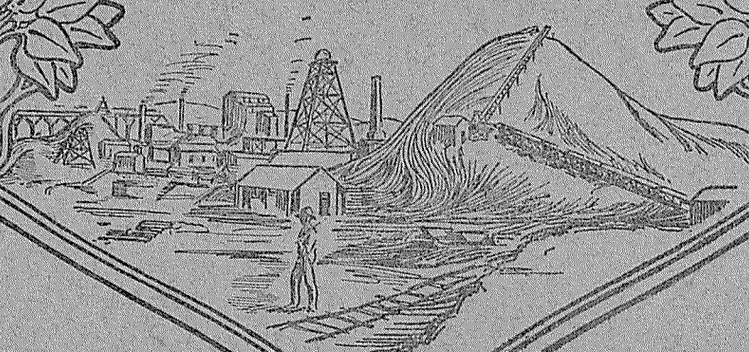
REPORT
OF THE
DEPARTMENT OF MINES
FOR THE YEAR
WESTERN · 1934. · AUSTRALIA



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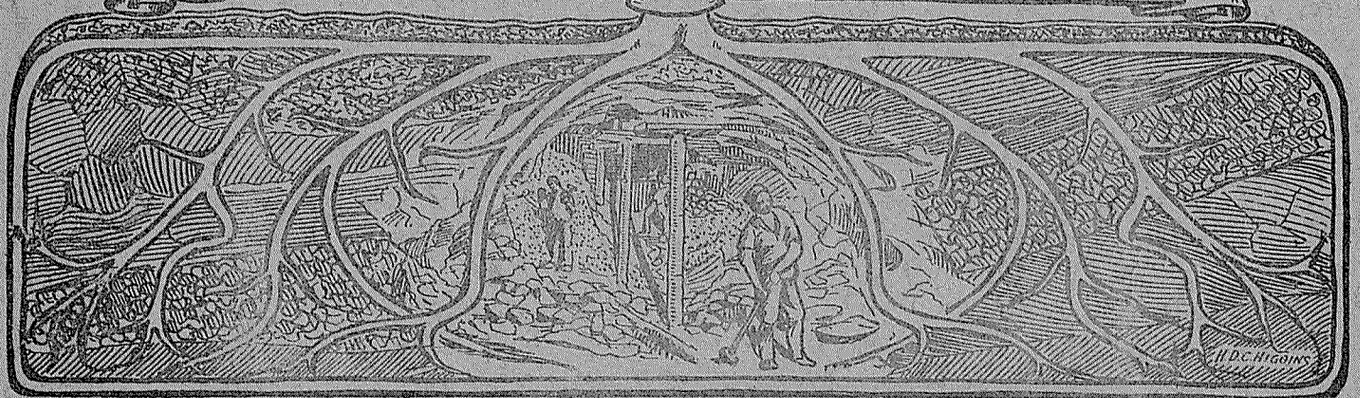

1935.

WESTERN AUSTRALIA.

REPORT

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DEPARTMENT OF MINES

FOR THE YEAR

1934.

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ANNUAL REPORT OF THE DEPARTMENT OF MINES, WESTERN AUSTRALIA, 1934.

TABLE OF CONTENTS.

DIVISION I.

STATE OF WESTERN AUSTRALIA.

Report of the Department of Mines for the State of Western Australia for the Year 1934.

To the Hon. the Minister for Mines:

Sir,—

I have the honour to submit the Annual Report of the Department for the year 1934, together with reports from the officers controlling the sub-departments, and comparative tables furnishing statistics relative to the Mining Industry.

With the deepest regret I have to record the very great loss sustained by the Department in the death, in August, of Mr. A. M. Howe, State Mining Engineer. He was an officer of outstanding ability who will be greatly missed, and his courteous and kindly nature endeared him to the whole staff.

I have, etc.,

M. J. CALANCHINI,
Under Secretary for Mines.

Department of Mines,
Perth, 30th March, 1935.

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 1934.

The value of the mineral output of the State for the year was £3,116,716, an increase of £56,789 over the year 1933.

The production of asbestos, copper, glauconite, lead and silver showed a decline, whilst arsenic, coal, felspar, gold, gypsum, silver-lead ore, tin and tantalite showed increases. In addition, small parcels of alunite, ochre and pottery clay were reported. Although the tonnage of coal produced showed a bigger tonnage the estimated value was less, owing to the reduction in price paid for that commodity.

The normal value of the gold yield was £2,766,708, being 88.77 per cent. of the total output value.

The value of the coal output was £278,704; arsenic £37,705; silver, £7,113; gypsum, £7,210; felspar, £5,482; asbestos, £2,601; tantalite, £2,990; tin, £6,765 and glauconite, £1,200.

Dividends paid by mining companies amounted to £968,558, in comparison with £534,681 in the preceding year. In addition, £40,500 were paid as a bonus by one of the companies. (see Table 6.)

To the end of the year 1934 the total dividends paid by mining companies amounted to £30,840,869. To the same date the total value of the mineral production was £186,885,065, of which the gold production accounts for £172,923,556 based on normal values; but premiums from sales of gold during 1920-24 and 1930-34 and payments under "The Gold Bounty Act, 1930," increased by £10,474,483 the total values of mineral and gold productions respectively.

GOLD.

The gold yield shows an increase, being 14,131 fine ounces greater than in 1933; which was 31,646 ounces greater than 1932.

The average value per ton of ore treated in the State as a whole decreased from 34.05 shillings in 1933 to 30.66 shillings in 1934, calculated on a basis of £4 4s. 11.45d. per fine ounce of gold but the increased price obtained for gold during the year (averaging 101.9 per cent.) would materially add to these values. In the East Coolgardie Goldfield, which produced approximately 52.24 per cent. of the State's reported yield, the average value of the ore treated fell from 37.23 shillings to 31.51 shillings per ton.

The average values for the East Murchison (Wiluna) and Mt. Margaret (Sons of Gwalia) Goldfields were 22.78 and 31.68 shillings respectively.

The tonnage of ore treated in 1934, 1,772,931 tons, was an increase of 183,952 tons over the 1933 production.

Increased tonnages were produced from East Coolgardie (78,899); East Murchison (60,140); Yilgarn (11,857); Dundas (11,717); North Coolgardie (7,361); Coolgardie (3,235); Peak Hill (3,097); Murchison (2,968); Pilbara (2,349); and smaller increases from the other fields, with the exception of Mt. Margaret and Phillips River Goldfields which showed a decrease of 1,276 and 1,083 tons respectively.

The installation of new plant for the handling and treatment of ore is reflected in the increased tonnages of ore raised and treated per man employed underground in the East Murchison and East Coolgardie Goldfields, the tonnages rising from 596 to 699 in the East Murchison and from 430 to 441 in the East Coolgardie Goldfield, although the average tonnage per man employed above and underground decreased approximately 14 per cent., presumably owing to the number of men engaged in surface work erecting buildings and machinery, etc., upon properties which have not yet reached the producing stage.

Of the seventeen goldfields listed in Table 3, nine reported increased gold yields. East Murchison, 13,089 ounces; Dundas, 8,195 ounces; Yilgarn 3,634 ounces; North Coolgardie, 2,866 ounces, being the principal contributors; whereas East Coolgardie, Broad Arrow and Murchison showed the largest decline: 25,433, 2,653 and 1,612 ounces respectively.

The acreage held under mining lease for all minerals is 70,774 acres, being an increase of 12,511 acres when compared with 1933.

The area held for gold mining is greater by 14,673 acres, and for other minerals lesser by 2,162 acres.

The area held under prospecting areas is 59,262 acres, including 2,123 acres for coal. This is an increase of 15,169 acres on the area held in 1933.

In addition to the area held under leases and prospecting areas very large areas have been set aside as reservations under the provisions of Section 297 of the Mining Act and various persons and companies granted the right of occupancy on conditions imposed by the Minister. This policy has resulted in the attraction of considerable capital and most of the areas are being actively developed. One company, the Western Mining Corporation, in addition to ordinary development work, has been carrying out an extensive programme of aerial and geophysical surveys.

The average number of men engaged in all classes of mining was 13,310, an increase of 2,620 on the number employed in 1933.

The number of men engaged in mining for minerals other than gold showed a decrease of 3. There were increased numbers on asbestos and tin and less on tantalite, gypsum and lead.

In gold mining there was an increase of 2,623.

The value of the average amount of gold produced per man employed on gold mines was £262.48 in 1933, and £217.02 in 1934, calculated at normal value.

The average tonnage raised per man was 141.57 tons, and in the previous year 164.37 tons, a decrease of 22.80 tons per man.

The examinations of miners under the provisions of "The Mine Workers' Relief Act, 1932," were continued during the year.

In the East Murchison field there was an increase of 13,090 fine ounces.

In the Black Range district there was an improved output, although the tonnage treated was smaller.

At Barrambi only a few prospectors were operating.

At Berrigrin there was a small increase in numbers, and a couple of crushings were reported.

At Bellchambers a few prospectors were engaged, and one small crushing was reported.

At Currans Find there was an increased number and a couple of good crushings reported.

At Errolls a greatly increased activity was noticeable but not any noteworthy production so far.

At Hancocks there was little change but a few outputs were reported.

At Jonesville there was a marked improvement and active development is being done on the "Swan Bitter" and "North End" Leases from each of which good returns were reported.

From Maninga Marley a small output was recorded and there was a falling off in the number of prospectors.

From Montagu there was a small production but an increased number of prospectors was at work.

At Nungarra there was not any improvement, the position being practically unchanged.

At Sandstone there was an improvement and some good returns were recorded.

At Youanmi a good deal of investigatory work was being done on the old mine and it is thought to be almost certain that an English company will take it over, when a considerable revival may be expected.

In the Lawlers district there was a small increase and returns were reported from Kathleen Valley, Mount Sir Samuel, Bronzewing and Lawlers itself. A good deal of prospecting was in evidence.

In the Wiluna district there was an increased output. On the Wiluna Gold Mines, Ltd., work continued actively and satisfactorily. On the Bulletin Lease a large amount of development work was accomplished. Likewise on the Moonlight Leases, the Goldfields Australian Development Company did a great deal of exploratory work and it is understood the results are most promising. Returns were also reported from the outside centres of Cole's Find, Corboy's Find, Diorite, Gum Creek, Kingston, New England and Waldeck's, and many prospectors were working at those centres. There was no production from either Mt. Keith or Mt. Eureka. The Murchison field had a decrease of 1,612 fine ounces.

In the Meekatharra district there was a falling off. At Meekatharra itself a great deal of activity was evident and many mining tenements have been taken up. A lot of exploratory work has been done by companies that have acquired options or purchased properties and a considerable revival is looked for. Returns were reported from the outside centres of Abbots, Belele, Burnakura, Chesterfield, Gabanintha, Garden Gully, Gum Creek, Holden's Find, Jilawarra,

Munarra Gully, Quinns, Ruby Well, Yaloginda, Wanganui and Nannine. Many prospectors were operating at these various centres.

At Nannine the Aladdin Gold Mines, Ltd., have taken up many holdings and have been actively working. They expect to do some drilling also shortly. The North Western Gold Company has also acquired several properties close to the township and it is expected that they will be thoroughly prospected shortly.

With the exception of a small development about three miles from Meekatharra, no new finds were reported.

In the Cue district there was a decrease.

Outputs were reported from the outlying centres of Behring Pool, Cuddingwarra, Culculli, Mindoolah, Oliver's Patch, Reedy's, Ryansville, Tuckabianna, Tuckanarra and Weld Range in addition to the Cue centre. The Premier Gold Mining Company, which holds an option over the Big Bell Mine, completed an extensive drilling programme and commenced sinking a prospecting shaft. It is hoped to be at the production stage soon.

The Triton Gold Mines at Reedy's were busy developing and erecting plant and are quickly approaching the production stage. Next year should record a great advance in output in this district.

In the Day Dawn district there was a small decrease. Returns were reported from Day Dawn, Lake Austin, Mainland and Pinnacles.

At Day Dawn the Western Mining Corporation is actively prospecting a Reserve which includes the old Fingal Mine. One or two other shows are giving much promise.

At Lake Austin two new companies are actively developing their properties. At the Pinnacles a lot of prospecting is being done.

In the Mt. Magnet district there was a decrease.

It is certain there will be an early improvement as at Mt. Magnet there has been much activity combined with the erection of treatment plants and next year should show a considerably enhanced output.

At Lennonville exploratory work and diamond drilling was being done by the Wheel of Fortune Gold Mines, Ltd. A couple of crushings were reported from this centre.

At Paynesville several prospectors were working, but only one small return was recorded.

At Moyagee there was a revival and an increase in the number of prospectors. One crushing was reported.

The Peak Hill Goldfield had a decrease of 20 fine ounces. In the vicinity of Peak Hill there has been a good deal of activity and the State Battery had a busy year. Many crushings were reported, mostly of low-grade ore.

Returns were reported from the outlying centres of Horseshoe, Mt. Fraser, Mt. Seabrook, Wilthorpe and Jimble Bar. At the latter centre a large amount of diamond drilling was being done on the main leases by the Western Mining Corporation.

At Robinson Range, a locality about 20 miles South-East of Peak Hill, worked about 20 years ago, several prospecting areas have been taken up but no returns have yet been reported.

The Yalgoo field had an increase of 1,246 fine ounces. In the immediate vicinity of Yalgoo mining continued to be quiet and only a small output reported. Returns were recorded from the outlying centres of Bilberatha, Carlaminda, Field's Find, Goodingnow (which was the busiest centre on the field), Gullewa, Messenger's Patch, Mount Gibson (where there was a decline in the number of prospectors operating), Noongal, Pinyalling, Retaliation (where development work and diamond drilling is being carried out on the Atlas Gold Mines, Ltd., and a large number of men employed), Rothsay (where a treatment plant is in course of erection by the Rothsay Gold Mines, N.L., and is expected to commence treatment early in the New Year), Wodgengarra, Warda Warda, and Warriedar. At Yuin there has been a revival and a battery erected. It is stated that diamond drilling will shortly be undertaken.

The Mt. Margaret field had an increase of 1,161 fine ounces. In the Mt. Margaret district the principal producing centres were Burtville, Ida H. and Laverton. There was considerable activity at Beria, where the erection of plant on and the unwatering of, the Lancefield Mine was proceeding. Production is expected early in the coming year. Other properties in the vicinity of this mine have been attracting a good deal of attention.

At Burtville several prospectors have been getting good crushings and at Ida H. considerable activity was evident. At the various other outlying centres prospectors were busy and generally the district shows distinct evidence of a marked revival.

In the Mount Morgans district the principal producing areas were Mt. Morgans, Murrin Murrin, Linden, Yundamindera, Eucalyptus and Mt. Margaret.

At Mt. Morgans the old Westralia Mt. Morgans Mine has been reopened and extensive repair work is being carried out. Several other abandoned mines are being again taken up and worked. The V's United Mine adjacent to the township of Mt. Morgans is expected to commence operations early in the New Year and to have a good deal of promise. In the various outlying centres prospecting has been active and many crushings recorded.

In the Mt. Malcolm district the principal producer was the Sons of Gwalia Mine. This mine treated 12,000 tons monthly and the development at depth was again satisfactory.

On the old Harbour Lights Mine, which is a big low-grade proposition, unwatering is in progress. The Gambier Lass has been acquired by a company and preparations to open it up are in hand. At Wilson's Patch the old Great Western has been unwatered and it is thought has an excellent chance of developing well.

At Darlot and Mt. Clifford there is a good deal of activity, and prospecting is being keenly carried on throughout the whole district.

The Coolgardie field had an increase of 864 fine ounces.

In the immediate vicinity of Coolgardie there was considerable activity. The old Bayley's Mine is now held by an English company with ample working capital and is being unwatered and plant erected. Several other old mines are again being worked.

At Tindals nothing of note transpired.

From Gibraltar crushings were reported and a good deal of prospecting was being done

At Burbanks a good deal of development was in hand and at Bonnievale diamond drilling was being carried out on the old leases.

At Widgiemooltha there was not much change.

At Larkinville only a few alluvial miners are working and not much gold being recovered.

In April a Reward Lease was applied for at a locality 26 miles from Coolgardie on the Norseman Road, since known as Spargo's Find. Good returns have been obtained and it is considered a very promising property.

At Jourdie Hills nothing of note transpired.

At Higginsville there was little change, likewise at St. Ives.

In the Kunanalling district prospecting was very active throughout, and at Carbine some promising developments were recorded. During the year the Mining Registrar's Office, which had been closed for some years, was reopened.

The North Coolgardie Field had an increase of 2,865 fine ounces.

In the Menzies district there was a wonderful revival and practically all the old mines are again being worked. The Lady Shenton was acquired by a company and good ore has been revealed. Plant for the working of the mine is being installed. The First Hit, which produced many good crushings, is now under option and a large number of men are employed.

At Yunndaga much activity prevails and several payable crushings have been reported.

At Broughtonville four (4) miles Easterly from Yunndaga several parties were working and returns were reported.

At Comet Vale machinery is being got ready for the purpose of unwatering the mine. A five-head battery is operating on the Lake View Mine.

At Mt. Ida the leases held by the Timoni Syndicate were taken over by a company and plant is being erected.

The old Copperfield is being unwatered and a good deal of work is being done on the Forest Belle and Boodie North. Several other shows are working and about 70 men are employed at this centre.

In the Ularring district many prospectors were working throughout. The sensational yields from the old Lady Gladys Mine at Mulline, mentioned in last year's report, were not maintained as expected.

In the Yerilla district mining was active, at Yarri, several holdings were being worked. At Edjudina and Patricia a small amount of work was being done. At Yilgangi a new find known as the Yilgangi Queen had a couple of small crushings.

At Yerilla some prospecting was being done but nothing of importance was found.

In the Niagara district there was considerable activity at Kookynie and Niagara and companies are reopening the Cosmopolitan and Gregory Mines. Many prospectors are working at the various centres.

The North East Coolgardie Field had an increase of 1,830 fine ounces.

Mining in this field has been exceedingly quiet for many years but an improvement is now noticeable. At Kanowna a company has acquired the old Golden Valley Mine and is busy unwatering. Plans for the erection of plant are being prepared.

The Last Chance Mine is under option to a company and unwatering is in progress.

Most of the other abandoned mines have again been taken up.

In the Kurnalpi district nothing of note transpired.

The Broad Arrow Field had a decrease of 2,653 fine ounces. This field has always been an attractive one for prospectors, and large numbers were operating during the year. In the immediate vicinity of Broad Arrow a 5-head mill was erected on the Golden Arrow and undertakes public crushing.

At Bardoc a lot of work is going on and the centre attracts a considerable amount of attention.

At Ora Banda the Gimlet Mine is being unwatered and many leases are working. The State Battery has been kept exceedingly busy.

At Grant's Patch the Ora Banda Amalgamated Company has been developing its property with very promising results. A 10-head mill is in course of erection.

At Balgarrie the Gold Reefs Company has done a lot of work, including diamond drilling, and it is stated that large bodies of low-grade ore have been revealed.

In the East Coolgardie Field the number of men engaged in mining was 3,519, and in 1933, 3,275, an increase of 244. This goldfield gave employment to over 28 per cent. of the number of men engaged in gold mining, and the reported production for the year was 334,275 fine ounces, over 52 per cent. of the total reported yield. The tonnage treated was 899,760 tons, being 78,899 tons greater than in 1933. The yield showed a decrease of 25,433 fine ounces on the preceding year. The average grade of the ore per ton fell from 37.23 shillings in 1933 to 31.51 shillings in 1934. The Lake View and Star was again the chief producer. Developments on this mine have been very good and during the year it acquired the Australia Mine, on which developments are stated to be also satisfactory.

On the Great Boulder Mine good work has been done, and big tonnages of payable ore proved. The new mill was completed and put into operation. The Paringa Mining and Exploration Company has been busy equipping and developing its mine. A large amount of diamond drilling has been done from the surface and the results are reported to be most satisfactory.

