

During the year 875 samples have been examined as against 602 for the previous year, an increase of 273. The increase is largely due to the Government Tender Board using the services of this section to determine the better class of articles submitted to them by the various tenderers. No fewer than 139 samples were sent in during 1931, comprising all sorts of articles, including oils, soaps, jams, vinegar, baking powders, stove and boot polishes, etc., and it seems likely that this work will increase year by year.

Toxicology.—A record year for this class of work was experienced: 139 police cases were investigated, 115 being the previous record. Many of the exhibits showed curious characteristics: there were two cases of poisoning by oil of eucalyptus, two formaldehyde ("formalin"), two oxalic acid, and one hydrochloric acid case, all more or less unusual poisons.

In one case the alkaloid piperidine, the active constituent of pepper, was discovered, the distillate obtained having an extremely irritating odour. It is supposed the deceased met his death from taking an overdose of pepper.

In one case chocolates containing the wing cases of the insect *Cantharis vesicatoria*, commonly known as "Spanish Fly," were found. No doubt the chocolates were administered with criminal intent.

One other case should be mentioned in which "cyanide" had been obviously taken, but its determination was rendered impossible as the doctor in charge had added "formalin" as a preservative. These two chemicals form an additive compound which interferes with the detection of cyanide.

The use of preservatives is definitely deprecated in the "Advice letter" delivered to medical officers throughout the State by the local police authorities, and such a proceeding as above recorded would assume serious proportions in the case of murder, or attempted murder. It is to be hoped that the police authorities will notify the various medical practitioners to refrain from adding "formalin" and other preservatives to exhibits to be forwarded to this office for analysis.

The other toxicological cases were due to well-known poisons, amongst which strychnine, lysol and cyanide predominated.

Revenue Stamps.—204 stamps credited to this section were forwarded by the Treasury, and were examined by Dr. Simpson.

Liquors from the Inspection of Liquors Branch.—Fifteen (15) samples were examined and five successful prosecutions for adulterated liquor took place.

Some samples of bad wine were submitted during the year, but unfortunately unpalatable or even undrinkable wine may pass our present standards. If a limit for "soundness," that is, volatile acidity, for wines could be introduced it would tend to prevent the sale of some at least of these on the market. Such a standard exists in continental countries.

Foods.—202 samples were examined for the Health Department, an increase of 99 over last year. The more important of these will be commented upon.

Vinegar.—Seven samples of vinegar were examined. The whole question of vinegar manufacture and the regulations thereon need, in my opinion, reviewing. As far as can be ascertained there is no means of reliably discovering whether vinegar is brewed or is an imitation or synthetic product. Most pure malt vinegars give a "formol" reaction, but it is possible for a vinegar to contain some malt and other protein substances and yet to fail in this respect. It seems to me that until the Act is modified in order to allow a qualified chemist to inspect a manufacturing plant it will not be feasible to definitely say whether a vinegar is a brewed or artificial product.

Ale and Stouts.—Sixteen (16) samples were examined for the Health Department, five of which contained the prohibited substance, saccharin, and one failed to comply with the labelling regulations.

Margarine.—Eight (8) samples were examined, and all failed to pass the regulations.

Butter.—Four (4) were examined for the Superintendent of Dairying and thirty-one (31) for the Health Department. Of the four former one slightly exceeded the amount of water allowed, whilst the others passed. Of the 31 samples examined for the Health Department 16 did not pass the regulations and a number of successful prosecutions ensued.

Self-raising Flours.—Twenty-six (26) samples were examined and 16 failed to comply with the regulations either through lack of liberating the requisite amount of carbon dioxide when moistened and heated, or through the use of acid phosphate compounds in place of cream of tartar without disclosing this fact on the label.

Baking Powders.—Six (6) samples of baking powder were received for examination, one of which did not comply with the regulations.

Mallet Bark.—Five (5) samples were submitted. Two of these were dust and chips respectively and gave a low value for tannins, but the remaining three representative samples were well up to standard.

Oils.—Thirty-seven (37) samples were examined for the Tender Board and were found to be generally satisfactory.

Petrol.—Eight (8) samples were examined also for the Tender Board and were similarly satisfactory to the oils.

Petroleum.—Eighteen (18) samples of soils and other natural material were examined for this product during the year, but no evidence of its presence in the State was detected.

Proximate Analysis—continued.

	892	893	894	895	896	897
	%	%	%	%	%	%
Water lost on air drying for 24 hours (in lump form)	3.16	3.06	4.10	4.65	2.71	4.06
Additional water lost at 105°C. ...	15.09	15.82	19.32	23.21	15.15	21.76
Total water ...	18.25	18.88	23.42	27.96	17.86	25.82

Ratio of V.H.C. to F.C. ... 1 : 1.83 1 : 1.87 1 : 1.77 1 : 1.67 1 : 1.30 1 : 1.20

892 Westralian No. 3 Seam
893 Co-operative No. 3 Seam
894 Proprietary No. 3 Seam
895 Stockton No. 3 Seam
896 Griffin
897 Cardiff

Pigments.—Samples of red oxide and red ochre of excellent quality and bright colours were received from the Kurnalpi District.

Asbestos.—Samples of chrysotile asbestos were received from three miles east of Meilga Station Homestead on the Ashburton River. This is the first official record of this occurrence. A grading test gave—over 2 mesh, 12 ozs.; over 4 mesh, 2 ozs.; over 10 mesh, 1 oz.; under 10 mesh, 1 oz. per lb. The fibre ranged from $\frac{3}{4}$ inch to $2\frac{3}{4}$ inches in length. The matrix occurring with the asbestos consisted mainly of antigorite with some biotite and veinlets of dolomite.

Ceramics.—Eight clays were examined to determine their suitability for use in the pottery industry. One from Wagin burnt to a pure white at all temperatures up to 1,250 deg. C. and to a good white at 1,250deg. C. It is very fine grained, containing 99 per cent. of clay substance plus grit under 90 mesh. The clay is semi-refractory with an Ashley figure for plasticity of 30, and could be used with advantage as a substitute for china clay.

A soft granitic clay from Mt. Helena, after levigation to remove the grit over 60 mesh amounting to 31 per cent., yielded a product giving an Ashley figure for plasticity of 100, which is that for ball clays and red brick clays. The levigated clay burnt to a white body showing incipient vitrification at 1,250deg. C. Clays of this type are used to improve the working qualities and strength of white ware mixtures.

Fullers Earth.—Any clay with a fine texture and an Ashley figure over 150 is to be regarded as a Fullers earth, and those with a figure of 300 are to be considered of superior quality as regards adsorption capacity for dyes and greases.

An examination of six samples from Beermullah gave the following Ashley figures:—140, 330, 433, 466, 536 and 557, with 54, 21, 34, 20, 12, and 3 per cent. of grit over 90 mesh respectively.

Alunite.—Quite a large number of samples taken from the chain of lakes extending east from Baandee through Lake Brown to Lake Deborah were submitted by the Government Geologist. These consisted of the fine muds from the lake beds and in nearly every case revealed the presence of alunite.

A sample of white compact mineral from a bore for soil samples on Location 14343 in the Lake Brown area consisted of alunite associated with quartz, albite and kaolin. It differs in character from the sedimentary alunite occurring at Campion, but it was impossible to decide, from the small samples obtained, whether it was of the vein or concretionary variety.

The preliminary examination of the samples collected by myself from Chandler Lake at Campion

previously proved to carry alunite has been completed. The samples were taken over the lake to a depth of 3 feet (water level at the date of sampling, October, 1928) at approximately ten chain intervals by boring with a 2-inch augur. The samples from each foot were kept separate. The water in every case was strongly acid to litmus. The water soluble and caustic soda soluble sulphur trioxide were determined in each sample. The soda soluble sulphur trioxide is combined to form alunite. The figures, which were obtained for sulphur trioxide soluble in caustic soda, have been averaged for each hole and calculated as alunite, and are shown in the accompanying plan (Plate 1), and with the exception of a series from the southern part of the lake indicate a fairly uniform grade of material. Samples obtained from a spot 20 chains S. of the N.W. corner peg on 38H on Chandler Lake show an improvement at depth. The following figures were obtained for soda soluble SO_3 :—

Average of	Average of	Average of
1st 3 feet.	4th foot.	5th foot.
24.14 per cent.	25.58 per cent.	26.50 per cent.

Experimental work to determine the suitability of the local alunite as a source of metallic aluminium and the recovery of the potash and sulphur as by-products is being carried out as opportunity offers. The local material is also being investigated as a possible source of alums.

The occurrence of alunite in this State in large quantities is of considerable interest in view of the increasing demand for potassium fertilisers, particularly in regard to our fruit growing industry, and represents a potential source of wealth and employment.

Miscellaneous Mineral Notes.

Bismutosphaerite (bismuth carbonate).—Alluvial bismutosphaerite was obtained from Thompson's tantalite lease at The Sisters, near Moolyella.