The North Kalgurli United Mine, Ltd., was doing a large amount of diamond drilling. The North Kalgurli (1912), Ltd., did a considerable amount of work and is producing regularly. On both the South Kalgurli and Boulder Perseverance developments were very satisfactory. On the latter a second unit of the mill was completed. On the North Kalgurli Central and mines held by the B.A.N.Z. Company a lot of prospecting work was done. At the North End of the field the Broken Hill Proprietary Company worked continuously on the Hannans North with encouraging results.

At Hampton Plains several old mines have been reopened and are being actively prospected.

At Binduli, Golden Ridge, Mt. Monger and Boorara many prospectors were engaged. The State mill at Kalgoorlie was running continuously and an additional 5-head was erected.

In the Bulong district there was a renewal of activity but nothing of note was reported.

The Yilgarn Field had an increase of 3,633 fine ounces. At Bullfinch the improvement noted last year was more than maintained and many crushings were reported.

At Corinthia there was not much prospecting being done and the number of men employed was less than in the previous year. Each of the existing leases, however, recorded an increased production.

At Enuin there was considerable activity early in the year but this was not maintained, only a few prospectors remaining at the close of the year. A small production was reported.

At Forrestania mining was dormant.

From the Golden Valley Centre there was a good production and the Radio and Radio Deeps were again consistent producers, the former being the third largest producer in the field. Production was also reported from Blackbournes, Greenmount, Holleton, Hope's Hill, Kennyville, Koolyanobbing, Mount Jackson, Parker's Range, Southern Cross, Marvel Loch, Palmer's Find and Westonia.

At Marvel Loch there were increases both in production and the number of men employed and considerable activity was evident. From Palmer's Find early in September an assisted prospector reported the discovery of gold. It was soon recognised that the locality would develop into one of importance and considerable activity resulted. The areas held by the Commonwealth Mining and Finance Company, Limited, promised to prove one of the outstanding discoveries of recent years. The locality is about eight miles South of the Yellowdine Railway Station. At Westonia the principal producer was again the Princess Royal Gold Mining Company which is also the premier producer of the field. Plans have been prepared for the unwatering of the Edna May group and the erection of a modern treatment plant. Active mining operations should be in full swing at an early date.

The Dundas Field had an increase of 8,194 fine ounces. The Norseman Gold Mines increased its plant, and, in addition to ordinary development work, carried out some diamond drilling. The O.K. and Lady Miller have been taken over by a company and are being developed.

The Western Mining Corporation has options over several mines, including the Mararoa and Princess Royal in addition to reservations, and has done a great deal of work with, it is reported, very encouragaing results. This field attracted a great amount of attention and mining was very active.

The Phillips River Field had a decrease of 381 fine ounces.

The Hatter's Hill centre produced a good proportion of the output. There has been a marked revival in this field. At Kundip the Beryl Gold Mines continued drilling operations and the results are reported to be good. Mining operations have been begun and a good number of men employed. Public crushing plants are working at Hatter's Hill, Kundip and Ravensthorpe and a considerable number of mining tenements taken up. Business increased to an extent that necessitated reopening the Mining Registrar's Office, which had been transferred to Head Office for some years.

The Pilbara Field had an increase of 413 fine ounces. A large number of prospectors was operating throughout this field. In the vicinity of Marble Bar diamond drilling was being done on the Apex Mine by a strong English company.

At Nullagine there was increased activity and several abandoned properties were being reopened. Attention is still being given to the "conglomerates, and indications are that an English company will be formed to develop them. Crushings were reported from Bamboo Creek, Marble Bar, Sharks Gully, Talga Talga, Tambourah, Salgash, Yandicoogina, McPhee's Patch, Lallah Rookh, Twenty Ounce Gully, Warrawoona and Coppin's Patch.

The State Mills at Marble Bar and Bamboo Creek were kept busy most of the year. There was not any production from the West Kimberley Field and no mining was being done.

The Ashburton Goldfield recorded an output of 70 fine ounces, being an increase of 35 fine ounces; the Gascoyne Goldfield an output of 71 fine ounces, being an increase of 45 fine ounces; and the Kimberley Goldfield an output of 225 fine ounces, being an increase of 43 fine ounces. In the two former very little mining was being done, being practically only alluvial. In Kimberley a good number of prospectors were working, and an improvement is indicated. From districts outside the proclaimed goldfields productions were reported from West Pilbara, where the Weerianna Gold Mines, N.L., and the Glenrocbourne G.M. Co., N.L., have begun operations, but not yet reached the producing stage. The gold reported came from various prospecting areas and also included some alluvial. Also from Burracoppin, where several leases and prospecting areas had crushings, and Toodyay, where about 30 men were prospecting at the end of the year. Crushing facilities have not yet been erected at this centre.

TIN.

The quantity of tin exported was 47 tons, valued at £6,765, an increase in tonnage of 10 tons, and in value of £2,208. The production reported was 11.47 tons valued at £1,426 from the Pilbara Goldfield, and 1.55 tons, valued at £218, from the Greenbushes Mineral Field. Operations in the latter field were mostly confined to two dredges and a fair number of alluvial miners. It is certain there was a larger production than that reported to the Department. In the New Year the Department intends to test certain areas by boring for deep leads, which it is hoped will be successful and result in an increased production.

TANTALITE.

Nine (9) tons, valued at £2,990 were exported, an increase in tonnage of one (1) ton and in value of £820. The only reported production was a small one from the Pilbara field.

COPPER.

No copper was exported nor any production reported.

LEAD.

No lead was exported, but the production of five (5) tons, valued at £61, was reported from the Northampton Field, and in the previous year one (1) ton valued at £13. Mining in this field was still very quiet.

COAL.

The output of coal was 500,343 tons, being 41,944 tons greater than in 1933. The whole output came from Collie, the Wilga deposits not being worked.

The number of men employed, 500, was only 7 less than in the preceding year, and the output per man was in 1933, 732 tons, and in 1934, 802 tons. There was little change in the Collie Field during the year.

OIL.

The Freney Kimberley Company had an oil geologist examining its territory practically throughout the year, and it is understood that later he will inspect areas in the Wooramel District. Nothing was being done elsewhere.

ASBESTOS.

The reported production was 155 tons, valued at £2,975; a decrease in tonnage of 104 tons, and in value of £1,712, all from the West Pilbara district. The quantity exported was 170 tons, valued at £2,601, a decrease in tonnage of 96 tons, and in value of £2,316 on the previous year.

OTHER MINERALS.

The quantity of silver obtained as a by-product and exported was 61,394 ounces, valued at £7,113, a decrease of 5,642 ounces, but increase in value of £321. Lead and silver-lead amounted to 10 tons, valued at £86, an increase in tonnage of of 5 tons, and in value of £31. Also 2 tons of alunite, valued at £15; 1,608 tons of arsenic, valued at £37,705; and 1,816 tons of felspar, valued at £5,482. The production was reported of 5,307 tons of gypsum, valued at £7,209; 240 tons of glauconite, valued at £1,200; 26 tons of ochre, valued at £68; and 55 tons of pottery clay, valued at £69.

MINING GENERALLY.

The Western Australian gold production was 51.94 per cent. of the total for Australasia and Mandated Territory of New Guinea, and in the preceding year 63.59 per cent., exclusive of Mandated Territory of New Guinea. There was not any improvement in mining for base metals, as low prices continued to rule for most of them.

In gold mining the marked activity of recent years continued, and over a period of five (5) years the output has been almost doubled. The continually rising price of gold and the high rate of exchange make the industry a most attractive one. The inflow of capital into the State continued and most of the old mining centres which had become moribund are now hives of industry. The outstanding find during the year was at Yellowdine, east of Southern Cross, and it promises to be the best auriferous discovery for many years. It was discovered in September by a prospector sent out under the prospecting scheme inaugurated by the Minister for Mines.

The scheme for assisting prospectors was continued and the men engaged at the commencement of the year—1,700—were reduced in numbers to 900 at the end of the year. Very few of those assisted have returned to the city, and about 700 have obtained employment in different branches of the Mining Industry, or are prospecting on their own funds.

A large number also have their holdings under option, and it is expected that a big percentage will be purchased by companies. Since June, 1933, assisted prospectors have reported crushing a total of 13,000 tons for a return of 5,800 ounces. The expenditure for the 12th months was £33,967, while £6,461 were refunded by prospectors from gold won.

In December, the Federal Government decided to make available to the State the sum of £50,000 to further assist this prospecting scheme as a measure of unemployment relief, and the Hon. the Minister undertook to send out 1,000 men as rapidly as possible.

The area held under prospecting areas for gold and minerals, apart from coal, viz., 57,139 acres, is greater by 15,799 acres than in the preceding year.

During the year the Commonwealth Government and the Governments of Queensland and Western Australia decided to embark on an aerial geological and geophysical survey of the North of Australia. The sum of £150,000, half furnished by the Commonwealth and half by the Governments of Queensland and Western Australia, will be spent over three years in a comprehensive survey, which, while it is primarily for the development of the North, will be valuable from a defence point of view.

At the close of the year everything was well advanced for the commencement of operations early in 1935.

The expenditure incurred in rendering assistance to mine owners and the industry generally under the provisions of the Mining Development Act totalled £53,307 8s. 11d., and in the preceding year £50,807 6s. 4d.

PART II.—MINERALS RAISED.

TABLE 1.

Quantity and Value of Minerals produced during Years 1933 and 1934.

Description of Minerals.	1933.		1934.		Increase or Decrease for Year compared with 1933.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
		£		£		£
1. Alunite (exported), statute tons	...	...	2	15	+ 2	+ 15
2. Arsenic (exported), statute tons	1,331	36,753	1,608	37,705	+ 277	+ 952
3. Asbestos (exported), statute tons	266	4,917	170	2,601	— 96	— 2,316
4. Coal (raised), statute tons	458,399	289,806	500,343	278,704	+ 11,944	— 11,102
5. Copper (exported), statute tons	35	1,132	...	...	— 35	— 1,132
6. Felspar (exported), statute tons	453	1,618	1,816	5,482	+ 1,363	+ 3,864
7. Glauconite (reported), statute tons	349	1,745	240	1,200	— 109	— 545
8. Gold (exported and minted), fine ozs.	637,207	*2,706,683	651,338	*2,766,708	+ 14,131	+ 60,025
9. Gypsum (reported), statute tons	2,608	3,686	5,307	7,210	+ 2,699	+ 3,524
10. Lead (in Concentrates) (exported), statute tons ...	1	13	...	...	— 1	— 13
11. Lead and Silver Lead (exported), statute tons ...	5	55	10	86	+ 5	+ 31
12. Ochre (reported), statute tons	...	...	26	68	+ 26	+ 68
13. Pottery Clay (reported), statute tons	...	...	55	69	+ 55	+ 69
14. Silver (exported), fine ozs.	67,036	6,792	61,394	7,113	— 5,642	+ 321
15. Tantalite (exported), statute tons	8	2,170	9	2,990	+ 1	+ 820
16. Tin (exported), statute tons	37	4,557	47	6,765	+ 10	+ 2,208
	...	£3,059,927	...	£3,116,716	...	+ £56,789

* The value of fine gold is computed at £4 4s. 11·45d. per ounce, in addition the estimated premiums paid to producers amounted to £A2,179,571 and £A2,792,165 for the years 1933 and 1934 respectively.

TABLE 2.

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

Year.	Total Exports.	Mineral Exports (exclusive of Coal).	Percentage.
	£	£	
1902	9,051,358	7,530,319	83·20
1903	10,324,732	8,727,060	84·53
1904	10,271,489	8,625,676	83·98
1905	9,871,019	7,731,954	78·33
1906	9,832,679	7,570,305	76·99
1907	9,904,860	7,544,992	76·17
1908	9,518,020	7,151,317	75·13
1909	8,860,494	5,906,673	66·66
1910	8,299,781	4,795,654	57·78
1911	10,606,863	7,171,638	67·61
1912	8,941,008	5,462,499	61·09
1913	9,128,607	4,608,188	50·48
1914	8,406,182	3,970,182	47·23
1915	6,291,934	2,969,502	47·19
1916	10,878,153	6,842,621	62·92
1917	9,323,229	5,022,694	53·87
1918	6,931,834	2,102,923	30·34
1919	14,279,240	6,236,585	43·67
1920	15,149,323	3,096,849	20·44
1921	10,331,405	1,373,810	13·30
1922	11,848,025	2,875,402	24·27
1923	11,999,500	3,259,476	27·16
1924	13,808,910	1,424,319	13·24
1925	13,642,852	173,126	1·27
1926	14,668,184	1,597,698	10·89
1927	15,805,120	472,041	2·99
1928	16,911,932	996,099	5·88
1929	16,660,742	1,802,709	10·82
1930	19,016,639	6,370,396	33·49
1931	14,266,650	4,333,421	30·37
1932	16,771,465	5,657,870	33·74
1933	18,098,214	5,328,869	29·44
1934	16,784,705	5,759,324	34·31
Total since 1902 ...	396,485,148	154,492,191	38·97

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.					
	1933.	1934.	Percentage for each Goldfield.		Average Value per ton of Ore treated (Gold at £4 4s. 11·45d. per fine oz.	
			1933.	1934.	1933.	1934.
	fine ozs.	fine ozs.			shillings.	shillings.
1. Kimberley	182	225	·029	·035	...	...
2. Pilbara	4,908	5,321	·771	·832	98·03	59·04
3. Ashburton	35	70	·005	·011	...	...
4. Gascoyne	26	71	·004	·011	111·37	...
5 Peak Hill	3,094	3,074	·486	·481	37·00	25·16
6. East Murchison...	124,062	137,152	19·478	21·434	23·41	22·78
7. Murchison	28,106	26,494	4·413	4·141	30·59	27·12
8. Yalgoo	5,176	6,422	·813	1·001	48·83	50·82
9. Mt. Margaret	49,618	50,779	7·790	7·936	30·87	31·68
10. North Coolgardie	10,597	13,462	1·664	2·104	119·01	75·08
11. Broad Arrow	10,724	8,071	1·684	1·261	78·73	48·88
12. North-East Coolgardie	1,088	2,918	·171	·456	68·54	64·35
13. East Coolgardie	359,708	334,275	56·475	52·241	37·23	31·51
14. Coolgardie	10,817	11,681	1·698	1·826	57·97	48·84
15. Yilgarn	22,356	25,989	3·510	4·062	56·49	48·44
16. Dundas	4,238	12,432	·665	1·943	42·10	52·08
17. Phillips River	1,389	1,008	·218	·158	29·06	28·57
State generally	804	427	·126	·067	249·43	59·52
Totals and averages	636,928	639,871	100·000	100·000	34·05	30·66

The total gold yield of the State is as shown in Table 1, being the amount of gold exported in concentrates, 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.

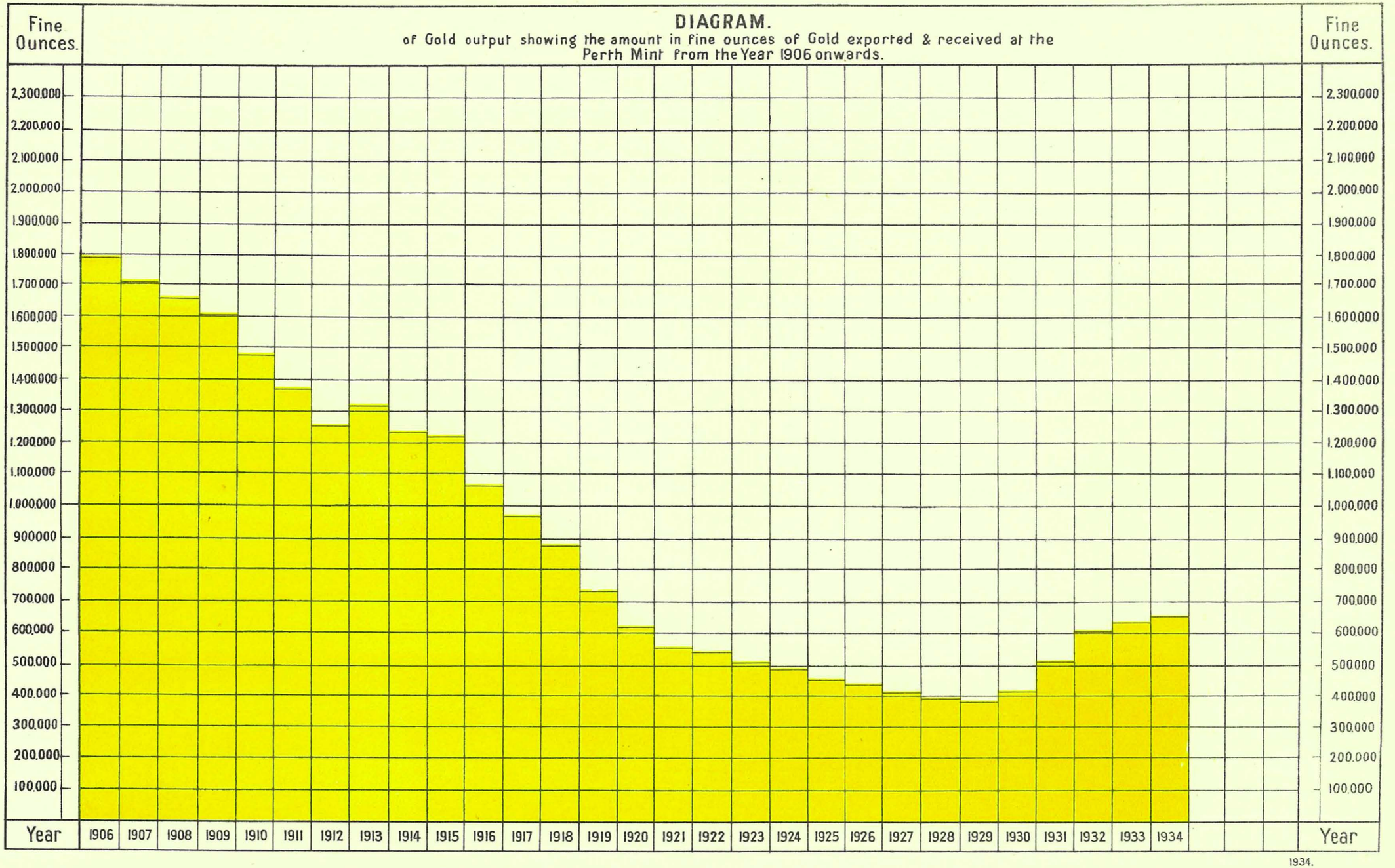
TABLE 4.

Averages of Gold Ore raised and treated, and Gold produced therefrom, per man employed on the several Goldfields of the State, during 1933 *and* 1934.

Goldfield.	1933.				1934.			
	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	43·85	27·98	50·60	32·29	56·93	29·22	45·87	23·54
3. Ashburton	...	...	...	...	...	...	...	...
4. Gascoyne	20·00	10·00	26·22	13·11	...	...	...	...
5. Peak Hill	222·02	92·26	96·69	40·18	340·03	161·92	102·48	48·80
6. East Murchison	596·44	326·55	164·32	89·97	699·25	309·18	187·88	83·07
7. Murchison	143·71	66·98	51·76	24·13	132·15	54·04	43·22	17·67
8. Yalgoo	44·80	22·34	25·75	12·84	48·25	21·84	29·87	13·52
9. Mt. Margaret	315·37	176·66	114·59	64·19	256·70	120·89	96·35	45·38
10. North Coolgardie	32·19	14·19	45·09	19·88	40·55	18·38	36·58	16·58
11. Broad Arrow	53·08	23·24	49·19	21·53	41·82	18·89	26·20	11·83
12. North-East Coolgardie ...	25·78	9·79	20·92	7·94	42·47	16·51	34·75	13·51
13. East Coolgardie	430·45	250·64	188·62	109·83	440·84	255·69	163·78	95·00
14. Coolgardie	50·00	19·99	34·12	13·64	40·09	16·92	24·54	10·36
15. Yilgarn	139·50	71·38	92·76	47·46	154·68	76·82	88·40	43·90
16. Dundas	131·55	58·97	65·20	29·23	111·98	55·99	68·70	34·35
17. Phillips River	126·84	67·65	43·40	23·14	60·73	36·30	20·56	12·29
Total Averages	309·86	164·37	124·21	65·89	283·71	141·57	102·39	51·09

DIAGRAM.

of Gold output showing the amount in fine ounces of Gold exported & received at the Perth Mint from the Year 1906 onwards.