Pucherite (bismuth vanadate) was present in a concentrated "wash" from Charleville, $1\frac{1}{2}$ miles south of Belchambers.

Wolfram (tungstate of iron).—An unusual looking black and yellow specimen from Melville consisted of veins of wolfram in a ground mass of scheelite and limonite.

Spodumene (silicate of lithium and aluminium).—An albite quartz pegmatite from three miles S.E. of Wodgina carried a large amount of small columnar crystals of spodumene and nodules of blue apatite.

Glauconite (hydrous silicate of potassium and iron).—A chalk from Wedge's property north of Gingin contained 0.8 per cent. of acid soluble potash present as glauconite.

A greensand obtained at a depth of 100 feet in a bore 8 miles south-west of Donnybrook assayed 1.85 per cent. of acid soluble potash, equal to about 23 per cent. of glauconite.

An encrustation from the dry bed of Elder Creek at the west end of the Warburton Range collected by Mr. Forman of the Geological Survey, consisting mainly of gypsum and calcite, contained a small quantity of a greenish mineral and acid soluble potash with no soda soluble sulphates, which suggests the presence of glauconite.

Margarite (silicate of calcium and aluminium).—This white micaceous mineral was recorded for the first time in the State. Specimens were received from Gibraltar and Nevorja consisting of an intergrowth of margarite and corundum.

Scorodite (hydrous arsenate of iron).—Samples of arsenical gold ores from P.A. 2090 at Greenmount, near Southern Cross, contained scorodite associated with quartz, limonite, jarosite, pyrite, arsenopyrite, rutile, zircon and garnet. A pyritic gold ore from Marda consisted of quartz, pyrite and limonite with a little arsenopyrite, galena and scorodite.

Chrysoberyl (beryllium aluminate).—A concentrate obtained by vanning a biotite rock from Dowerin contained a small quantity of flat plates of chrysoberyl.

This mineral was also recorded from Poona.

Prehnite (hydrous silicate of calcium and aluminium).—Light green crystals from the river beds between Halls' Creek and the North Australian Border consisted of prehnite.

Miloschite (chromiferous variety of kaolinite).—Specimens of this comparatively rare mineral were received during the year from Mawson and Dangin. In each case the mineral was sealy, bluish green in colour, with a pearly lustre. A partial analysis of the Dangin mineral gave—Cr₂O₃, 1.72 per cent.: K₂O, 0.10 per cent.: Na₂O, 0.06 per cent.

Alexandrolite (chromiferous variety of halloysite). Greenish yellow alexandrolite was recorded this year from Grose's P.A. at Wardawarra where it is associated with psilomelane and nontronite.

Cobaltite (sulpharsenide of cobalt).—A gold ore from 1½ miles N.W. of Ravensthorpe assaying 1 oz. 8dwts. gold per ton carried 2.43 per cent. of cobalt present as cobaltite.

Ilmenite (titaniferous oxide of iron).—Black pebbles submitted from Yöwergabbie proved to be ilmenite, assaying TiO₂, 55.6 per cent.: FeO, 45.3 per cent., with specific gravities ranging from 4.6 to 4.8. A sample from the Blackwood River at Greenbushes contained 48.6 per cent. TiO₂.

Six samples of borings from a creek at Mullalyup contained ilmenite, giving the following figures:—

Hole.	Depth.		Concentrate.	TiO ₂ in Concentrate.
	ft.	ft. in.	%	%
1	0 to 4		37.65	49.79
1	4	4 7	24.20	44.23
2	0	4	21.40	41.92
2	4	6	25.50	42.38
3	0	4	27.60	47.01
3	4	6	3.72	28.24

Rutile (oxide of titanium).—Pebbles of rutile from 4 miles south of Dangin varying in specific gravity from 4.29 to 4.31 contained a trace only of iron.

Cassiterite (oxide of tin).—A small piece of pegmatite from Baumgarten's find at Lake Nabberu consisted of cassiterite, albite felspar, muscovite mica and quartz.

Allanite (hydrous silicate of lime, iron, aluminium and cerium).—A specimen of a black glassy mineral received from Waddouring proves to be allanite, whilst a pegmatite vein from the same locality received later also contained a little of that very rare mineral. Its associates are microcline, quartz and biotite mica.

Aragonite.—Specimens of crystalline aragonite slightly stained with a film of limonite and giving a strong reaction for strontium were received from Turee Station, Angelo Creek.

Mineral Analysis.—Complete mineral analyses have been made of the following:—

- Minerals*.—Actinolite, Dowerin; Almandite, Ninghanboun; Andesine, Dowerin; Biotite, Dowerin, Poona; Chrysotile, Meilga Station; Cobaltite, Ravensthorpe; Corundophilite, Ninghanboun; Dravite, Kelm-scott; Leucophosphite, Ninghanboun; Magnesite, Bamboo; Margarite, Gibraltar; Redondite, Ninghanboun.
- Rocks and Ores*.—Cordierite garnet gneiss, Albany; Arsenical ore, Youanmi.
- Meteorites*.—Beneubbin.

Exhibition.—I was instructed to prepare a display of gold specimens, including the Golden Eagle Nugget, and other local minerals in connection with the exhibition of local products held in the Centenary Pavilion at the Royal Show in October.

The exhibits attracted considerable attention, but in a large number of cases great doubt was expressed as to the genuineness of the big nugget in spite of the fact that it was uncovered and the public encouraged to examine it closely.

SECTION III.—AGRICULTURE, WATER, AND SEWERAGE.

By A. J. Hoare, A.A.C.I.

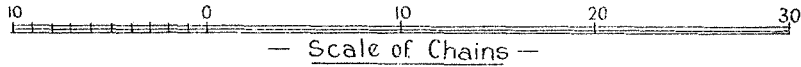
The total number of samples entered for examination this year is 1,912, a decrease of 529 over last year. Their sources are shown in the table on page 53.

Soils.—The number of soils received during the year totalled 619; of these 551 were submitted by the Department of Agriculture in connection with different investigations that are being carried out by officers attached to that department. The saline soil investigations by Dr. Teakle accounted for 138. An example of the mistakes that may be made by placing too much reliance on grab samples was instanced in the case of samples submitted from a strawberry plantation (a drained swamp), on which the plants failed to grow or were unthrifty; five soils were sent in and the sodium chloride figure ranged from 0.033-4.160 per cent. the pH (Quinhydrone) 3.65-5.38. A survey of the plantation (two acres in extent) was conducted by officers of the Agricultural Department in conjunction with Mr. B. L. Southern, and 108

ALUNITE DEPOSIT

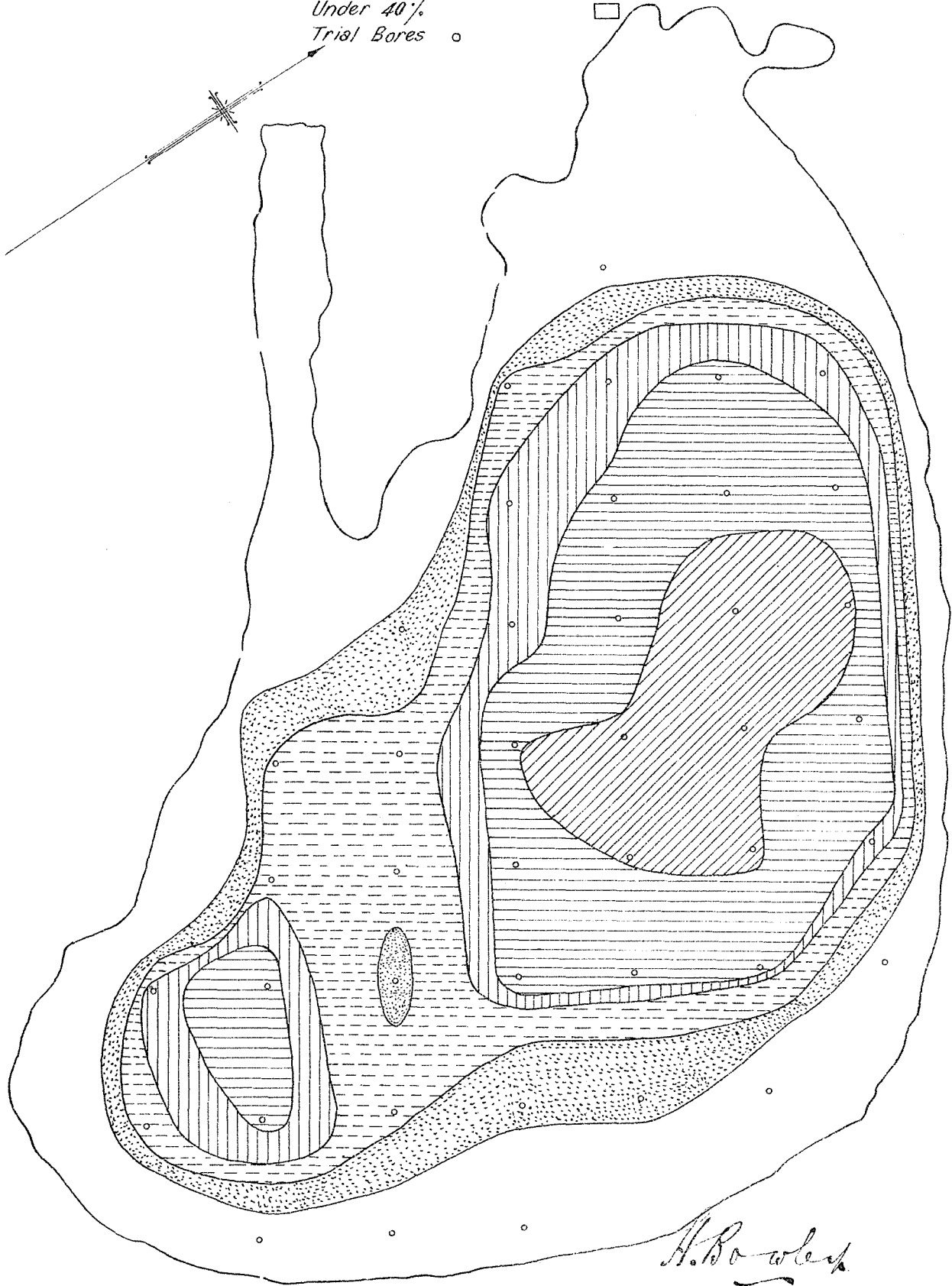
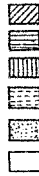
IN CHANDLER LAKE, CAMPION