1934.

Note:— Previous to 1906, Gold Produced, 14,871,687 Fine Ozs.

Peak Year 1903, Gold Produced, 2,064,801 " "

TABLE 5.

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

	Output of Gold.	Value.*	Percentage of Total.	
			Output of Commonwealth.	Output of Australasia.
	Fine ozs.	£		
1. Western Australia	651,338	2,766,708	59·522	51·919
2. Victoria	70,196	298,173	6·415	5·595
3. New South Wales	36,123	153,441	3·301	2·880
4. Queensland	115,471	490,490	10·552	9·204
5. Papua	12,856	54,609	1·175	1·025
6. Tasmania	5,622	23,881	·514	·448
7. South Australia	6,870	29,182	·628	·548
8. Northern Territory	1,870	7,943	·170	·149
9. Mandated Territory of New Guinea ...	193,929	823,757	17·723	15·458
10. New Zealand	160,248	680,690	...	12·774
	1,254,523	5,328,874	100·000	100·000

* Exclusive of Premium.

TABLE 6.

Dividends, etc., paid by Western Australian Mining Companies during 1934 and Total to date.

(Mainly compiled from information supplied to the Government Statistician's Office, by the Chamber of Mines of Western Australia.)

Goldfield.	Name of Company.	Bonus.	Capital returned.	Dividends.	
				1934.	Grand total paid to end 1934.
		£	£	£	£
Peak Hill	Various Companies	...	...	...	160,666
East Murchison ...	Wiluna Gold Mines, Ltd.	...	...	300,000	540,000
Do.	Various Companies	...	...	...	437,968
Murchison	Various Companies	...	...	...	1,992,670
Mt. Margaret ...	Sons of Gwalia, Ltd.	...	...	97,500	1,290,988
Do.	Various Companies	...	...	...	376,213
North Coolgardie ...	do. do.	...	...	...	575,032
North-East Coolgardie	do. do.	...	...	...	89,854
East Coolgardie ...	Boulder Perseverance, Limited	...	...	57,664	1,660,958
Do.	Golden Horseshoe (New), Limited	...	(c)	27,500	55,000
Do.	Great Boulder Proprietary G.Ms., Ltd. ...	...	...	58,332	6,275,549
Do.	Lake View and Star, Limited	40,500	...	280,000	615,000
Do.	North Kalgurli (1912), Limited	...	...	50,000	68,750
Do.	South Kalgurli Consolidated, Ltd.	(a)	(b)	62,500	658,751
Do.	Other Companies	...	...	...	14,927,489
Coolgardie	Various Companies	...	...	...	339,495
Yilgarn	Mt. Jackson Gold Mines, Ltd.	...	...	4,700	4,700
Do.	Princess Royal G.M. Co., No Liability ...	...	...	2,800	8,400
Do.	Other Companies	...	...	...	513,199
Dundas	Norseman Gold Mines, No Liability	...	...	27,562	27,562
Do.	Other Companies	...	...	...	222,625
		£40,500	...	£968,558	£30,840,869

(a) £62,500 in 1932 and 1933. (b) £93,750 in 1932 and 1933. (c) £55,000 returned in 1932.

TABLE 7.

Quantity and Value of Minerals, other than Gold, reported to the Mines Department during 1934.

Goldfield, District, or Mineral Field.	1934.		Increase or Decrease for Year as compared with 1933.	
	Quantity.	Value.	Quantity.	Value.
	tons.	£A	tons.	£A
BLACK TIN.				
Pilbara Goldfield (Marble Bar District)	11·47	1,426	— 1·03	— 68
Greenbushes Mineral Field	1·55	218	— 1·45	— 195
Total	13·02	1,644	— 2·48	— 263
ASBESTOS.				
Pilbara Goldfield (Marble Bar District)	...	...	— 7·00	— 230
State generally (West Pilbara)	155·00	2,975	— 104·00	— 1,712
Total	155·00	2,975	— 111·00	— 1,942
GYPSUM.				
Yilgarn Goldfield (Yellowdine)	1,651·50	1,651	+ 1,049·50	+ 1,049
State generally (Baandee)	2,167·25	3,252	+ 1,664·25	+ 2,498
(Woolundra)	1,488·00	2,306	— 15·00	— 24
Total	5,306·75	7,209	+ 2,698·75	+ 3,523
FELSPAR.				
Coolgardie Goldfield (Coolgardie)	193·00	386	— 260·00	— 1,232
GLAUCONITE.				
State generally (Moora District)	240·00	1,200	— 109·00	— 545
TANTALITE.				
Pilbara Goldfield (Marble Bar District)	·50	130	— 7·50	— 2,040
LEAD.				
State generally (Northampton M.F.)	5·00	61	+ 4·00	+ 48
ALUNITE.				
State generally (Lake Campion)	2·00	15	+ 2·00	+ 15
OCHRE.				
State generally (Carbarup)	26·00	68	+ 26·00	+ 68
POTTERY CLAY.				
State generally (Goomalling)	55·00	69	+ 55·00	+ 69

The estimated number of men engaged in winning base metals showed a decrease, despite 10 more men being returned as producing tin ore at Greenbushes and 6 more in producing asbestos in the Pilbara Goldfield than in the previous year. There was a reduction in the production of tantalite and 12 men less employed thereat; 8 less in the raising of gypsum and 2 men less in the coal mining industry, as shown in Table 8.

Gypsum was the only mineral which showed an increase in the quantity reported, accountable to the continued activity in the building trade and increased export of the finished article. Only one small parcel of tantalite was recorded, the exports apparently being made up of metal raised previous to 1934. Although the quantity of felspar shows a considerable decrease in quantity reported, there is every reason to believe that the figure is an under estimate and will be picked up in next year's returns.

A small trial shipment of alunite was exported for experimental purposes, which may lead to an export trade if tests are favourable. A deposit at Carbarup containing ochre received some attention but it is too early to state whether any results of permanent value will eventuate.

The high price obtainable for gold and the continued low level of prices obtainable for base metals militates against any extensive exploitation of minerals outside of gold.

TABLE 8.

Quantity of Coal raised during 1933 and 1934, estimated Value thereof, Number of Men employed, and Output per Man.

Coalfield.	Year	Quantity raised.	Estimated Value.	Men employed.		Quantity raised.	
				Above ground.	Underground.	Per Man employed underground.	Per Man employed above and underground.
		tons.	£			tons.	tons.
Collie	1933	458,399	289,806	119	507	904	732
	1934	500,343	278,704	124	500	1,001	802

The figures for 1934 disclose an improvement for the year, in comparison with 1933 results. The output showed an increase in tonnage of 41,944. The average number of men engaged in the industry remained practically stationary; 5 men more and 7 men less above and underground respectively, a net decrease of 2 men. The quantity of coal raised increased by 97 tons per man employed underground, and by 70 tons per man of the total number employed. Owing to the reduction in the price payable for the coal the value of the output was calculated as being £11,102 less than in 1933.

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, 1933 and 1934.

Description of Leases.	1933.		1934.	
	No.	Acreage.	No.	Acreage.
Gold Mining leases on Crown land	803	13,163	1,513	27,412
„ „ „ private property	8	168	26	592
Mineral leases on Crown land	177	44,832	172	42,646
„ „ „ private property	4	100	5	124
Prospecting Areas	2,276	44,093	3,038	59,262
	3,268	102,356	4,754	130,036

The total number of leases held for mining purposes increased by 724, and the area by 12,511 acres, as compared with the year 1933. The number of leases for gold mining increased by 728 and the area by 14,673 acres. The number of mineral leases decreased by 4 and the area by 2,162 acres.

For the year 1933 the number of prospecting areas held was 2,276, of a total acreage of 44,093, including 3 areas of 2,753 acres for coal.

For the year 1934 the number of prospecting areas held was 3,038, of a total acreage of 59,262, including 2 areas of 2,123 acres for coal.

Part IV.—MEN EMPLOYED.

Table 10.

Average number of Men engaged in Mining during 1933 and 1934.

Goldfield.	District.	Reef or Lode.		Alluvial.		Total.	
		1933.	1934.	1933.	1934.	1933.	1934.
1. Kimberley	...	...	...	3	6	3	6
2. Pilbara	Marble Bar	140	189	1	13	141	202
	Nullagine	7	21	4	3	11	24
3. Ashburton	...	...	...	2	4	2	4
4. Gascoyne	...	2	4	...	2	2	6
5. Peak Hill	...	77	63	...	...	77	63
6. East Murchison	Lawlers	82	88	...	...	82	88
	Wiluna	1,063	1,222	...	...	1,063	1,222
	Black Range	234	341	...	...	234	341
7. Murchison	Cue	327	487	...	...	327	487
	Meekatharra	364	355	...	...	364	355
	Day Dawn	135	188	...	...	135	188
	Mt. Magnet	339	469	...	...	339	469
8. Yalgoo	...	403	475	...	...	403	475
9. Mt. Margaret	Mt. Morgans	148	221	...	...	148	221
	Mt. Malcolm	461	513	15	15	476	528
	Mt. Margaret	149	370	...	...	149	370
10. North Coolgardie	Menzies	181	315	6	10	187	325
	Ularring	106	166	2	6	108	172
	Niagara	65	101	8	11	73	112
	Yerilla	160	197	5	6	165	203
11. Broad Arrow	...	482	656	16	26	498	682
12. North-East Coolgardie	Kanowna	91	140	9	10	100	150
	Kurnalpi	33	61	4	5	37	66
13. East Coolgardie	East Coolgardie	3,151	3,330	44	52	3,195	3,382
	Bulong	77	131	3	6	80	137
14. Coolgardie	Coolgardie	600	812	63	73	663	885
	Kunanalling	122	227	8	16	130	243
15. Yilgarn	...	468	574	3	18	471	592
16. Dundas	...	142	354	3	8	145	362
17. Phillips River	...	60	82	...	...	60	82
State generally	...	32	81	...	...	32	81
Total—Gold Mining	...	9,701	12,233	199	290	9,900	12,523
Minerals other than Gold.							
Alunite	State generally	...	1	...	...	...	1
Asbestos	Pilbara	2	8	...	...	2	8
	West Pilbara	7	9	...	...	7	9
Arsenic	Wiluna	35	35	...	...	35	35
Coal	Collie	626	624	...	...	626	624
Glauconite	Moora	3	3	...	...	3	3
Gypsum	State generally	20	12	...	...	20	12
	Yilgarn	7	7	...	...	7	7
Tantalite	Pilbara	15	3	...	...	15	3
Ochre	Carbarup	...	3	...	...	...	3
Tin	Greenbushes	55	65	...	...	55	65
	Pilbara	...	...	8	8	8	8
Pottery Clay	Goomalling	...	3	...	...	...	3
Lead	...	10	4	...	...	10	4
Felspar	...	2	2	...	...	2	2
		10,483	13,012	207	298	10,690	13,310

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 1934

FIG. 1

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

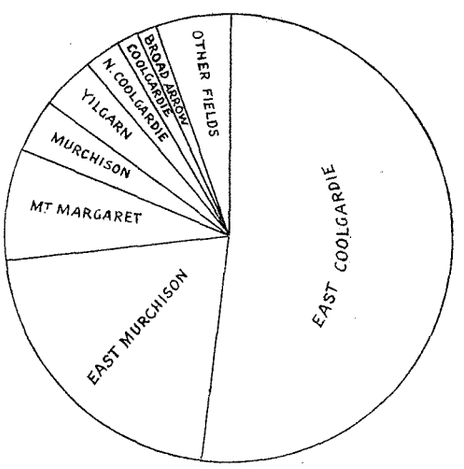


FIG. 2

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

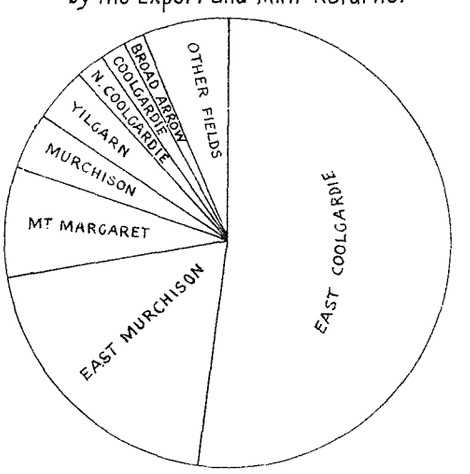


FIG. 3

Value of Gold and other Minerals.

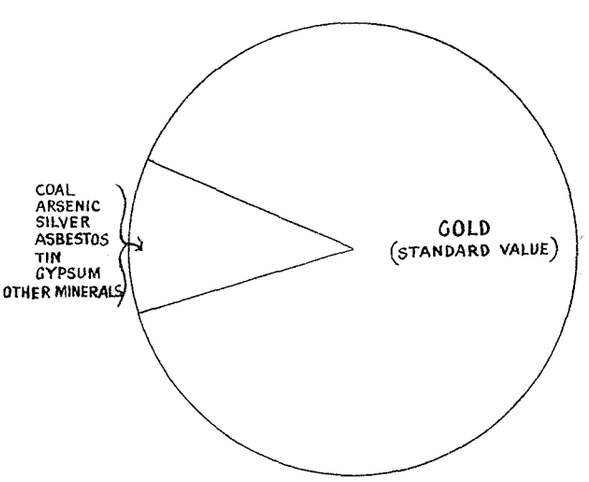


FIG. 4

Value of Minerals other than Gold.

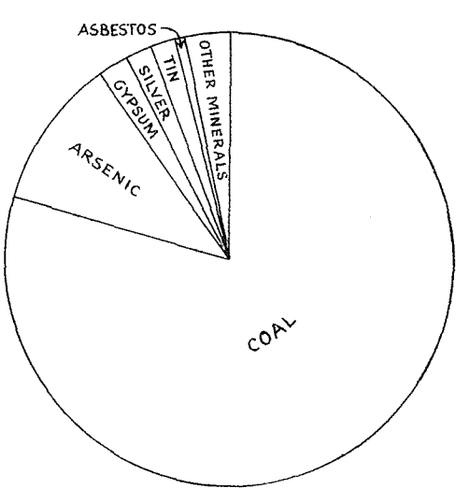


FIG. 5

Areas of Land leased for Goldmining on various Goldfields.

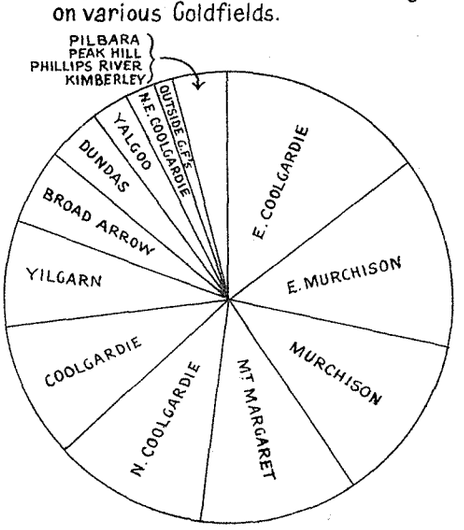
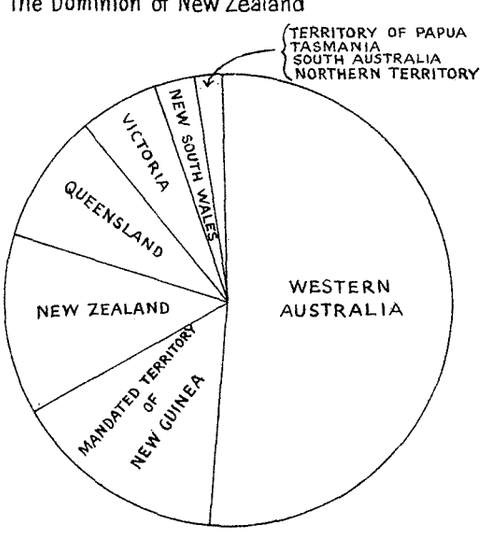


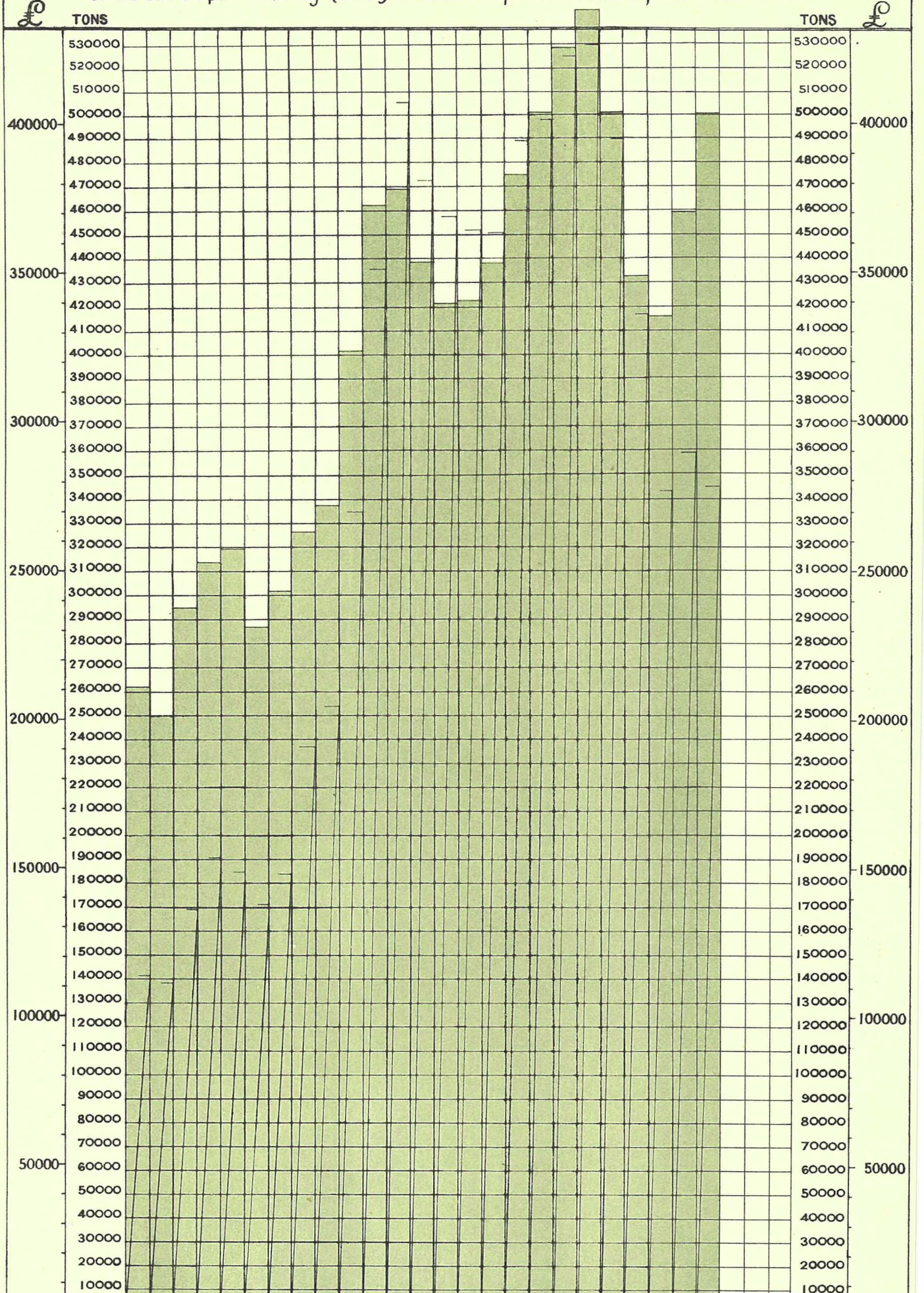
FIG. 6

Output of Gold in the States of Australia and the Dominion of New Zealand



DIAGRAM

Of the Coal Output – Shewing Quantity & Value as reported to Mines Dept from 1910 onwards