Percentage of Pure Alunite in top three feet



-LEGEND-

- Over 60%
- Over 57.5% and under 60%
- Over 55% and under 57.5%
- Over 50% and under 55%
- Over 40% and under 50%
- Under 40%
- Test Bores ○



A. Rowley

samples were collected; the chlorine figure ranged from nil to less than 0.100 per cent. in most cases and in only five did the figure exceed 0.100 per cent., and then the highest figure was only 0.385 per cent., the pH ranged from 3.70-6.38. Any opinion based on the figures obtained for the first set of grab samples would be contradicted by the results of the organised survey. The trouble appeared to be more a matter of drainage, as the water level was only about one foot below the surface.

The use of manganese in agriculture was another investigation conducted by the Agricultural Department, and 99 soils were submitted for the estimation of manganese, which ranged from a trace to 0.083 per cent. Mn as Mn_2O_3 (HCl soluble). So far the field trial plots, using manganese sulphate, are said not to show any marked improvement over those to which manganese has not been added.

Fertilisers.—Of the 31 samples received only 15 were official samples, and of these only one failed to comply with the registered figures. The number of samples taken under the Fertilisers Act is considerably less than in previous years.

Fungicides and Insecticides.—Only four samples were received during the year. One of these, a carbolic powder, manufactured in the Eastern States of Australia, contained phenol, naphthalene, lime and inert matter. The analysis did not agree with the figures supplied by the manufacturers. This was a very crude mixture, and the physical condition was very unsatisfactory, 15 per cent. being retained on a 20 mesh sieve, including some lumps $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter, consisting substantially of naphthalene.

Fodders and Rumen Contents.—Fifty samples were received during the year; 35 of these were in connection with the investigation into the braxy-like disease of sheep, and were submitted by the Agricultural Department for the analyses of the ash. This work has not yet been finalised by this section, although the actual cause of the disease has been discovered by Dr. Bennetts, of the Department of Agriculture. Four samples of fodder were submitted in connection with the Gingin rickets in sheep; these were also for the analyses of the ash. The Muresk Agricultural College sent in four fodders for analysis as to their feeding value.

Limes, etc.—Thirty samples were received. Of these five were from different consignments of lime supplied to the Metropolitan Water Supply Department for use in the treatment of the water supply. Five were from the Tender Board in connection with the above treatment, the balance of the samples being calcareous sands.

Waters.—There was a considerable falling off in the number of samples received during the year, only 814 against 1,661 for last year; 609 waters were from the Metropolitan Water Supply Department, principally for dissolved oxygen determinations and reaction (pH). The usual quarterly hygienic analyses of all the hills sources were carried out as in previous years. A check was also kept on the quantity of free chlorine that remained in the water after chlorination at the reservoirs and pipe head dams. Samples were collected on approximately the 10th, 20th, and 30th of each month at King's Park from one of the reticulation mains supplying the city of Perth.

A partial analysis was made of the first and second samples, and a complete chemical analysis of the third. The results are shown in the graph on Plate 2. The quality of the water from the reservoirs and pipe head dams is consistently good.

The usual samples from Mundaring reservoir and Kalgoorlie reticulation were received every quarter for hygienic analysis from the Department of Works and Labour. Eighteen samples from Gingin and Denmark were submitted by the Agricultural Department. Waters for stock and irrigation purposes received during the year numbered 118, and, as is the usual case, a fair proportion of these were too saline to be of any value.

Sewage.—The usual quarterly samples were received from the sewage treatment works at Perth, Subiaco and Fremantle. A sample of sludge taken from the septic tanks at Subiaco, that was to be used as a fertiliser, gave the following figures:—

Lab. No.	...	5431	
Original moisture	...	...	85 per cent.
Analysis of Steam-dried material—			
Nitrogen	...	...	3.01 per cent.
Total phosphoric oxide (P_2O_5)	...	...	0.63 „
Total potash (K_2O)	...	...	0.086 „

Mineral Deficiency Diseases in Stock.

Denmark.—Apart from finishing the work on samples of fodder received during 1930, the only work done this year from this district was the complete chemical analyses of six waters, taken from affected and non-affected blocks.

Gingin.—Twelve waters from four different sources were sent in from this district for complete chemical analyses, the samples having been taken over a period of 12 months. Five fodders and nine bloods were also received, the blood samples were taken principally from affected lambs. It is expected that further work will be done during 1932 on the analysis of blood taken from normal and affected animals.

Forestry.—The officers of the Forestry Department have noticed for some years that seedlings show more vigorous growth on old ash beds than they do on ordinary soils, but efforts to make up blends in artificial fertilisers to give the same results have been unsuccessful. Samples of vigorous growing and unthrifty tuart and mallet seedlings were submitted for analysis, together with their respective soils. The figures obtained did not, on the whole, show any marked difference.

Samples of soil were sent in from a pine plantation in which the trees, *Pinus radiata*, were growing well in some parts and in others showed dead tops and yellow foliage. The only marked difference in the soils was that the salt content from the spots where the growth was good was in one case one-fifth and in the other one half of those where the plants had failed. Further samples are to be submitted during 1932 to check the above figures.

Flour.—The ten samples of flour received during the year were submitted by the local millers for examination as to the strength, gluten (wet and dry), and crude protein content.

Bran and Pollard.—Only seven bran and pollard samples were received during the year for check under the Feeding Stuff Act. In all cases the figures

found, although they did not comply with all the standards set down, were within the permitted limits of variation allowed under the Act.

Wheat.—Two hundred and sixty-two samples were examined. Of these 174 were received from the Agricultural Department for the determination of the nitrogen and moisture content. These are a continuation of the experiments started last year, and carried out at the different State farms, on fallowed and unfallowed land, using sulphate of ammonia in addition to the ordinary amount of super used.

Thirteen wheats were for milling, and the analysis of the flour; these were for export purposes, and were submitted by the local agents for the Japanese buyers, who require a certificate showing the bushel weight, moisture, crude protein, wet gluten, flour, bran and pollard yield for each shipment.

Following on the work that was started in 1929, samples of the f.a.q. wheat from each State in Australia were collected and milled in the experimental mill, which has been reconditioned. The figures obtained are as follows:—

F.A.Q. WHEATS—SEASON 1930-31.