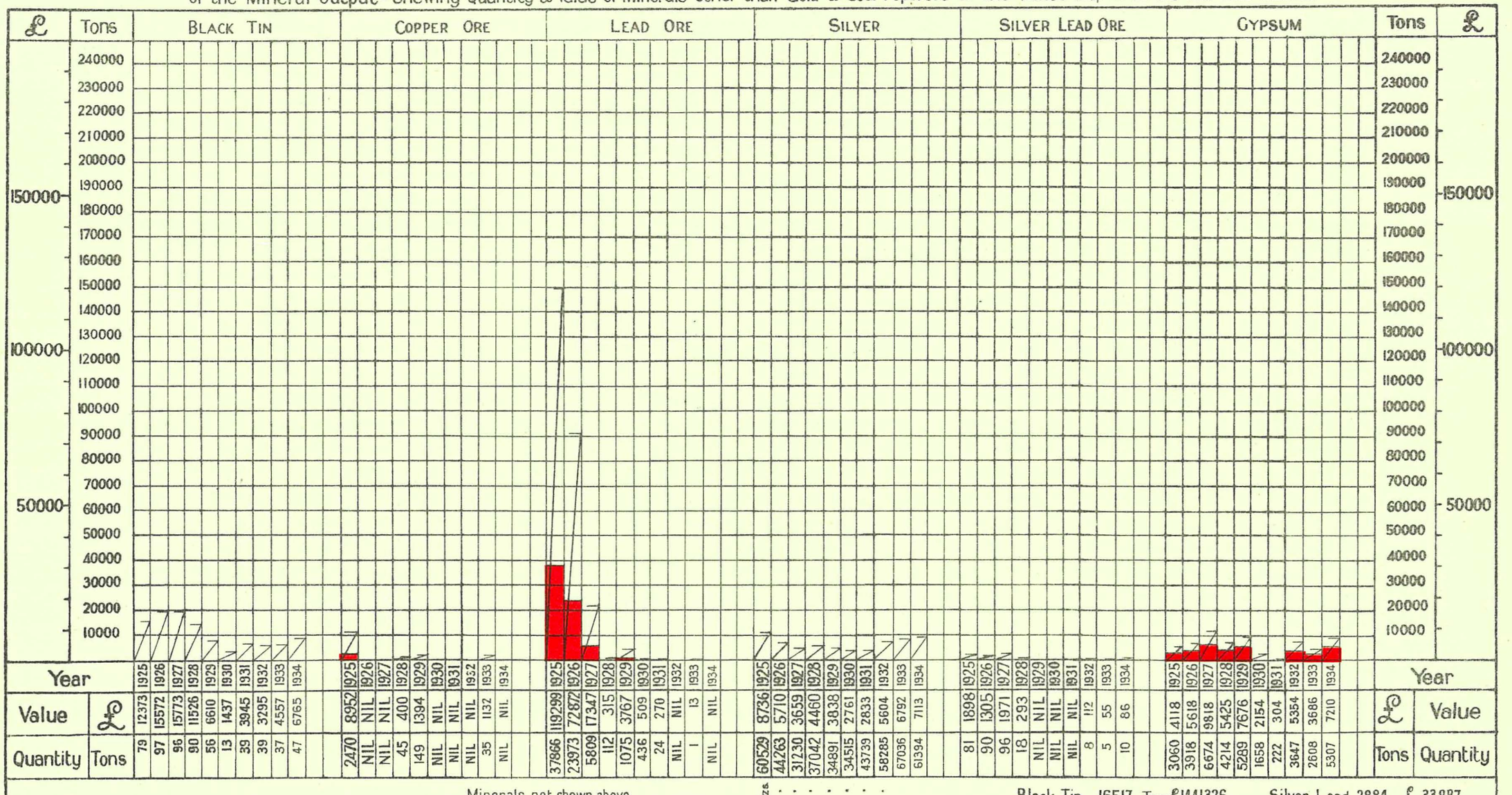


Year		1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	Year
Value	£	113699	111154	135857	153614	148684	137589	147823	191822	204319	270355	350346	407117	381555	368949	363255	363203	394400	407967	420145	426706	394758	336178	270630	289806	278704				£ Value
Quantity	Tons	262166	249890	295079	313818	319210	286666	301526	326550	337039	401713	462021	468 817	438443	420714	421864	437461	474819	501505	528420	544719	501425	432400	415719	458399	500343				Tons Quantity

1934.

DIAGRAM

of the Mineral Output - shewing Quantity & Value of Minerals other than Gold & Coal reported to the Mines Dep[t] from the Year 1925 onwards



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

Minerals not shown above

Arsenic	1609 tons	Value	£37,705
Asbestos	170	-	£2,601
Tantalite	9	-	£2,990
Other Minerals		-	£6,122

Previous to 1925 the Quantity & Value of various Minerals reported amounted to

Black Tin	16517	Tons	£1441326
Copper	250759	-	1735875
Ironstone	57830	-	36695
Lead	339485	-	1057487
Asbestos	858	-	37902
Pyritic Ore	74048	-	45496
Silver Lead	2884		£ 33987
Tantalite	102		15268
Limestone	93706		18290
Silver	2,540,212	Ozs.	357779
Other Minerals			5339

1934.

PART V.—ACCIDENTS.

TABLE No. 11.

MEN EMPLOYED IN MINES, KILLED AND INJURED IN MINING ACCIDENTS DURING 1933 AND 1934.

A.—*According to Locality of Accident.*

Goldfield.	Killed.		Injured.		Total Killed and Injured.	
	1933.	1934.	1933.	1934.	1933.	1934.
1. Kimberley	...	...	...	...	...	...
2. West Kimberley	...	...	...	...	...	...
3. Pilbara	...	...	...	...	...	...
4. West Pilbara	...	...	...	...	...	...
5. Ashburton	...	...	...	...	...	...
6. Gascoyne	...	...	...	...	...	...
7. Peak Hill	...	...	...	...	...	...
8. East Murchison	2	5	78	128	80	133
9. Murchison	1	5	24	25	25	30
10. Yalgoo	...	...	...	1	...	1
11. Mt. Margaret	...	6	64	52	64	58
12. North Coolgardie	2	...	...	1	2	1
13. North-East Coolgardie	...	...	...	1	...	1
14. Broad Arrow	...	...	...	1	...	1
15. East Coolgardie	12	13	186	477	198	490
16. Coolgardie	1	...	1	2	2	2
17. Yilgarn	1	...	1	1	2	1
18. Dundas	2	...	2	3	4	3
19. Phillips River	...	1	...	...	...	1
MINING DISTRICTS—						
Northampton	...	...	...	...	...	...
Greenbushes	...	...	...	...	...	...
Collie	1	...	190	236	191	236
Swan	...	3	...	2	...	5
Total	22	33	546	930	568	963

From the above table it will be seen that the total number of fatal accidents for the year 1934 is 33, as against 22 in the preceding year. The number injured shows an increase of 384. In the report of the State Mining Engineer, published as Division II. of this report, these accidents are classified according to causes.

B.—*According to Causes of Accidents.*

	1933.		1934.		Comparison with 1933.	
	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.
1. Explosives	11	12	9*	16†	— 2	+ 4
2. Falls of Ground	2	51	6	65	+ 4	+ 14
3. In Shafts	2	4	5	25	+ 3	+ 21
4. Miscellaneous Underground	7	366	8	656	+ 1	+ 290
5. Surface	...	113	5	168	+ 5	+ 55
	22	546	33	930	+ 11	+ 384

* Includes 3 fatal accidents at a quarry. † Includes 2 serious accidents at a quarry.

Thirty fatal accidents occurred at gold mines. The death rate per 1,000 men employed at gold mines was 2.45 as against 2.16 in 1933.

PART VI.—STATE AID TO MINING.

The number of State Batteries existing at the end of the year was 25 with 4 leased.

From inception to end of 1934, gold and tin to the value of £7,437,048.43 have been recovered from State plants. 1,856,042.44 tons of auriferous ore have been treated, and have produced £5,857,630.89 by amalgamation; £1,210,392 by cyanidation; £265,266.11 by slimes; £9,353.37 from residues, and 81,786 tons of ore produced tin to the value of £93,834, and in addition, £572 were recovered from residues.

During the year, gold ore treated was £97,454 tons for 53,268.9 ounces of bullion by amalgamation, producing 48,608 tons of payable tailings, yielding 14,793.5 ounces and 32,904 tons of unpayable tailings, yielding 2,491.3 ounces, making a total of 81,512 tons for 17,284.8 ounces.

The working expenditure for all plants was £98,298 13s. 3d., and the revenue £113,495 10s. 5d., which shows a profit of £15,196 17s. 2d. on the year's operations.

The capital expenditure since inception of the scheme has been £440,805 4s. 7d., £348,824 0s. 5d. from General Loan Fund and £91,981 4s. 2d. from Consolidated Revenue.

The cost of administration for the year was £4,887 10s. 2d. as against £4,926 10s. 8d. for the year 1933.

The working expenditure from inception to the end of the year exceeds the revenue by £127,193 16s. 6d.

GEOLOGICAL SURVEY.

The year's field work of this branch of the Mines Department is set out in the following list of reports:—

1. Inspection of Welsh's Find near Yarri, North Coolgardie Goldfield.

2. The Geology and Petroleum Prospects of area West of Dandaragan.

3. Inspection of Palmer's Find—Yellowdine, Yilgarn Goldfield.

4. Lode Mining at Yinniding Creek, Toodyay District.

5. Town Water Supply at Meekatharra, Murchison Goldfield.

6. Larkinville Gold Mining Centre, Coolgardie Goldfield.

In addition, following the usual policy of the branch, field officers tended verbal advice to owners of small mines and prospectors in various districts.

Much of the Government Geologist's time was taken up with duties connected with the Aerial Geological and Geophysical Survey, in which this State, in collaboration with the Commonwealth and Queensland Governments, is carrying out investigations in Northern Australia, North of approximately Lat. 22° S.

ASSISTANCE UNDER "MINING DEVELOPMENT ACT, 1902."

The following statement shows the sum advanced during the year 1934 under "The Mining Development Act, 1902":—

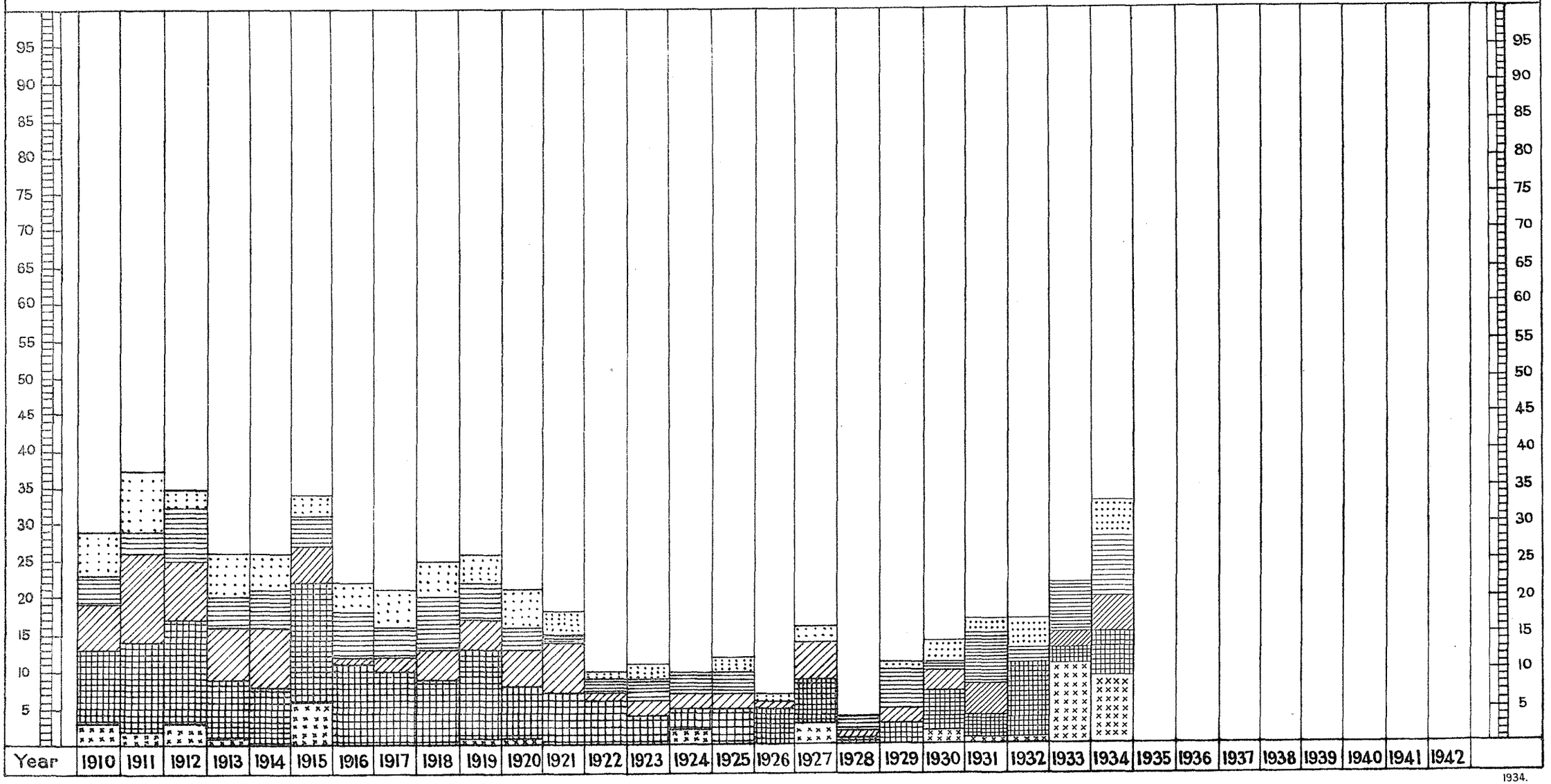
	£ s. d.
1. Advanced in aid of Mining Work and Equipment of Mines with Machinery	0 7 3
2. Subsidies on Stone Crushed for Public	368 10 0
3. Providing Means of Transport, Equipment and Sustenance to Prospectors	36,162 0 2
	£36,530 17 5

Other Assistance granted from the Vote during the year on various matters totalled	16,776	11 6
The Subsidies paid on stone crushed for the Public amounted to ..	368	10 0
And ore 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 2,213¾ tons.		
The receipts under the Mining Development Act, exclusive of interest payments, amounted to ..	7,664	7 10

And included—

	£ s. d.
Refunds of Advances	644 17 2
Sales of Securities ..	465 12 2
Miscellaneous Refunds	6,553 18 6
	£7,664 7 10

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



1934.

Explosions

Falls of Ground

In Shafts

Miscellaneous Underground

On Surface Including Machinery

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 3,878, as against 3,784 total for the preceding year, showing an increase after all adjustments of 94 boilers.

Of the total 3,878 useful boilers 2,075 were out of use at the end of the year; 1,713 thorough and 21 working inspections were made, and 1,726 certificates were issued.

Permanent condemnations totalled 21, and temporary condemnations 35. There were no conversions. Four boilers were transferred beyond the jurisdiction of the Act, and one was reinstated.

The total number of machinery groups registered was 10,753 against 10,076 for previous year, showing an increase of 677.

Inspections made total 7,830, and 3,610 certificates were granted.

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

Winding Competency (including certificates issued under Regulation 40 and Section 60)	19
First Class Competency (including certificates issued under Regulations 40 and 45, and Sections 60 and 63)	29
Second Class Competency (including certificates issued under Regulation 40 and Section 60)	31
Third Class Competency (including certificates issued under Regulation 45 and Section 63)	30
Locomotive Competency	16
Traction Competency	—
Internal Combustion Competency	67
Crane and Hoist Competency	9
Boiler Attendants' Competency	143
Interim	6
Copies	8
Transfers	6
	364

The total revenue from all sources during the year was £6,766 13s. 8d. as against £6,125 8s. 1d. for the previous year, showing an increase of £641 5s. 7d.

The total expenditure for the year was £4,855 4s. 4d. as against £5,120 2s. 10d. for the previous year, showing a decrease of £264 18s. 6d.

PART VIII.—SCHOOL OF MINES.

In this, the 31st year of the School's existence, there was an increase in the number of enrolments on the previous year. Although, as usual, there was a falling off as the year progressed this was to some extent compensated for by the enrolment of new students during the second and third terms. The attendances at classes have been very satisfactory. Consequent on the rapid revival in gold mining there has been a great demand for qualified men to fill technical positions on many of the mines being opened up.

Several of these positions have been filled by ex-students from the School and in every instance they have given satisfaction.

In the Metallurgical Laboratory thirty-nine (39) investigations, the majority in connection with the cyanidation of old residues from mines in all parts of the State, were completed. The demand for work of this kind is increasing, and it is gratifying to note that the Commonwealth Council for Scientific and Industrial Research is assisting by making an annual grant to the laboratory.

The number of assays and chemical determinations in the Metallurgical Laboratory was:—Assays for gold, 1,165; Chemical determinations, 850; a total of 2,015.

The assistance offered to prospectors by the School has again been largely availed of, and during the year the number of free assays and determinations has been:—

Assays for gold	1,682
Assays for other metals, etc.	23
Mineral determinations	200
Total	1,905

In addition, a great deal of assistance and advice has been given to prospectors in all parts of the State, comprising geological, mining, and metallurgical advice, and every effort has been made to help prospectors, battery owners, and cyanide operators in carrying out their operations efficiently and economically.

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, 30th March, 1935.

DIVISION II.

Report of the State Mining Engineer for the Year 1934.

The Under Secretary for Mines.

Sir,

I have the honour to submit for the information of the Hon. Minister for Mines my report on the operations of this Branch of the Mines Department for the year 1934.

STAFF.

An unusually large number of staff changes occurred during the year under review.

State Mining Engineer.—It is with deep regret that I have to record the death of Mr. Alexander Maxwell Howe on the 14th August. He had a fine record of service and was held in high esteem both within and without the Department. He joined the State Service as a State Battery Manager in 1905 and was appointed Inspector of State Batteries in 1906. Six years later he was promoted to Superintendent of State Batteries. In July, 1928, he was made Superintendent of State Batteries and Chief Inspector of Machinery, and a few months later, on the retirement of the late Mr. Alexander Montgomery from the position of State Mining Engineer, Mr. Howe was promoted to that office, and held it until September, 1933, when an illness from which he never recovered compelled him to relinquish his work.

I returned to duty on 1st March, after a term of three years on loan to the Broken Hill Proprietary Company, as acting State Mining Engineer, and I was subsequently appointed to that position as from 1st November.

District Inspectors of Mines.—Mr. W. Phoenix was appointed Senior Inspector of Mines for the State as from 26th October, his former title being Senior Inspector of Mines for the Kalgoorlie District.

Mr. E. E. Brisbane was appointed a special Inspector of Mines as from the 14th September, having previously held the position of Ventilation Officer.

Mr. L. P. J. Gibbons, District Inspector of Mines, resigned from the Department on 9th June to accept a position outside the Service.