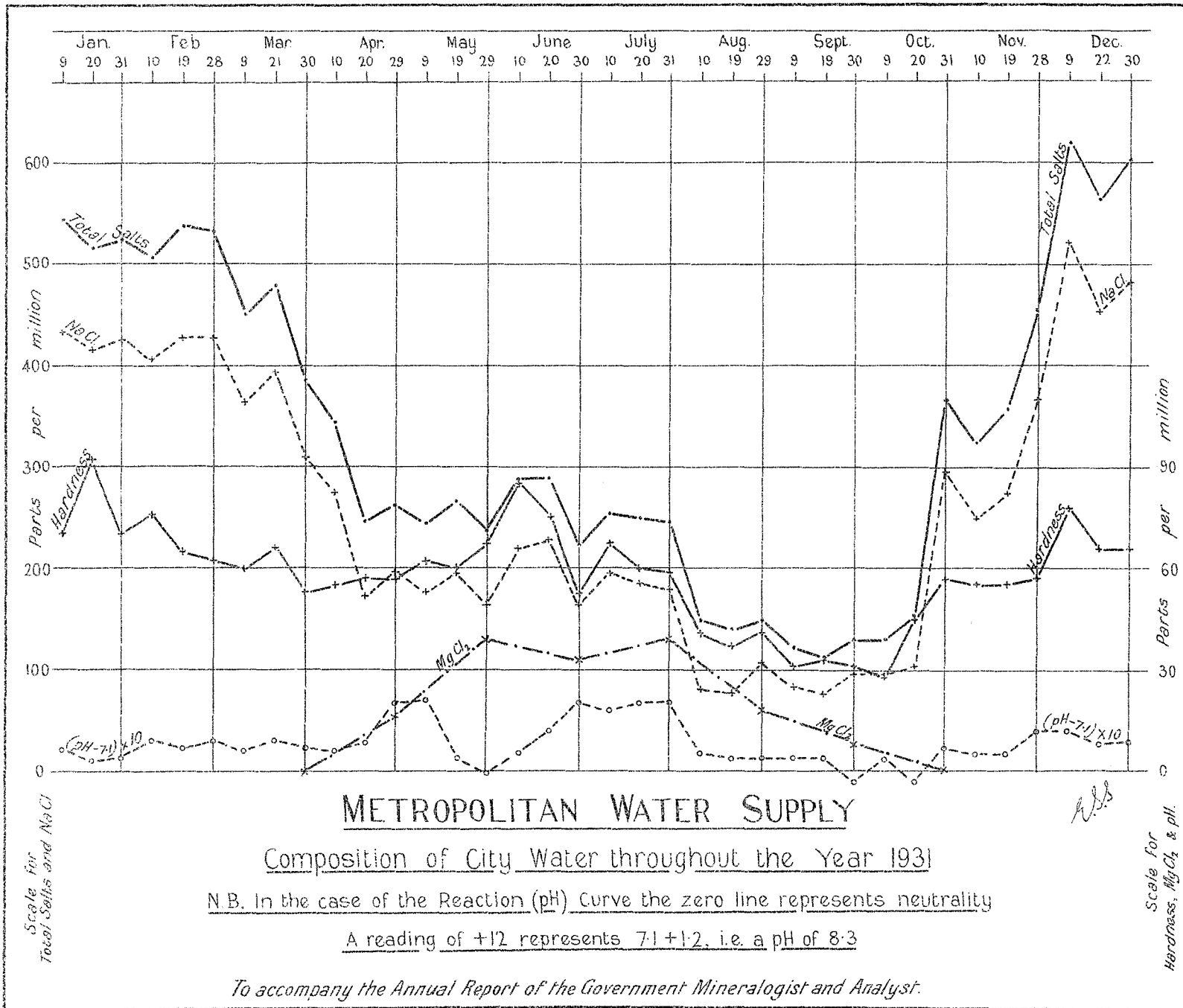
Lab. No.	2663	2664	2665	2701
State	New South Wales.	Victoria.	South Australia.	Western Australia.
Bushel Weight—				
Declared	59½ lbs.	58½ lbs.	60 lbs.	62½ lbs.
Original	60¾ "	58¾ "	60¾ "	63½ "
Cleaned	60¾ "	59¾ "	61½ "	64 "
Moisture	12.02 per cent.	13.20 per cent.	11.40 per cent.	12.00 per cent.
Weight of 1,000 grains	43.17 gms.	36.66 gms.	37.28 gms.	42.11 gms.
Products—				
Flour	71.0 per cent.	71.4 per cent.	70.8 per cent.	70.7 per cent.
Bran	19.8 "	19.7 "	20.0 "	19.7 "
Pollard	9.2 "	8.9 "	9.2 "	9.6 "
Flour—				
Moisture	12.79 "	12.81 "	11.75 "	11.90 "
Strength	54.50 "	54.50 "	55.50 "	55.75 "
Ash	0.79 "	0.71 "	0.70 "	0.71 "
Protein (N x 5.7)	11.11 "	10.37 "	11.51 "	10.14 "
Gluten, wet	32.83 "	30.86 "	32.65 "	30.36 "
Gluten, dry	10.77 "	10.07 "	10.91 "	10.01 "
Colour	Excellent	Very good	Good	Excellent

Grain moisture determined on cracked grain—being loss in 1 hr. at 130°C.