Mr. J. H. Verran was appointed in Mr. Gibbons' place on the 1st January and Mr. J. S. Foxall was appointed as an additional District Inspector at Kalgoorlie as from the same date.

Mr. H. P. Rockett was granted long service leave in November and will resume duty on 7th June, 1935.

Workmen's Inspector of Mines.—It is with regret that I have to report the death of Mr. L. C. Darcey who had held the position of Workmen's Inspector of Mines continuously and satisfactorily since the first election in the Kalgoorlie District in 1916. He died rather suddenly in October, and at the end of the year, his position had not been filled.

Mr. Leahy was appointed as an additional Workmen's Inspector at Kalgoorlie on 25th July.

Mr. R. P. McMennemin was re-elected a Workmen's Inspector of Mines at Wiluna for a further period of two years as from 1st July.

Mr. J. H. Close was appointed a half-time Workmen's Inspector of Mines at Collie on 20th December.

ACCIDENTS.

During 1934, 33 fatal and 930 serious mining accidents were reported to this office (including 3 fatal and 2 serious accidents at a quarry), compared with 22 fatal and 546 serious accidents during 1933. These figures show an increase of 11 fatal and 384 serious accidents.

Table 11, showing the 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:—

	1930.	1931.	1932.	1933.	1934.
Fatal accidents to men engaged in mining	14	17	17	22	30
Total number of men engaged in mining (average)	5,442	7,147	8,695	10,690	13,310
Accident death rate per 1,000 men	2·57	2·38	1·96	2·06	2·25
Fatal Accidents at Quarries	...	...	1	...	3

Fatal Accidents at Gold Mines—30.

FATAL ACCIDENTS.

Brief particulars of each fatal accident which occurred during the year are given hereunder:—

Explosives.

Two men were killed and one seriously injured when a misshole containing an unexploded charge of fracture was bored into. The men on the previous shift had reported that a charge had failed to fire and the men going on shift were warned. A verdict of accidental death was returned by the jury, who added a rider that "in the event of a misshole being reported, more care should be taken before men are allowed to bore again on the face of the misshole."

A premature explosion caused the death of a miner who was firing out a face. No explanation was forthcoming at the inquiry to prove the cause of the explosion, and a verdict of accidental death was returned by the jury.

In another case a miner was taking some packets of fracture and the necessary capped rods of fuse into the face of the level, and when about 100 yards from the face the fracture exploded. He was killed instantly and his mate who was apparently waiting near the face, died from asphyxiation. At the inquest there was insufficient evidence to determine the cause of the explosion, and the jury brought in a verdict of accidental death.

Drilling into unexploded fracture in the butt of an old hole caused the death of an experienced miner. Evidence at the inquest showed that the explosion was a minor one, and that only part of the original charge could have been left unexploded when firing out.

At a quarry in the Swan Mining District, three men lost their lives and two were seriously injured through the premature explosion of a blasting charge. There was insufficient evidence at the inquest to show what caused the premature explosion.

In every case where accidents occurred from explosions, searching investigations were made by the Inspector of Mines and Chief Inspector of Explosives. No fault could be found with material supplied, and at the same time no faults could be found with the men handling it.

Falls.

A miner was shovelling mullock from under a winze when a quantity of ground fell from higher up in the winze, and deceased was struck on the head by a small piece of rock. This hidden danger could not have been foreseen.

Another fatality occurred while precautions were being taken to make the working place safe. Deceased was barring down a small piece of loose ground, which had been left when portion of the hanging-wall fell. Apparently the ground was treacherous and more of it came away than was anticipated. In falling he caught his head against a sharp piece of stone and died immediately. The Inspector of Mines requested that the place be secured with timber.

While working a prospecting area, a prospector was killed by a fall of rock in a drive at the 35ft. level. Verdict of accidental death was returned by the jury who added a rider: "We consider, after having seen the drive in question, that it was unsafe ground for inexperienced miners to work in."

Two men had finished boring out and were climbing up the stope when they were caught by a fall of rock, one man being killed instantly and his mate had one leg broken. The ground had been examined by them earlier in the shift when some loose and fine particles of ground had fallen. They decided it was safe and continued boring.

A machine miner came to his death by a fall of rock after he had fired out a face. The Inspector of Mines agreed with the verdict of accidental death returned by the jury.

An experienced miner was killed while attempting to make the working place safe. He had some difficulty in barring down a key piece which apparently was holding the larger piece. He moved to bar the ground from another point, when it fell and caught him.

Shafts.

One man was fatally injured through travelling in a cage in which steel was being carried, contrary to the Mines Regulation Act. The accident was brought about by some of the steel becoming dislodged and striking the wall plates of the shaft. The jury returned a verdict of accidental death, with a rider that "more attention should be given to carrying out regulations that men should not ride in the cage with tools or other materials being raised or lowered." The skipman and the other workman who was in the cage were prosecuted, and fines were inflicted in both cases.

The reconditioning of a shaft necessitated the removal of ladders from the east wall to the north wall. A fitter who was descending the shaft appears to have stepped across from the new ladderway to the top ladder of the old ladderway, which was not secured at the top and against which he had been warned. It came away and he was thrown down the shaft.

Two men were working 70 feet from the bottom of a shaft where pumps were being installed when an electric shock was received by one of the men while standing on the kibble and he fell to the well at the bottom of the shaft. Thorough investigations were made by the Chief Testing Officer of the Electricity Supply, Perth, and no evidence could be found to account for the current getting into the shaft. A verdict of accidental death due to drowning after receiving an electric shock from an unknown source was returned by the jury.

A miner lost his life through falling down a main shaft from 1,300ft. to 2,200ft. level. There was no evidence to prove how the accident happened. The gates were in order and the plat well lighted by electric light.

Men were being lowered and when the skip reached the 27 level one of the men did not wait for it to come to rest completely, with the result that he was caught between the skip and the plat timber. He received head injuries from which he died a week later.

Miscellaneous Underground.

A slight accident caused the death of another miner. He slipped while descending a pass and injured his knee. He died four months later from toxaemia as a result of the accident.

Two men lost their lives through breathing poisonous gases formed during the firing out of north and south drives at the bottom of a winze. The compressed air had been turned off at the level above. Without turning on the air, one of the deceased miners decided to go down the winze; his mate went to his assistance and both were overcome. The jury returned a verdict of accidental death, but added the following rider:—"We are of opinion that suitable appliances should be on hand on each level for rescue work in similar cases." The jury asked that the names of three of the men (including one of the deceased) be forwarded to the proper authorities for the bravery shown by these men.

While working in a winze two men were caught by a run of sand, about two tons, and one man was suffocated before assistance could reach him. There was no suggestion of carelessness.

An accident occurred to a miner who was boring off a staging when it collapsed and he received head injuries from which he died later. He was extremely unfortunate as the staging had been well rigged, and was only five feet above the floor of the level.

One minor was working in a winze when he had a fit, and the injuries and shock he received in falling contributed to his death. The jury returned a verdict of accidental death, and added a rider to the effect "that a rope be provided in developing the early stages of winze sinking."

In another instance a miner was accidentally struck on the head by a falling pass log. The logs were being passed down through the winze into the stope. The place was well lit and only a few feet below the level.

Another man who was employed trucking sand was found dead at the bottom of a sand pass. He was probably carried into the pass by running sand and smothered.

Surface.

A braceman pulled a full truck out of the cage and then proceeded to put an empty one in its place. While doing so, the full truck moved away, and gathering speed, ran over the end of the rails, cleared the bin, and dropped 30 feet, emptying its contents on the deceased who happened to be where it fell. Precautions against the possibility of a repetition of this type of accident have been taken.

A man was killed as a result of an explosion of a drum which originally contained cresylic acid and had subsequently contained sulphuric acid. The evidence showed that a little sulphuric acid was left in the drum which, by interaction with the iron of the drum, produced hydrogen gas. This gas, when mixed with the correct proportion of air, forms an explosive mixture. Not realising any danger, the oxywelder applied the oxywelding flame to the drum which made a hole in it and caused the explosion.

An unfortunate accident occurred in a crimping shed, to an employee whose duty it was to cut fuses into lengths and crimp a detonator on one end of each. He also, from time to time, had to test the burning rate of the fuse he was using. On this occasion, he appears to have lit up the fuse in the crimping shed where he had a number of detonators, and in some way they exploded. While it is not possible to say exactly what did happen, it seems probable that the unfortunate accident can be attributed to his having had a naked light in the crimping shed. The jury returned a verdict of accidental death, and added a rider "commending the action of two employees in entering the building to remove the deceased while detonators were exploding."

A surface worker who was scraping mud from the conveyor pulley wheel had his hand and arm caught between the belt and the wheel, and was dragged in, receiving injuries to his shoulder and forearm. Gangrene set in and he died three days later.

A manager of a retreatment plant was found dead on the floor of the precipitation room. He had apparently fallen from the platform 12 feet above on to the concrete floor. A verdict of accidental death was returned by the jury who added a rider that "the platform should be guarded by a rail." This was immediately placed in position.

In all the above accidents, a thorough investigation was made by the Inspectors of Mines to ascertain the cause of the accidents and to see if the Mines Regulation Act was infringed in any way.

In the case of seven of the accidents, the jury added riders to their verdicts, which are given above. In the case of the remaining accidents the verdict was that of accidental death, with no blame attachable to any person.

In one instance only was there any infringement of the Mines Regulation Act and, as already mentioned in this instance, a skipman and another workman were both prosecuted and fined.

The following table shows all the fatal and serious accidents reported to this office during 1934, and are classified according to the gold or mineral field in which they occurred. The causes of the accidents are also shown:—

	Explosives.		Falls of Ground.		In Shafts.		Miscellaneous Underground.		Surface.		Total.	
	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.	Fatal.	Serious.
1. East Coolgardie	3	6	2	6	3	13	3	361	2	91	13	477
2. Mt. Margaret	1	...	...	3	1	1	4	36	...	12	6	52
3. Coolgardie	...	...	...	...	...	1	...	...	...	1	...	2
4. North Coolgardie	...	1	...	...	...	...	...	...	...	...	...	1
5. North-East Coolgardie ...	...	...	...	...	...	1	...	...	...	...	...	1
6. Broad Arrow	...	...	...	1	...	...	...	...	...	...	...	1
7. Dundas	...	2	...	...	...	1	...	...	...	...	...	3
8. Yilgarn	...	...	...	...	...	...	...	...	...	1	...	1
9. Murchison	2	4	2	1	...	1	...	12	1	7	5	25
10. East Murchison	...	...	1	5	1	7	1	93	2	23	5	128
11. Peak Hill	...	...	...	...	...	...	...	...	...	...	...	...
12. Yalgoo	...	1	...	...	...	...	...	...	...	...	...	1
13. Northampton	...	...	...	...	...	...	...	...	...	...	...	...
14. Greenbushes	...	...	...	...	...	...	...	...	...	...	...	...
15. Swan	*3	*2	...	...	...	...	...	...	...	...	3	2
16. Phillips River	...	...	1	...	...	...	...	...	...	...	1	...
17. Collie	...	...	...	49	...	...	...	154	...	33	...	236
18. Pilbara	...	...	...	...	...	...	...	...	...	...	...	...
19. West Pilbara	...	...	...	...	...	...	...	...	...	...	...	...
20. Ashburton	...	...	...	...	...	...	...	...	...	...	...	...
Totals for 1934	9	16	6	65	5	25	8	656	5	168	33	930
Totals for 1933	11	12	2	51	2	4	7	366	...	113	22	546

* These accidents occurred at a stone quarry.

SERIOUS ACCIDENTS.

The number of serious accidents was high last year as compared with 1933, even after making allowance for the increased number of men employed, and for the fact that many accidents classed as serious are of the nature of septic cuts, salt water boils, bruises, etc., a serious accident being one which keeps a worker away from his work for a period of a fortnight or more.

The introduction into the industry of a large number of inexperienced men has no doubt been to some extent a contributory cause, as a great many accidents would have been prevented had the injured men themselves used a little more care and forethought.

Every endeavour was made by the officers of the Department to prevent miners taking unnecessary risks and to see that the provisions of the Mines Regulation Act, framed to prevent accidents, were strictly enforced.

The Inspection branch was certainly understaffed for a period of the year and some difficulty was experienced in obtaining suitable additional inspectors.

WINDING MACHINERY ACCIDENTS.

During the year, fourteen accidents were reported in connection with winding machinery; comprising eight overwinds, five miscellaneous accidents and one skip derailment.

Overwinding.—The overwinds were all of a minor nature; no damage of any consequence occurred, and they were fully investigated by the Engine Drivers' Board.

Skip derailment.—Only one minor accident was recorded. A rock lodging on the track against the shaft centre seems to have been the cause of the skip leaving the rails. No damage was done to the shaft timbers or the road.

Miscellaneous.—A cage was caught in the shaft above the plat. When trying to get the cage clear, one of the main links broke. The safety grippers acted promptly.

In another instance a crank shaft on the winding winch fractured.

While lifting cage off the chair at top brace, the throttle handle became detached from the throttle valve. The cage went to the thimble, rivet sheared, and safety grippers came into action.

The fracture of a safety hook caused a skip to fall to the bottom of the shaft.

A flange of a pit-head pulley, which had become weakened with wear, fractured. No damage was done to the rope.

ADMINISTRATION.

Amendments of Acts.

Mines Regulation Act, 1906.—Regulation 15, Part 2, Clauses 2 and 3; amendments of districts and centres assigned to Workmen's Inspectors of Mines. (Gazetted 2nd March and 11th May, 1934.)

Regulation 6 (d).—Amendment of third paragraph, also Forms G. and H. in appendix thereto, relating to permission of diseased persons to work underground at specified mines. (Gazetted 24th August, 1934.)

Regulation 15, Part 1.—Amendment of districts and headquarters assigned to various Inspectors of Mines; also the appointment of one Senior Inspector, one Special Inspector (Ventilation), and one Special Inspector (Electricity) for the whole State. (Gazetted 26th October, 1934.)

Regulation 4, General Rule 1, Paragraphs (b) and (c), also General Rules 46, 47, and 48.—Amendment by omitting the words "District" and inserting the word "Senior" wherever they occur throughout the reading of such General Rules. (Gazetted 26th October, 1934.)

Proclamation declaring an area of land as described in Schedule to be known as the West Pilbara Mining District, within the meaning of the Mines Regulation Act, 1906. (Gazetted 26th October, 1934.)

Regulations under the Mines Regulation Act, 1906, reprinted with amendments in lieu of the regulations heretofore in force. (Gazetted 16th November, 1934.)

Coal Mines Regulation Act, 1902-1926.—Amendment of Regulation 9, Clause (e), Subclause (1) under Part 1, relating to Accident Relief Fund. (Gazetted 23rd February, 1934.)

Prosecutions.

During the year nine prosecutions were instituted, and in each case a conviction was obtained.

In seven cases managers were prosecuted for breaches of Regulation (6) (h) of "The Mines Regulation Act, 1906," for having employed persons with expired interim health certificates. In each case a fine of 10s. was imposed with 3s. costs.

In the other two cases, one man pleaded guilty to a charge of riding in a cage carrying steel, contrary to Section 32, Subsection 21, Mines Regulation Act, 1906, and was fined £1, with 3s. costs, and the skipman was charged with allowing men to travel in a cage carrying steel, contrary to Section 57 of "The Mines Regulation Act, 1906," and a fine of £2, with 3s. costs, was imposed.

Exemptions.

Forty-five certificates were issued in accordance with the provisions of Section 31 (4) for exemption from the provisions of Section 31, Subsection 1 (b) of "The Mines Regulation Act, 1906."

Sunday Labour.

Three permits to employ men on Sundays were granted during the year.

On one occasion permission was given to a company to employ 18 men on Sundays, for a period of five months, on shaft sinking and development work. After rigid inquiry into the application, Sunday labour was found necessary to avoid subsequent loss of employment to a large number of employees.

Sunday labour was permitted on another occasion where a serious breakdown had occurred to the surface plant, and it was necessary to employ 20 men on haulage of ore for one Sunday to prevent loss of time in the working of the mine.

A third permit was granted, as Sunday labour was necessary for shaft sinking against a heavy inflow of water.

LOANS AND SUBSIDIES.

The following monetary assistance was given to the mining industry:—

	£	s.	d.
Advances towards development work and equipment of mines	0	7	3
Providing transport and general assistance to prospectors	36,162	0	2
Cartage subsidies—Paid to prospectors on ore treated at State Batteries ..	15,417	6	7
Subsidies paid to privately-owned batteries	368	10	0
Miscellaneous expenditure	1,359	4	11
	£53,307	8	11

The total expenditure was £53,307 8s. 11d., compared with £50,807 6s. 4d. during 1933, and £24,089 10s. 8d. during 1932. (Appendix No. 1.)

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

GOLD MINING.

The gold mining industry has continued to make a wonderful recovery. Gold reached a new high price record, averaging 170.7s. per ounce in Australian currency.

In consequence low grade ores have continued to be profitably mined and it is pleasing to be again able to record a substantial increase in the tonnage of the ore treated and in the amount of gold won each year since 1929.

The actual figures since 1929 are as follows:—

Year.	Ore Treated.	Total Gold Yield.	Value of Gold Yield Australian Currency.	Average Value per ton.		Value of Gold per oz. Australian Currency.
				Dwts.	Shillings. Australian Currency.	
	Tons.	Fine ozs.	£			Shillings.
1929	628,400	377,176	1,602,142	11·84	51·0	85·0
1930	645,344	419,767	1,864,442	13·00	57·8	89·3
1931	982,163	518,045	2,998,137	10·55	61·1	117·4
1932	1,327,021	599,421	4,403,642	9·03	66·4	145·4
1933	1,588,979	636,928	4,886,254	8·01	61·5	153·4
1934	1,772,353	639,871	5,558,873	7·22	62·7	170·7

An analysis of these remarkable figures shows that gold began to increase in value in 1930 and has continued to do so each year since. The ore treated has increased from 628,400 tons in 1929 to 1,772,353 tons in 1934. The gold won in 1929 had a value of £1,602,142, and in 1934 had risen to £5,558,873 in Australian currency.

The grade of the ore measured in dwts. per ton has dropped steadily from 13.00 dwts. in 1930 to 7.22 dwts. in 1934, but if measured in shillings (Australian currency) the value during the same period has actually increased from 57.8s. to 62.7s. per ton.

The importance of the gold mining industry to the State may be gauged from the following figures:—

Gold exported	£5,731,902
Wool exported	£3,060,556
Wheat exported	£3,951,858

As is usual the gold won during the year does not coincide exactly with that exported during the same period, but this comparison with the industries which have been the mainstay of the State is very illuminating. The flourishing state of the industry is reflected in the improved condition of the mines, both on the surface and underground, and in the introduction of modern machinery and appliances.

Dust and Ventilation.—The ventilation question has received close attention with a view to eliminating dust as far as possible and keeping down temperatures. On the whole, temperatures have been reasonably low, but there are still a few places in the deeper portions of the mines where a greater volume of air is desirable. The completion of the Chaffers Shaft has improved the ventilation of the lower workings.

We are encouraging the installation of large fans to ensure an adequate supply of air which can be directed to all working places.

At the Wiluna Gold Mine the collapse of some stopes interfered with the ventilation system, and made conditions unsatisfactory during the early part of the year. A double inlet fan, having a capacity of 100,000 cubic feet per minute, has since been installed on the East lode, while the ventilation of the west lode is controlled by a fan with a capacity of 40,000 cubic feet per minute. The work of securing a permanent return airway is nearly completed.

A dust survey will shortly be made to ascertain the reduction in dust quantities effected by the increased volume of air.

The Moonlight Gold Mine, at Wiluna, has also installed an exhaust fan to improve ventilation until such time as a connection is made to the surface from one of the levels.

Our Senior Inspector of Mines is to be commended for his efforts in the Press and elsewhere to educate all concerned to a proper realisation of the fact that the health of all underground workers is involved in the proper ventilation of the mines. The miners have been slow to realise this and are still inclined to be careless of their own health in this regard, and the managements do not all attach sufficient importance and give sufficient thought to this most important question.

THE MINES.

Brief details of the operations of some of the more important gold mines in the State are given hereunder under the headings of the Goldfields in which they occur.

East Coolgardie Goldfield.

This goldfield includes Kalgoorlie, our principal gold mining centre. All the producing mines operated continuously and for the most part increased their outputs. There was also a notable increase in the development work effected.

Practically all the old mines at Kalgoorlie have been taken up. Many of these are being prospected by strong financial companies with some very satisfactory results.

The remarkable increase in the development footages generally, and in diamond drilling in particular, effected at the principal mines will be noted from the following figures:—

Year.	Shaft Sinking.	Driving.	Crosscutting.	Rising and Winzing.	Diamond Drilling.	Totals.
						feet.
1932	...	18,948	6,984	7,472	10,316	43,720
1933	...	26,671	18,868½	9,367	15,568½	70,897
1934	589	32,533	13,448	13,687	48,480	108,737

The Great Boulder Proprietary G.M., Ltd.—This Company's mine has developed very satisfactorily during the year. Special attention has been given to the "B" and "X" lodes which have been opened up from Hamilton Shaft at the No. 16, No. 18 and No. 19 Levels. Eventually, these levels will also be connected with the main shaft, thus improving both transport and ventilation.

At Lane and Edward's shafts a considerable tonnage of ore has been won above the No. 12 level. Conroy's and Borg's lodes are being developed at the No. 5, No. 7, and No. 9 levels and are providing quite large tonnages of ore.

The new treatment plant has been completed and put into commission. The work in this plant is of a high standard. Electric power is used throughout, derived from the Power Corporation.

The Lake View and Star, Limited.—This company during the year acquired the Australia mine, which is developing satisfactorily. Air is now obtained from the company's main air line, and modern rock drills have been introduced. The ore from the main ore bins is conveyed by a belt to a new bin and trammed to the Chaffers mill.

At the Lake View section the mining and development of the lode near the western boundary was continued.

At the Chaffers section the workings are in good order and well ventilated. The main shaft was sunk and a plat cut at the No. 34 level. At this level 700 feet of driving north and south were carried out and four connections made with winzes from the No. 33 level. Stoping south of the crosscut is proceeding at various levels. The No. 12 level has been driven under the "Star" workings and ore is being drawn off from the filled stopes.

In the Star section development in a southerly direction has given promising results. Ventilation is also good, the Star shaft being a downcast one.

At the Horseshoe No. 2 shaft, the No. 2 lode is being opened up with satisfactory results. The old main Horseshoe shaft will be equipped with an exhaust fan to improve ventilation.

The Ivanhoe section still supplies a large proportion of the ore won and the underground conditions are satisfactory.

On the surface, additions and improvements are constantly being made to the treatment plant and to the power plant. A new smoke stack with dust collector has been added to the roasters. A new compressing unit is under construction and the foundation laid for another generator. A new slimes treatment plant is being erected to re-treat an old residue dump.

The South Kalgurli Consolidated, Limited.—This company had a good year. Most of the work was done on the Lake View lode between the No. 12 and No. 16 levels. At Mortys shaft, the Perseverance lode was developed at the No. 12 and No. 14 levels, and the "X" lode was satisfactorily developed at the No. 8 and No. 12 levels. The Croesus Proprietary property was worked continuously, development work proceeding below the No. 10 level. The company also carried out diamond drilling operations on some outside properties.

The Boulder Perseverance, Ltd.—This company's plant ran continuously during the year. A second unit of the treatment plant was completed and has been put into commission. Development work generally has given satisfactory results. At the No. 19 level a crosscut is being put out to intersect the downward continuation of the lodes near the Australia boundary.

North Kalgurli (1912), *Ltd.*—This company now sends 5,000 tons monthly to the Perseverance treatment plant. At the North Kalgurli lease developments generally were satisfactory and the 960ft. level is opening up well.

At the Union Jack lease, development work is proceeding at the No. 3 and No. 4 levels and good values have been met with in and adjacent to the calc schist country rock. This company is now also working the old Kalgurli mine. The main shaft has been reconditioned to the 1,350ft. level. The lode at the 1,250ft. and 1,350ft. levels is in calc schist country but is nevertheless reported to be of good width and value.

Paringa Mining and Exploration Company, Ltd.—This company carried out extensive diamond drilling from the surface with very good results. The plant at the south shaft was reconditioned and unwatered to the 920ft. level. At the 400ft. level, a connection was made to the north shaft drive. The 800ft. level is reconditioned and ready to work. The north shaft was equipped with head gear, boiler, and winder and an air compressor. The shaft has been unwatered and the levels reconditioned. It is now proposed to sink this shaft a further 300 feet.

The North Kalgurli United Mines, Limited.—This company has tested the ore body at a depth of 900 feet by a series of bore holes. The old mine has been unwatered and the shaft reconditioned to a depth of 412 feet. The necessary survey is in progress to connect these workings with those of the North Kalgurli (1912), Ltd.

The North Kalgurli Central Gold, N.L.—This company has equipped their shaft with a head gear and has installed winding and compressing plants. Diamond drilling to the extent of 1,615 feet was carried out, and in addition 1,349 feet of development. The results are said to have been encouraging.

The B.A. & N.Z. Mines, Ltd.—This company has operated at the lower end of the Adeline Lead with favourable prospects. They also unwatered and reconditioned a portion of the Oratava Shaft.

The Broken Hill Proprietary.—This company's plant at Hannans North Gold Mine ran continuously and profitably during the year. The main shaft was sunk a further 195 feet and the 800ft. level is now being driven. At the Enterprise Leases, development was proceeded with mostly at the 1,500ft. level where driving, crosscutting, and diamond drilling were carried out.

Hampton Plains Mines.—

At Hampton Plains, the Celebration Mine is being unwatered and is to be floated into a strong company.

The Pernatty Mine is being reconditioned and developed.

The White Hope Mine is now held by a strong company and is being thoroughly tested prior to the erection of a treatment plant.

At the Golden Hope Gold Mine, Hunt Bros. continued to operate their mill and treated a quantity of ore from the Celebration Mine, prior to the sale of the latter mine to the Australian Mining Trust.

The Mount Martin Gold Mine has been acquired by a company. A ten-head battery has been erected and put into operation.

Mount Margaret Goldfield.

Sons of Gwalia, Limited.—This company operated continuously and had a very satisfactory year.

The No. 27 level is now being opened up with satisfactory result. Winzes below this level will now be started and a new ventilating fan is to be installed. Lateral development also opened up additional ore supplies.

Shaft sinking below the No. 27 level is in progress. The shaft is now approaching a depth beyond which single stage winding on the underlie will not be effective.

Extensive alterations are being made to the treatment plant including the introduction of new grinding units, drag classifiers, and corduroy strakes.

The Lancefield (W.A.) Gold Mines, N.L.—This company has unwatered the mine. The workings were found to be in good condition. The treatment plant designed for tonnage of 12,000 tons per month is nearly completed. The flotation method of concentration will be employed. It is estimated that the concentrated sand will be 25 per cent. of the original tonnage.

North Coolgardie Goldfield.

Practically all the old mines have been taken up again. The ore won in the past from this goldfield has averaged 15.2 dwts. per ton, but the Menzies Consolidated is the only mine which reached 1,000ft. in depth. The country rock is hard and faults and slides are common, which make it difficult to follow and work the reefs.

Lady Shenton Gold Mines (1934), *Ltd.*—This company was floated and took up the old Lady Shenton Mine. The Alpha Shaft was unwatered. The reef thrown east by a fault has been driven on from a winze below the 400ft. level. It is proposed to equip Ray Shaft which has a depth of 630 feet.

The Sand Queen-Gladsome Mines, Ltd.—Preparations are in hand for the unwatering of this mine by means of a Pomona pump.

Dundas Goldfield.

The Norseman Gold Mines, N.L., has increased its output during the year, and has opened up the ore body with encouraging results by shaft sinking and driving.

The Phoenix Gold Mines, Ltd. (old Mararoa G.M.), is being developed by the Western Mining Corporation. At the lower levels payable lenses of ore have been met with.

Yilgarn Goldfield.

The Southern Cross United Mines, Ltd.—This company is re-opening the old Frasers Gold Mine. The main shaft has been equipped with a set of steel poppet heads, 60 feet in height. Diamond drill bore holes have been put down to intersect the lode at depths of 300 feet and 500 feet. The projected development programme includes shaft sinking and the opening out of the lode below the old workings.

The ore body in this property has been worked continuously about the 100ft. level for a length of 1,500 feet.

The Marvel Loch Development Company.—This company is opening up a low grade proposition. Nine shafts have been sunk to a depth of 100 feet and winzes have been sunk below this level to a further depth of 65 feet.

The ore body averaging between 4 and 5 dwts. per ton in value, is said to be payable for a length of 800 feet, and the ore in reserve is estimated to be approximately 50,000 tons.

At present the ore is soft, and a treatment plant capable of treating 6,000 tons per month is under consideration.

The Yellowdine Gold Development, Ltd.—This company is developing the most important find made during the year. On the southern leases (Whinfield's Leases) two strong parallel ore bodies running approximately north and south have been proved to be of exceptionally high grade for very considerable lengths. Further north on Egan's Lease, another strong ore body, high grade at the south end, but poorer further north, is also being developed.

A number of bore holes have been put down, giving rather unexpected results, thus giving rise to much conjecture regarding the exact nature of the deposit.

The development of this property is being watched with the greatest interest both in this State and in London.

East Murchison Goldfield.

The Wiluna Gold Mines, Limited.—The Wiluna Gold Mine had a very good year, maintaining a steady output of an average of 41,403 tons per month. Early in the year two eight cylinder 800 h.p. Premier engines were put into commission, and two more are in the course of erection.

The main shaft is approaching 1,300ft. and the ore pockets and loading station at the 1,200ft. level are being cut. The Bulletin shaft is down to about 200 feet. The single and two bench systems of stoping are still used almost exclusively.

The Moonlight Wiluna Gold Mine, Ltd.—At this mine the main shaft was sunk to 300ft. and about 1,000ft. of driving completed. The shaft is equipped with an electric winder. The air compressor is also electrically driven, the power being supplied by the Wiluna Gold Mines.

Youanmi Gold Mines.—An extensive and satisfactory diamond drilling campaign was carried out on this mine and it is now proposed to float a strong company in London to reopen this mine.

Murchison Goldfield.

The Triton Gold Mine, N.L.—Development work on this mine has proceeded rapidly. Two shafts, 1,200 feet apart and formerly 140 feet in depth, were both sunk to 300 feet at which depth they were connected by long drives. In all about 1,800 feet of driving was done at this level. With the information gained a new main shaft, 18ft. by 7ft., was then started about 400 feet North of the North shaft, and sinking is now in progress.

Preparations are now in hand for the erection of a treatment plant having a capacity of about 5,000 tons per month.

The Big Bell Gold Mine.—At this mine an extensive diamond drilling campaign to test this big low-grade ore body has been carried out, and the results obtained are now being checked by driving and crosscutting. Some driving and crosscutting was carried out at the 120ft. level and the shaft will now be sunk to a depth of 250 feet. It is proposed to sample the ore body in sections every 100 feet by crushing the ore won from the various sections of the crosscuts in an automatic sampler and obtaining samples in that way.

The Mount Magnet Gold Mines, Ltd.—This company has sunk the main shaft from 200 feet to over 300 feet. Crosscuts at 200 feet and at 300 feet proved the lode to have a payable width of approximately 20 feet in each instance. The ore body is now being opened up at each of these levels.

A modern treatment plant designed to treat 4,500 tons of ore per month will be completed early in 1935. The power plant is to consist of two six cylinder 267 B.H.P. Ruston Hornsby Diesel engines direct coupled to 217 K.V.A. alternators.

COAL MINING.

Coal mining was again confined to Collie.

Five mines produced coal during the year, viz.:—The Co-operative, Proprietary, Cardiff, Stockton, and Griffin Mines. The output was 500,343 tons, or an increase of 41,944 tons. The average number of men employed was 625, being a decrease of 1.

The serious accidents amounted to 236, as compared with 190 last year. There were no fatal accidents this year and one last year.

No permits for work on Sundays were issued and there were no prosecutions for breaches of the Coal Mines Regulation Act.

Very little development work was carried out during the year. The Griffin Mine was the only producing mine to extend the main dip.

At the Co-operative Mine, two dip headings were started but were not persevered with. These are now being continued and, if successful, will prolong the life of this mine.

It should be mentioned that the Hard Coals Company commenced driving a tunnel to reach the coal at the beginning of September. Having reached the coal and exposed a face of eight feet of coal, a sample of it was taken for a test by the Railway Department. Work was then stopped. Work can be resumed when there is a sale for the coal.

There was no industrial trouble of any consequence, the only stoppage being at the Proprietary Mine which resulted in a general stoppage for a few days on all the mines.

METALS AND MINERALS OTHER THAN GOLD AND COAL.

The production of metals and minerals other than gold and coal was again relatively small, owing to the low prices prevailing.

Arsenic, obtained entirely from the Wiluna Gold Mines as a by-product, was easily the most important of these, the production having a value of £37,705. Reference to Part II., Table 1, shown in Division 1, Report of the Under Secretary for Mines will show that there were also increases in the value of production of gypsum won, also silver, tin and felspar, and that these were the only minerals where production had a value of over £5,000.

GENERAL.

The Commonwealth Government has this year shown an increased interest in the gold mining industry.

At the instance of the Council for Scientific and Industrial Research, the Commonwealth Government agreed to the inclusion of £5,000 on the estimates of the Council to be expended on research work in connection with gold mining.

The Mining Advisory Committee at Melbourne agreed tentatively that the £5,000 available should be allotted as follows:—

Mineralographic work	£1,000
Ore dressing at Melbourne ..	£1,000
Ore dressing at Adelaide	£1,000
Ore dressing at Kalgoorlie ..	£1,000

leaving £1,000 for allocation as experience might suggest.

In order to carry out the scheme, insofar as Western Australia is concerned, a local committee has been appointed consisting of the State Mining Engineer, representing the Mines Department, Mr. C. E. Blackett representing the Chamber of Mines, Mr. F. G. Brindsen, representing the local branch of the Institute of Mining and Metallurgy, and Dr. B. H. Moore, representing the School of Mines.

By the end of the year the preliminary work in connection with the scheme was well in hand.

The record high price of gold gave rise to increased activity in the search for new mines and in the re-opening of old ones.

The outstanding find of the year was that at Yellowdine, now being operated by the Yellowdine Gold Development Company. This find naturally gave an increased incentive to prospectors, especially as it is situated in an easily accessible portion of the State, which must have been quite frequently traversed.

It is pleasing to be able to record the continuance of the remarkable revival in gold mining which began in 1930.

The big companies continue to equip their mines in accordance with most modern practice. Mining towns are being renovated and there is everywhere evidence of increasing prosperity and progress.

RICHARD C. WILSON,
State Mining Engineer.

APPENDIX No. 1.

MINING DEVELOPMENT EXPENDITURE.

	£	s.	d.
Advances outstanding, 31st December, 1934:—			
Advances authorised prior to 1934 ...	238,868	17	2
Advances authorised during 1934 ...	0	7	3
	£238,869	4	5
Principal Moneys advanced:—			
Prior to 1934	215,430	7	1
During 1934	0	7	3
	£215,430	14	4
Principal Moneys repaid (including Sale of Securities):—			
Prior to 1934	49,298	8	3
During 1934	796	6	5
	£50,094	14	8
Bad Debts written back—			
Prior to 1934	42,832	13	3
During 1934	104,775	19	1
	£147,608	12	4

	£	s.	d.
Interest paid prior to 1934	24,792	8	8
Interest paid during 1934	1,301	17	3
	£26,093	5	11
Interest outstanding at 31st December, 1933 ...	18,719	6	8
Interest outstanding at 31st December, 1934 ...	7,564	5	4
Principal Moneys advanced	£215,430	14	4
Less Principal Moneys repaid ... 50,094 14 8			
Bad Debts written off ... 147,608 12 4			
Amounts transferred 26 5 6			
	197,729	12	6
Principal outstanding at 31st December, 1934 ...	17,701	1	10
Interest outstanding at 31st December, 1934 ...	7,564	5	4
	£25,265	7	2

APPENDIX No. 2,

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, 21st June, 1935.

Under Secretary for Mines.

Sir,

We submit herewith, for the information of the Hon. Minister for Mines, the Annual Report of the Board of Examiners for the year 1934.

Examinations for Certificates.

April Examination.—No applications were received for the April examination, and no meeting of the Board was held in that month.

October Examination.—Two candidates submitted themselves for examination in October, one taking the First Class and the other the Second Class examination. At the meeting of the Board on the 29th October, it was decided that the First Class papers warranted a First Class Certificate of Competency being issued to this candidate, but the Second Class candidate failed to obtain the requisite number of marks to enable the Board to grant a certificate.

Copies of the papers set for the First and Second Class examinations are appended to this report. These papers were exchanged with kindred boards in England and the Eastern States.

We have the honour, etc.,

R. C. WILSON,
State Mining Engineer, Chairman.

F. G. FORMAN,
Government Geologist, Member.

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

V. RUSSELL,
Secretary.

The Coal Mines Regulation Act, 1902–1926.

Examination for First Class Certificate of Competency.

Subject: ARITHMETIC.

Wednesday, 10th October, 1934: 9 a.m. to 11 a.m.

Possible Marks.	
17	1. Calculate the quantity of workable coal in an area of 120 acres of coal-bearing land, underlying which is a 7 ft. seam of coal dipping 30 degrees from the horizontal. The specific gravity of the coal is 1·3.
17	2. A water tub or skip 4 feet long, 3 feet wide, and 2 feet deep is filled with water on level ground, and then drawn up an incline which makes an angle of 16 degrees 42 minutes with the horizontal. What fraction of the contents of the tub will overflow ?
17	3. One hundred and ninety miners are employed in a colliery which has worked 9 days for the fortnight ; 20 miners average 8½ tons per day and work 8 days ; 130 miners average 9½ tons per day and work 9 days ; 40 miners average 10 tons and work 8½ days. What is (*a*) the average output per day per miner employed, (*b*) the gross output, and (*c*) the net saleable output, allowing 4½ per cent. for dirt and pit consumption ?
16	4. A wheeler's contract rate was 5 pence per ton for a distance of 240 yards, and 3/16 pence per ton additional for every 40 yards or part thereof over the 240 yards. This was increased by 15 per cent. and later by 7½ per cent. A reduction of 12½ per cent. then followed. What is the present tonnage rate for a distance of 310 yards ?
16	5. A coal washer yields in three classes of washed coal, (*a*) 10½ per cent., (*b*) 54 per cent., and (*c*) 35½ per cent. The selling prices of these are 15s. 6d., 12s. 3d., and 5s. 4d. respectively. What is the average price of the yield per ton ?
17	6. A cutting in stone is 198 feet long ; the sides of the cutting are vertical and the width of the cutting is 10 feet. The depth of the cutting at the commencement is 6 feet, and at the end of the cutting is 20 feet. The contract price is £3 10s. 6d. per lineal foot of the cutting. What is the cost per cubic yard ?
100	

Subject: GEOLOGY.

Wednesday, 10th October, 1934: 11 a.m. to 1 p.m.