Royal Agricultural Society Show Exhibits.—Sixty-eight wheats were received, more than double the number for last year. These are from different parts of the State, and after a preliminary examination by the judges 43 were milled in the experimental mill and prizes awarded according to points given for the different milling and baking characteristics. The champion prize was awarded to a sample

of Comeback from Mullewa, with a total of 92.75 points. The milling investigations were carried on by Mr. R. G. Lapsley, B.Sc.(Agr.), A.A.C.I., who also acted as judge in conjunction with Mr. G. L. Sutton, Director of Agriculture, and Mr. E. W. Wilson, miller for the Peerless Flour Milling Co.

A. J. HOARE, A.A.C.I.



DIVISION VIII.

Report of the Chief Inspector of Explosives for the Year 1931.

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," my report on the working of the Branch for the year 1931.

The importations of explosives into the State during the year showed an increase on the quantity imported during the previous twelve months. Five separate shipments were received. On submission of samples from each of these consignments to the official heat test, satisfactory results were obtained in all cases. Tests for velocity of detonation as obtained by the "Dautriche" method were also satisfactory, the explosives maintaining a reasonably high velocity of detonation during storage and until such time as they were issued from the Woodman's Point Reserve.

Table No. 1 shows the quantities of the various explosives imported into the State during the year:—

TABLE I.

Importations of Explosives into Western Australia during 1931.

Explosive.	Quantity in lbs.
Gelignite	565,500
Gelatine Dynamite	575,250
Blasting Gelatine	145,150
Permitted Explosives	20,000
Powder—Blasting and Pellet	90,725
Detonators (number)	1,805,000
Fuse (yards)	1,987,200

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.

	1927.	1928.	1929.	1930.	1931.
	lbs.	lbs.	lbs.	lbs.	lbs.
Gelignite	663,000	640,000	337,000	413,500	565,500
Gelatine Dynamite	428,000	487,500	405,000	447,000	575,250
Blasting Gelatine	85,000	127,500	233,500	220,000	145,150
Permitted Explosives	40,000	57,000	47,500	61,000	20,000
Powder—Blasting and Pellet	221,000	152,250	207,500	150,000	90,725
Detonators—No.	2,269,000	1,480,000	975,000	1,075,000	1,805,000
Fuse (Coils)	247,280	202,500	213,000	232,500	1,987,200

Table No. III., showing the distribution of the explosives, is interesting inasmuch as the figures indicate a much larger percentage used in gold mining to other industries in which explosives are used:—

TABLE III.

Distribution and Consumption of Explosives for Years 1930 and 1931.

	1930.		1931.	
	lbs.	Percentage of total.	lbs.	Percentage of total.
Gold Mining	935,900	80·85	1,320,700	90·98
Agricultural and Land Clearing	61,000	5·28	36,400	2·50
Government Departments, including Railways, Public Works and Water Supplies	28,500	2·40	29,650	2·04
Quarrying	86,500	7·49	37,150	2·56
Lead Mining	550	·04	150	0·01
Coal Mining	43,000	3·71	27,350	1·87
Tin Mining	650	0·05	200	0·01

Licenses, as per Table No. 1V., for the storage and sale of explosives were issued during the year:—

TABLE IV.

Licenses issued during 1931.

For Magazines on Government Reserves	46
For Magazines used by Government Departments	28
For Magazines erected on private property ...	47
Store Licenses for sale of explosives:—	
Mode (a)	103
Mode (b)	2
Fireworks only	214
Importation Licenses	2

Magazines and stores which are licensed for the storage of explosives have been inspected wherever possible throughout the State, the number of these inspections being 149. It is pleasing to note that it was not found necessary to take proceedings against any persons for breaches of the Explosives Act. The quantities of explosives found unfit for use through chemical deterioration or otherwise was very small. Table No. V. gives a list of the explosives and the quantities and the reasons for their destruction:—

TABLE V.

Destruction of Explosives during 1931.

Date.	Place.	Kind and Quantity.	Remarks.
23-5-31	Wiluna	100 detonators	Damaged by water.
20-7-31	Fremantle... ..	200lbs. gunpowder	Damaged by moisture.
27-7-31	do.	45lbs. gelignite	Chemical deterioration.

With a view to determining the chemical purity and stability of explosives and their suitability for use, the following tests were made:—

TABLE VI.

Tests and Analyses made during 1931.

Heat Tests	690
Analyses of Explosives	42
Fuse Tests	417
Fireworks tests	24
Tests for velocity of detonation	39
A.D.C.	10
Tests of detonators	56
Miscellaneous	15

Two new explosives were added to the authorised list of Explosives to be imported into or manufactured in Western Australia.

I desire to 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.

4th April, 1932.