Possible Marks.	
20	1. When working a face of coal in a coal mine, what evidences could present themselves which would induce you to anticipate you were approaching a fault (*a*) gradually, or (*b*) quickly ?
20	2. (*a*) How would you recognise a fault ? (*b*) What evidence would you need before you would organise an expensive prospecting campaign to look for a seam which had been faulted ?
20	3. (*a*) What are the recognised causes for faults in a coal mine ? (*b*) Describe, with diagrams (sections in particular), the usually occurring types of faults in the Collie field.
20	4. (*a*) Give a concise description of how partings in coal beds are formed. (*b*) Discuss the evidence for and against the "Migration" theory.
20	5. What do you know of the other coal measures in Australia, particularly as regards (*a*) their age, (*b*) location, (*c*) characteristics of the various Australian coals, (*d*) output, and (*e*) uses to which they are applied ?
100	

Subject: MACHINERY.

Wednesday, 10th October, 1934: 3 p.m. to 5 p.m.

Possible Marks.	
17	1. It has been decided to instal additional electric power plant at a colliery. What investigations would you make to enable you to decide upon the most economical type of plant for the purpose ? Discuss the adaptability of various types of power plant for the purpose, and to suit different conditions.
16	2. A centrifugal or turbine pump direct-coupled to an electric motor is at work underground. Give a list of the auxiliary gear and instruments that may be installed for starting and controlling the motor and pump, and for showing the performance of the plant.
17	3. Contrast compressed air and electricity as powers for use underground. In particular deal with questions of convenience and efficiency. Name types of plants that can be worked by each kind of power better than the other.
16	4. Explain the action of (*a*) the suction pump, (*b*) the force pump, and (*c*) the centrifugal pump.
17	5. Find the size of haulage engines required to drive an endless rope to haul 640 tons of coal in 7 hours up an incline 1 mile long, and rising at a grade of 1 in 6. The steam pressure is 80 lbs. per square inch. Allow 1/40 for friction.
17	6. A main wheeling road to the rise from a district producing 120 tons of coal per shift has become too heavy for horse wheeling. The roadway is 300 yards long, has a single skip track, and is heavily timbered. Electrical power is available, but is 50 chains away. Describe the form of subsidiary haulage you would recommend.
100	

Subject: MINING OF COAL.

Thursday, 11th October, 1934: 10 a.m. to 1 p.m.

Possible Marks.	
25	1. Outline the conditions which should be observed in working a seam of coal liable to spontaneous combustion, with a view to minimising danger should fires occur, and incidentally the prevention of heating.
25	2. A colliery is deriving its full output from pillars. A panel of pillars is standing with practically all the headings and bords heavily fallen. Sketch and describe how you would proceed to open up roadways and extract the pillars which are 10 yds. by 40 yds. The height of the seam is 6 ft. 6 ins.
25	3. The output of a colliery has decreased, for no apparent reason, after a few years of good outputs. There has been no change in the coal mines, and there are ample reserves of coal. Write a report, suggesting the lines of an investigation into the causes of the decrease in output, and possible remedies.
25	4. In a certain mine the seam is 10 ft. thick of clean hard coal, and it dips 1 in 7. All the workings are to the dip. On account of the hardness of the coal it is decided to undercut the bords with machinery. State the type of coal-cutter you would instal, and the reasons for your choice, and give a sketch of a dip section of ten machine bords, showing how you would lay out the section and the necessary haulage roads.
25	5. It is desired to prove the thickness of a seam believed to be about 90 ft. below the seam at present being worked. Give a brief description of the plant required, and the method and procedure you would adopt to put down a bore-hole.
25	6. Make a sectional sketch of a sinking shaft sufficient to illustrate a sinking bucket with guide ropes and rider attached. Explain the use of this apparatus.
25	7. Give a general description, and illustrate with sketches, the lay-out you would adopt for the handling of the skips on the surface for a colliery dealing with 1,000 tons in 7 hours. Show the grades of the roads and radius of curves, with approximate distances.
25	8. The method of working at a colliery is bord and pillar. The thickness of the seam is 10 ft. A split in the seam reduces this to a thickness varying from 4 ft. 6 ins. to 5 ft. Describe the method you would adopt to work this area, making full use of mechanical appliances.
200	

Subject: SURVEYING.

Thursday, 11th October, 1934: 2 p.m. to 4 p.m.

Possible Marks.

30 1. Describe the adjustments of a theodolite, and state briefly for what reason each adjustment is made.

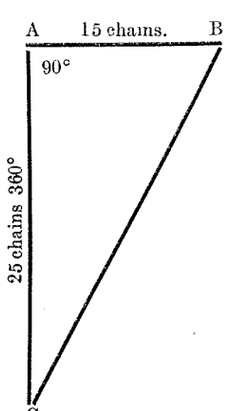
25 2. The table below represents a page from a level book. Complete the table and show how you would check the accuracy of the reduced levels.

Back Sight.	Intermediate Sight.	Fore Sight.	Rise.	Fall.	Reduced Level.	Distance.
13·25	——	——			100·00	0 ch.
——	8·15	——				1 ch.
——	8·40	——				2 ch.
7·20	——	2·10				3 ch.
——	5·15	——				4 ch.
——	6·20	——				5 ch.
——	10·25	——				6 ch.
——	——	14·20				7 ch.

25 3. From the following data of an incomplete traverse find the bearing and length of the closing line F A.

Line.	True Bearing.	Distance.
A B	339° 25′	107·9
B C	46° 17′	146·7
C D	300° 49′	201·9
D E	344° 15′	77·7
E F	228° 34′	273·4

25



4. Three bores, A, B, and C disposed as shown in the diagram cut the same seam of coal at depths of respectively 300 ft., 250 ft., and 225 ft. Calculate the dip and strike of the seam. The bearing CA is 360°.

25 5. Two adjacent straight stretches on a railway survey make an angle with one another of 158°. Explain how you would set out, and show the necessary calculations, for a circular curve of ten chains radius to join the two straights.

20 6. What precautions would you take to ensure accuracy in making a long underground traverse with a miner's dial.

150

Subject: VENTILATION AND DANGEROUS CASES.

Friday, 12th October, 1934: 10 a.m. to 1 p.m.

Possible Marks.	
25	1. It is desired that a ventilation survey of an extensive mine be made. State how you would proceed to do this. What instruments would you use, what observations would be made, and what precautions are necessary to ensure accuracy ?
25	2. A mine fan produces a ventilation current of 100,000 cub. ft. per minute, with a water gauge of 2 ins. Calculate the horse-power of ventilation. Assuming the horse-power of ventilation to be 60 per cent. of the energy imparted to the fan shaft by the driving motor, state what quantity of air you would expect if this imparted energy were doubled, the mine being otherwise unaltered.
25	3. You have made an inspection of a panel of pillars and formed the opinion that it is essential to urgently seal off this area to subdue spontaneous heating which you have detected. There are three openings. Describe the various steps you would take.
25	4. Describe fully the principles of ascensional ventilation, and say why it is advantageous. Make a sketch of several working places, showing how you would apply ascensional ventilation in pillar extraction.
25	5. It is required to pass 30,000 cub. ft. of air per minute into each of three splits, A, B, C, whose sizes are :— A.—2,000 ft. long 7 ft. by 8 ft. B.—2,500 ft. long 7 ft. by 7 ft. C.—3,000 ft. long 6 ft. by 8 ft. Find size of regulators required in A and B.
25	6. Assume a colliery is ventilated by a single current of 40,000 cub. ft. of air per minute, with a water gauge of 3 ins. at the fan drift. It is desired to split this air into three currents. Taking your own example of conditions, give a list of all the appliances and arrangements you consider necessary, and a brief account of the operation. When a change has been accomplished, how would you proceed to ascertain the results ?
25	7. Sketch a water gauge as used in ventilation, and show a definite reading thereon as taken on the intake side of a separation door. Explain fully how you would obtain an accurate reading, and what facts are indicated thereby.
25	8. Ventilate the accompanying plan, having due regard to the haulage of coal.
200	

Subject: COAL MINES REGULATION ACT, 1902-1926.

Friday, 12th October, 1934: 2 p.m. to 4 p.m.

Possible Marks.	
20	1. What are the provisions of the Act regarding the division of the mine into parts ?
20	2. What are the Regulations regarding the employment of persons in charge of machinery, etc. ?
25	3. What are the duties and responsibilities of the manager under this Act ?
20	4. What does the Act require regarding the opening and abandonment of Mines ?
20	5. Section 16 of this Act prohibits the use of single shafts, tunnels, or outlets. What are the exceptions to these ?
20	6. What does the Act require as to the survey and plans of mines ?
25	7. What are the requirements of General Rules 15, 21, and 25 ?
150	

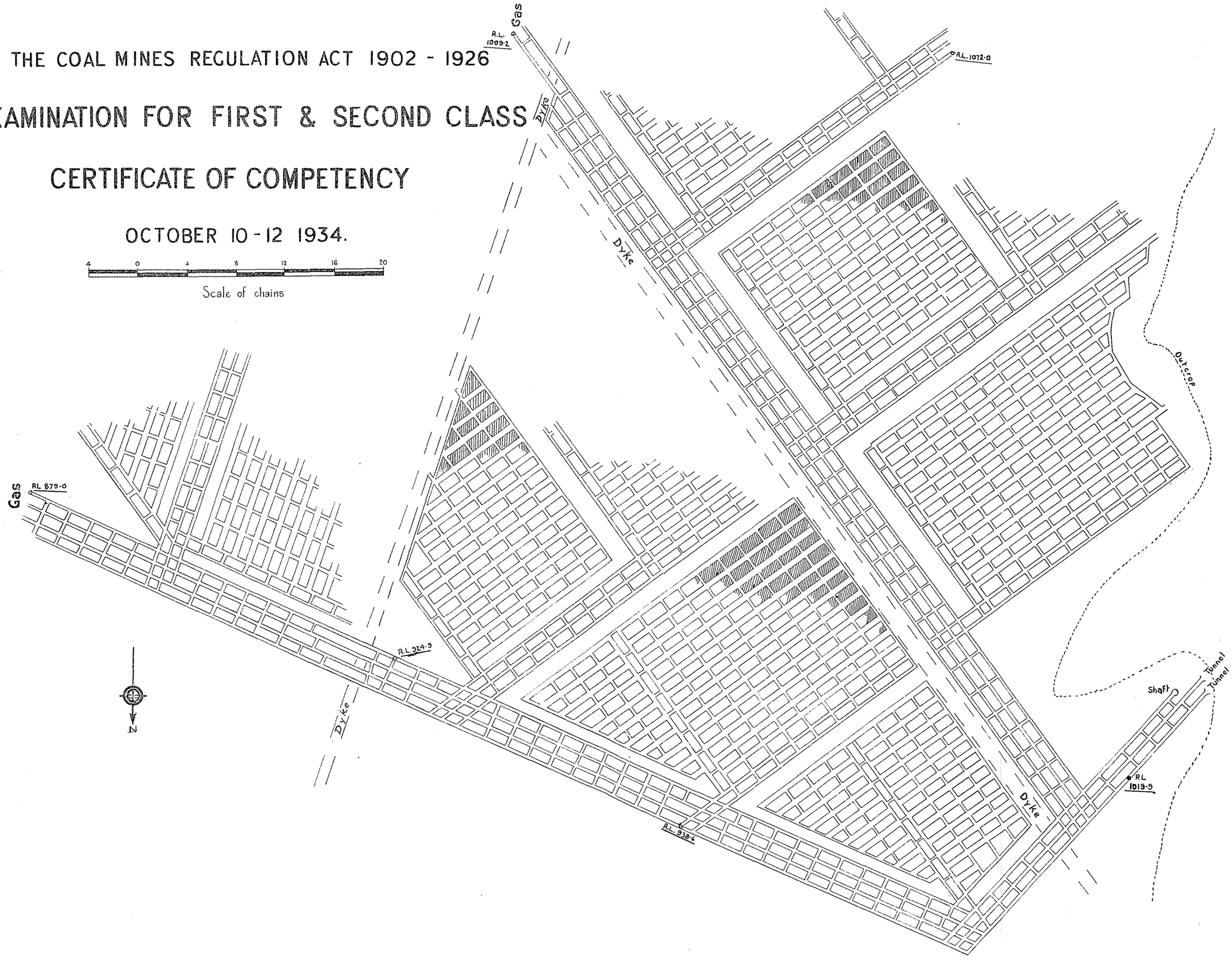
THE COAL MINES REGULATION ACT 1902 - 1926

EXAMINATION FOR FIRST & SECOND CLASS CERTIFICATE OF COMPETENCY

OCTOBER 10 - 12 1934.

4 0 4 8 12 16 20

Scale of chains



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

Subject: ARITHMETIC.

Wednesday, 10th October, 1934: 9 a.m. to 11 a.m.

Possible Marks.	
17	1. A pillar of coal 650 links long and 220 links broad has been worked out. The coal obtained from the pillar weighed 13,040 tons, and its specific gravity was 1·25. Calculate the thickness of the seam.
16	2. Find the cost per ton for brattice cloth in a heading 12 ft. wide and 6 ft. high. Assume (*a*) the price of brattice cloth to be 8¾d. per sq. yd., and (*b*) 18 cwt. of coal to the cub. yd.
16	3. The earth-work in the formation of a circular pond is 523·6 cub. yds. The depth of the excavation is 5 ft. What is the diameter of the excavation ?
17	4. In a 7½ hour shift 16 men strip a machine-cut conveyor face 121 yds. in length, in a coal seam 4 ft. 6 ins. thick with an undercut of 4½ ft. What average weight of coal does each man fill, and what weekly wage does each earn if the filling rate be 1s 9½d. per ton, less 8½ per cent. for explosives ? Assume the specific gravity of the coal to be 1·25.
17	5. Calculate the cubic capacity of a conical sinking bucket 3 ft. 3 ins. diameter at top, 2 ft. 9 ins. diameter at bottom, and 3 ft. 6 ins. deep.
17	6. Two headings 60 yds. apart are driven to meet one another. One heading travels 3 ft. per day, and the other travels 4½ ft. per day. In how many days will they meet, and how many yards will be driven in each ?
100	

Subject: COAL MINES REGULATION ACT, 1902-1926.

Wednesday, 10th October, 1934: 11 a.m. to 1 p.m.

Possible Marks.	
25	1. What conditions must be observed when firing shots on a main haulage roadway ?
25	2. What are the provisions of the Act relating to inspections before commencing work and during shifts ? How are these carried out in practice at any colliery with which you may be acquainted.
25	3. Quote the provisions of the Act with reference to the employment of boys.
25	4. What are the requirements of the Act regarding signalling in mines ?
25	5. Quote the General Rules dealing with the securing of roof and sides, and timbering of working places.
25	6. What does the Act require regarding the inspection of machinery ?
150	

Subject: ROADWAYS.

Wednesday, 10th October, 1934: 3 p.m. to 5 p.m.

Possible Marks.	
25	1. In an endless rope haulage to the rise, trouble is being met with slack rope gathering in front of the full skips. At present there are the usual tension arrangements on the empty rope after it leaves the "C" wheel. How would you overcome the trouble.
25	2. Give your views generally on the method you would adopt for transporting the coal from the face to the mechanical haulage in a seam with a full dip of 1 in 6. Assume "bord and pillar" is the system of work.
25	3. Describe the conditions under which you consider the following systems of haulage advisable :—(*a*) Endless rope, (*b*) Direct haulage, (*c*) Self-acting inclines, (*d*) Main and tail rope.
25	4. In some seams, roads driven into the solid coal stand better than roads formed in long-wall workings, and in other seams, roads formed in long-wall workings stand better than roads driven in the solid coal. Why is this ?
25	5. An old roadway which was driven in solid coal has fallen in closely. It is supposed to lead to workings which contain water, and it is proposed to re-open it. What precautions would you take in so doing ?
25	6. Describe with sketches how you would replace broken timbers in a roadway which is heavily weighted.
150	

Subject: MINING OF COAL.

Thursday, 11th October, 1934: 10 a.m. to 1 p.m.

Possible Marks.	
28	1. A fault is met with in driving a heading dipping 1 in 6, and it is assumed to be a 40 ft downthrow. Describe in detail, with the aid of sketches, how you would prove the coal beyond the fault by means of boring.
29	2. Three development headings are driven to the full dip of the seam, which is 1 in 10. The headings are each making 1,000 gallons of water per hour. Make a sketch showing how you would arrange the working of these headings, dealing with haulage arrangements, water, etc.
28	3. Sketch and describe how you would timber an 8 yd. bord with bad roof to enable a short wall machine to cut the place.
29	4. Under what conditions would you work by the bord and pillar system and the long-wall system respectively ?
28	5. In pillar extraction, when should the timber be drawn, and how far from the "loose end" would you stop ? The immediate roof is 6 ft. of laminated shale, and the cove is 500 ft.
29	6. What are the principal matters to which an under-manager should give his attention on making his ordinary inspection of a district ?
29	7. In starting to drive through a hard dyke you find that the shots blow out the sets of timber in the adjacent coal in the drive, causing falls and consequent risk and delay. The drive is 12 ft. wide. State clearly how you would avoid these occurrences.
200	

Subject: VENTILATION AND DANGEROUS GASES.

Thursday, 11th October, 1934: 2 p.m. to 5 p.m.

Possible Marks:	
25	1. How are the following gases formed in mines:—Carbon-monoxide, carbon-dioxide, and sulphuretted hydrogen. Which of them is most poisonous, and which, if any, is not poisonous? By what means can you detect the presence or absence of each? Give the chemical symbols for each.
25	2. What advantage is gained by splitting air in mines? What rules should be observed, and what method adopted? Give sketches.
25	3. Sketch a ventilating door in a mine roadway, showing details.
25	4. In a seam with a grade of 1 in 5, two headings are being driven to the rise. Sketch and describe how you would ventilate these places, having due regard to face haulage.
25	5. What methods are adopted for measuring the quantity of air passing any given place? State fully the method you would employ, and what precautions you would take so as to reduce the chances of error.
25	6. What is the principle of the water gauge as used in connection with ventilation? Describe its use, and give an illustration of two or three different readings in the same ventilating district, stating what information is conveyed by each of these.
25	7. A fan running at 40 revolutions per minute produces 65,000 cub. ft. of air. What quantity would be produced if the fan speed were increased to 55 revolutions per minute?
25	8. Ventilate the accompanying plan, having due regard to the haulage of coal.
200	

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 at State Batteries for the year 1934.

The total tonnage handled in both sections of our plants was 192,070, made up of 97,454 tons milled and 94,616 tons cyanided. This is an increase for the year of 16,303 tons and the tonnage milled is the highest on record, exceeding the previous highest in 1906 by 1,623 tons.

The following figures show the increased activity in prospecting.

Year.	Tons milled.	
1906	95,831	Record year.
1928	16,271	Lowest year.
1934	97,454	

Value of Ore.—Excluding incompleted crushings, 96,610 tons were crushed and yielded by amalgamation 53,268.9 ozs. of bullion or 45,150 ozs. fine gold, equal to 9.349 dwts. per ton. The contents of tailing produced was 18,759.05 fine ozs. or 3.883 dwts. per ton.

The total average value per ton was 13.32 dwts., or 56s. 2d. with gold at 85s. per oz. The values for 1932 and 1933 were 59s. 10d. and 59s. 4d. respectively.

Schedule III. attached to this report shows the values recovered at each battery, and whilst Bamboo Creek still holds pride of place with ore averaging £3 15s. 5d. per ton and Marble Bar second with £3 13s. 9d. values, the values are a very big drop from those obtained in the previous year of £6 8s. 3d. and £5 0s. 7d. per ton respectively. At Peak Hill the 7,121½ tons crushed only averaged £1 5s. 10d. per ton. These values are based on gold at 85s. per oz.

Value of Production:—

Recovery by amalgamation—		
	45,150 fine ozs.	worth £191,752.05
Tailing treatment—		
	14,549 „ „ „	61,860.93
	59,699 „ „ „	£253,612.98

£62,827.37 premium was actually received from tailing at the average rate of 101.4 per cent., and using this figure for the fine ozs. recovered by amalgamation the total value of production in Australian currency was £510,876.92.

A comparison with the two previous years is:—

1932.	1933.	1934.
£387,869	£459,743	£510,876

Recovery.—The average value of ore crushed was 13.32 dwts. Recovery by amalgamation was 9.349 dwts., or 70.19 per cent.

The whole of the tailing produced was not treated for the year, but applying the average extraction figure for the year of 76.75 to the value of the tailing, viz. 3.883 dwts., the total recovery would be 12.32 dwts. = 92.49 per cent. and giving an average residue value of 0.93 dwts.

Receipts and Expenditure (1933 figures in brackets).—Expenditure was £98,298 13s. 3d. (£80,785 6s. 6d.) and revenue received amounted to £113,495 10s. 5d. (£110,160 17s. 1d.). The increase in expenditure was mainly due to increased tonnage handled and increased wages and salaries paid, due to the repeal of part of the Financial Emergency taxation.

The excess of revenue over expenditure was £15,196 17s. 2d. Details are shown in a comparative synopsis later in the report.

MILLING.

Excluding three leased plants, one 15-stamp mill, four 10-stamp and sixteen 5-stamp mills were in operation and crushed 97,454 tons for a yield of 45,150 ozs. by amalgamation of an estimated value of £386,188 in Australian currency.

The only increase in the number of stamps was the additional 5-head at Kalgoorlie, which were put into operation in November. Additional tonnage was handled, amounting to 5,838 tons.

The tonnage crushed was the highest since the inception of State batteries.

The number of parcels treated was 2,303 as against 2,338 in 1933. The average tonnage per parcel was 42.3 tons. Batteries crushing over 6,000 tons for the year were as follow:—Kalgoorlie, 12,315.5 tons; Coolgardie, 10,851 tons; Cue, 12,137.75 tons; Ora Banda, 8,635.25 tons; Peak Hill, 7,580.5 tons; whilst Boogardie, Laverton and Meekatharra crushed over 5,000 tons.

The most noticeable increases were at Bamboo Creek and Marble Bar in the Pilbara, and this neglected field has very bright prospects at the present moment.

Stamp Duty.—The average stamp duty for 24 hours was 4.5 tons, running from 6.32 tons at Peak Hill to 3.41 tons at Laverton.

Considering the age of some of our plants, such as Laverton, and that we crush through 900 mesh screens, the result is satisfactory.

FUEL CONSUMPTION AND POWER COST.

Steam Plants.—We have only four steam driven plants, all of which are old and will be superseded this year by internal combustion engines as prime movers.

The ever-increasing cost of firewood in districts dependent on mulga and the difficulty in obtaining continuous supplies is gradually forcing the use of fuel oil. Coolgardie is using second growth timber with an estimated consumption of 13.4 lbs. per H.P.H. and at a cost of 0.98 pence was the only plant below 1d. per H.P.H.

Charcoal Producer Plants.—At the beginning of the year we had four of these plants, but St. Ives was converted during the period to a wood-burning one.

The figures are reasonably good with the best figure of 0.57 pence per B.H.P. at Mt. Ida.

Wood Producer Plants.—Twelve wood producer plants were in operation, including St. Ives for the latter part of the year. Ora Banda, Warriedar and Sandstone approximating 0.25 pence per B.H.P.

Fuel Oil Plants.—Two oil-driven plants at Yalgoo and Marble Bar were in operation. The Marble Bar engine ran unsatisfactorily and has been replaced. The consumption was 0.52 lbs. per B.H.P. at Yalgoo and 0.63 lbs. at Marble Bar.

MILLING COST AND REVENUE.

As we have only one account, all items such as administration, insurance, inspection, etc., are charged directly against our working costs.

The 97,454 tons milled cost 13s. 7.3d. per ton and revenue received was 9s. 6.3d.

The revenue is practically the same as for 1933, but the cost has increased from 11s. 6.7d. to 13s. 7.3d. There are a number of reasons for this, the main one being the higher wages and salaries paid, an adjustment of stores covering a period of some years and the very large increase in tonnage handled at the Pilbara plants, where costs are very high.

A synopsis showing comparative details for the years 1934 and 1933 and particulars of Head Office expenditure appears later in this report.

TAILING TREATMENT.

No treatment was undertaken at Marble Bar, Mt. Ida or Youanmi. At the two first-mentioned places the tailing is mostly refractory. At the present moment we are treating some of the Marble Bar tailing, which has been segregated, and it is hoped that a fair percentage will be amenable. At Mt. Ida the Timoni plant treated tailing free from copper for our customers and at Youanmi, though the Department purchased the tailing at ordinary rates, there was insufficient to warrant starting the plant.

Eighteen plants were in operation and handled 94,616 tons, or 10,465 tons more than in 1933.

REVENUE AND EXPENDITURE.

The expenditure under this heading was £66,661 7s. 10d. or 6s. 9.3d. per ton, and revenue 14s. 2d. as against 6s. 7.3d. or 15s. 9.7d. respectively in 1933, showing a profit of £35,442 1s. 10d.

Contract prices for handling went up in sympathy with increased wages and more than made up for the increased cost, but other charges fell. The drop in revenue was caused by the increase in the tonnage percentage on which owners are now paid, the lower value of tailing treated and the slightly lower percentage of recovery. A synopsis of the results compared with those of 1933 is as follows:—

Year.	Tons Treated.	Head Value.	Extraction.	Value of Call at Par.	Value Recovered.	Shortage.
		Dwts.	%	£	£	£ s. d.
1934	94,616	4·03	76·75	61,876	61,747	*170 13 3
1933	84,151	4·643	77·17	...	...	...

* Estimated loss by robbery at Wiluna of £199 14s. 11d. included in above figure.

The treatment of tailing is becoming an increasingly difficult one. The variety and complexity of the ores now being crushed are increasing. Copper is encountered in nearly every district and it is difficult to segregate the tailing until the officers have had actual experience of these ores. I venture to say that only dilution with clean tailing such as our system provides for makes the ultimate treatment of much of the tailing profitable.

The want of fresh water at St. Ives and Norseman has resulted in poor extractions at these centres. The water used is almost supersaturated with salt, etc., and the cyanide has to be dissolved in fresh water, which at Norseman is costing £2 5s. per 1,000 gallons.

A new tailing plant was erected at Payne's Find to treat the low-grade tailing which was accumulating to such an extent as to cause too large a loss of water by soakage. This tailing is refractory and difficult, but a profit of £496 was made on the treatment of 5,940 tons, with an extraction of 1 dwt. per ton.

At Peak Hill there are no treatment difficulties, but the tailing is so low grade that less than a dwt. per ton is extracted with residues as low as 6 grs. per ton. The profit on the treatment of 5,673 tons was only £231 14s. 4d.

Suitable labour has been scarce and further plants have been supplied with horses and drays to ease the position.

I am pleased to report that with the exception of Coolgardie treatment has more than kept pace with accumulations and premiums to owners in consequence are paid within a reasonable period.

An assay office and equipment were erected at Mt. Ida and a pilot plant installed for experimental work on the cupriferous tailing. Negative results only were obtained.

An additional unit of six vats was installed at Kalgoorlie to keep pace with the increased mill capacity and was in operation towards the end of the year.

Comparative Synopsis of Results at State Batteries for 12 Months ended 31st December, 1933 and 1934.

——	1933.			1934.		
	Tonnage.	Expenditure.	Revenue.	Tonnage.	Expenditure.	Revenue.
Milling	91,616	11/6·7	9/6·5	97,454	13/7·3	9/6·3
Tailing Treatment ...	84,151	6/7·3	15/9·7	94,616	6/9·3	14/2

Receipts and Expenditure.

——	Tonnage.	Expenditure.	Revenue.	Profit.	Loss.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.
Milling	97,454	66,661 7 10	46,442 4 3	...	20,219 3 7
Tailing	94,616	31,611 4 4	67,053 6 2	35,442 1 10	...
Tin Treatment	...	26 1 1	...	...	26 1 1
	192,070	98,298 13 3	113,495 10 5	35,442 1 10	20,245 4 8
			Less Loss ...	20,245 4 8	
			Net Profit ...	£15,196 17 2	

ERECTION AND RECONSTUCTION.

Kalgoorlie was enlarged by the erection of another 5-head of stamps and provision made to increase this plant with another 5 stamps. The new plant dropped stamps in November. The assay office was enlarged and an electrically driven Braund Crusher installed. The blacksmith's and fitting shop was also rebuilt and a larger lathe put in.

Weighbridges were erected at Laverton and Ora Banda, crude oil engines installed at the water supplies at Payne's Find and Sandstone and reconditioned gas engines put into commission at St. Ive's and Norseman.

Electric light was put in at Yarri and all batteries are now equipped.

Details of expenditure are as follow:—

	£ s. d.
Wages	3,778 13 0
Interdepartmental	2,555 6 3
Other	5,164 13 9
	£11,498 13 0

CARTAGE SUBSIDIES.

Cartage subsidies amounting to £15,039 13s. 2d. were paid. This is a substantial increase over the previous years, when figures were £12,935 and £13,265 for 1933 and 1932 respectively.

An increasing tonnage suggests a higher expenditure and it must be remembered that apart from the twenty-one State Batteries, subsidies were paid to twenty-four other treatment plants, making a total of forty-five in all.

A further increase can be looked for this year as the Railway Department has abolished the cheap rate for ore railed in trucks otherwise returning empty.

ADMINISTRATION.

Details of Administration.

	£ s. d.
Salaries	1,877 14 2
Inspection, including salary of Inspector	806 19 5
Insurance	2,054 18 4
Printing	117 16 3
Postage, etc.	30 2 0
	£4,887 10 2

Administration shows a further reduction over the 1933 figures from 6.7 pence to 6.1 pence per ton. It will be noted that 42 per cent. of the total administration charge was on account of insurance.

STAFF.

Difficulty in securing managers still exists and during the past year three managers resigned to accept appointments with various mining companies: L. J. Lambert going to the Western Queen Gold Mining Company; C. Martin to the Australian Mining Trust and B. W. Stenhouse to the Sons of Gwalia, the loss of these managers being only partially offset by the appointment of E. Eyres to Meekatharra. A. Cook, who had been acting manager at Ora Banda, was appointed to Laverton, whilst R. E. Wann was transferred from the assay office at Kalgoorlie to be assistant manager at St. Ives.

Owing to the prolonged illness of Mr. W. R. Burnside, Ed. Wann was transferred from Norseman to Coolgardie, Norseman being placed under Mr. J. E. Halligan of Cue, who was relieved by W. J. Weekley of Meekatharra, E. Speering taking over the plant at Peak Hill.

GENERAL REMARKS.

The outstanding feature of our operations was the record tonnage handled by our batteries, namely, 97,454 tons, the record having stood at 95,831 tons since 1906.

The working profit of £15,196 17s. 2d. was considerably less than in the preceding year, the main reason being the increase in wages, including the 44 hour week. It is natural to expect such increase with returning prosperity, and our employees are to be congratulated.

The purchase of scheme water at a high cost at our main centres such as Coolgardie, Kalgoorlie and Ora Banda, which together crushed 31,891 tons, and the enforcement of royalties on firewood and charcoal by the Forestry Department with resultant higher prices for fuel, had a direct bearing on the increased cost to our system, with a consequent gain in revenue to the departments concerned.

The estimated production, amounting to £510,876, shows a considerable increase over 1933 and is reassuring. The grade of ore dropped from 59s. 4d. to 56s. 2d. per ton with gold at 85s. per oz., but this fall is less than would be expected with the higher prices received for gold. The increased cost of living on the fields tends to restrict the working of lower grade material, but the main factor in keeping up the relatively high value is the popularity of large low grade propositions with mining capital and most of the promising shows are soon under option.

Prospectors were well catered for and very little congestion occurred at any centre. With the extra 5-head at Kalgoorlie and provision for a further 5-head if necessary, our customers can crush within reasonable time.

Since the starting up of the Ora Banda Amalgamated, the rush of ore booked at Ora Banda has been overcome and bookings are normal.

As mentioned previously in this report, there has been a marked increase in the ore crushed at our Pilbara batteries. The Bamboo Creek field is more or less circumscribed, but the district catered for by the Marble Bar battery is very extensive.

I am pleased to report that our dealings with the different prospecting executive bodies have been harmonious, and this is partly a reflection of the just treatment extended to customers by our outback staff.

The work of keeping our batteries up to the heavy demands made on them has not been neglected. New or reconditioned power plants have been installed at several plants, and this year will see a further six plants so equipped, and further attention to the crushing sections will be undertaken as opportunity occurs.

Before closing this report I should like to refer briefly to occasional criticism of our battery charges. The department, in spite of a very large increase in rates of wages and lesser increases in almost all commodities, has reduced its charges in milling at most centres by spending large sums of money on improvements, thus permitting a cheaper rate per ton for crushing done by time, the charge for which has not increased. An additional 5 per cent. is paid for tailing, and tailing is purchased nowadays that would have at one time been declared too refractory to treat. I would remind critics in centres like Kalgoorlie that the revenue derived from high grade tailing is high, but a prospector of Coolgardie today may be a prospector of Bamboo Creek, 40 miles from Marble Bar, to-morrow and can get his ore treated for the same charge.

The fact that forty per cent. of the tailing produced at State batteries for 1934 averaged only 1½ dwt. and some of it is difficult and expensive to treat is often lost sight of. To point my remarks, the Peak Hill figures are illuminating. For the year 7,580 tons were crushed for an average milling charge to owners of 7s. 2d. per ton, on which a considerable loss was made. The tailing revenue per ton was 3s. at par, or 7s. 2d. with premium, showing a small profit, but not commensurate with the loss on milling.

Peak Hill has produced one of the large gold producing mines, and whilst the Government keeps the district in existence there is a chance of producing further prosperous mines equal with other centres. The departmental method of allocating charges appears to be equitable and advantageous when dealing with the Goldfields as a whole, and the fact that there is no opposition and that most owners of private batteries in centres where State batteries are now existent charge 7s. more per ton than the Government is the best proof that our charges are more than reasonable.

I wish to record my appreciation of the efficient service and loyal co-operation of Goldfields and Head Office staffs.

Schedules showing the different operations are herewith.

D. F. BROWNE,
Superintendent of State Batteries.

27th June, 1935.

SCHEDULE 1.

Return showing Number of Tons Crushed, Gold Yield by Amalgamation, Average per Ton in Shillings, and Total Value for Year ended 31st December 1934.

Battery.	Tons Crushed.	Gold Yield Bullion.	Value per Ton.	Total Value.
		Ozs.	s. d.	£
Bamboo Creek	2,679¼	2,086·15	56 0·0	7,510·14
Boogardie	5,752¼	3,078·75	38 6·2	11,083·50
Coolgardie	10,851	6,812·20	45 2·4	24,523·92
Cue	10,187¾	5,078·55	36 0·7	18,282·78
Jimble Bar	2,777¼	1,020·95	26 5·5	3,675·42
Kalgoorlie	12,315½	6,478·65	37 10·3	23,323·14
Laverton	5,708¼	2,643·50	33 3·8	9,516·6
Marble Bar	3,359½	2,462·50	52 6·2	8,865·0
Meekatharra	5,645½	5,164·55	66 2·4	18,592·38
Mt. Ida	1,855½	765·55	29 7·2	2,755·98
Norseman	2,838¼	1,298·4	32 9·6	4,674·24
Ora Banda	8,635¼	4,380·8	36 4·8	15,770·88
Payne's Find	2,583½	2,344·9	65 2·4	8,441·64
Peak Hill	7,580½	1,953·7	18 4·8	7,033·32
Sandstone	4,026	2,393·0	42 9·6	8,614·8
St. Ives	2,014¼	657·95	23 4·8	2,368·62
Warriedar	2,082½	792·0	27 4·8	2,851·2
Wiluna	1,220¼	561·25	33 0·0	2,020·5
Yarri	2,692	2,036·2	54 4·8	7,330·32
Youanmi	160	99·1	44 4·8	356·76
Yalgoo	2,539¾	1,160·25	32 9·6	4,176·9
Total	97,454	53,268·9	39 2·4	191,768·04

SCHEDULE 2.

Tailing Treatment for 1934.

Battery.	Tonnage.	Yield.	Value.	Premium.
		Fine ozs.	£	£
Bamboo Creek	1,710	397·82	1,691·85	1,712·40
Boogardie	5,668	1,079·93	4,595·19	4,659·17
Coolgardie	9,415	1,390·71	5,906·47	6,014·20
Cue	8,107	1,833·58	7,781·52	7,960·80
Jimble Bar	1,848	441·77	1,876·20	1,900·62
Kalgoorlie	15,360	2,147·21	9,119·19	9,278·31
Laverton	7,250	999·84	4,315·43	4,388·53
Meekatharra	6,415	1,218·22	5,173·43	5,236·23
Norseman	3,416	542·81	2,295·49	2,314·04
Ora Banda	10,023	1,621·46	6,891·14	6,960·20
Payne's Find...	5,940	323·36	1,377·91	1,403·17
Peak Hill	5,673	360·46	1,546·47	1,575·73
Sandstone	4,374	634·29	2,694·59	2,746·31
St. Ives	2,408	298·15	1,223·84	1,224·22
Warriedar	2,434	570·81	2,421·53	2,397·71
Wiluna	1,825	425·16	1,803·35	1,895·07
Yarri	2,460	232·38	986·41	1,007·20
Yalgoo	290	31·83	160·92	153·46
Total	94,616	14,549·79	61,860·93	62,827·37

SCHEDULE 3.

Return showing Number of Parcels treated, Tons crushed, and average value for Year 1934.

No. of Crushings excluding Berdan Parcels.	Battery.	Tons Crushed.	Yield by Amalgamation, Bullion.	Yield by Amalgamation, Fine Gold.	Gross Contents Tailing (including not purchased), Fine Gold.	Total Contents of Ore, Fine Gold.	Average per ton, Fine Gold.	Gross Value per ton.
			ozs. dwt. grs.	ozs. dwt. grs.	ozs. dwt. grs.	ozs. dwt. grs.	dwt. grs.	£ s. d.
62	Bamboo Creek ...	2,673¼	2,086 3 0	1,768 7 0	609 19 0	2,378 6 0	17 19	3 15 5
141	Boogardie ...	5,746	3,078 15 0	2,609 14 0	1,223 4 0	3,832 18 0	13 8	2 16 7
300	Coolgardie ...	10,818½	6,812 4 0	5,774 8 0	1,927 2 0	7,701 10 0	14 5	3 0 4
228	Cue	10,138¼	5,078 11 0	4,304 16 0	2,600 13 0	6,905 9 0	13 14	2 17 7
19	Jimble Bar ...	2,777¼	1,020 19 0	865 8 0	623 7 0	1,488 15 0	10 16	2 5 2
345	Kalgoorlie ...	12,284½	6,478 13 0	5,491 12 0	2,625 2 0	8,116 14 0	13 4	2 15 11
187	Laverton	5,685½	2,643 10 0	2,240 15 0	835 10 0	3,076 5 0	10 19	2 5 8
109	Marble Bar ...	3,359½	2,462 10 0	2,087 6 0	837 14 0	2,925 0 0	17 9	3 13 9
137	Meekatharra ...	5,693½	5,164 11 0	4,375 8 0	1,201 6 0	5,576 14 0	19 12	4 2 10
37	Mt. Ida	1,851½	765 11 0	648 19 0	274 16 0	923 15 0	9 22	2 1 11
93	Norseman ...	2,819½	1,298 8 0	1,100 12 0	540 19 0	1,641 11 0	11 14	2 9 1
154	Ora Banda ...	8,609½	4,380 16 0	3,713 8 0	1,694 11 0	5,407 19 0	12 13	2 13 2
42	Payne's Find ...	2,519½	2,344 18 0	1,987 12 0	279 2 0	2,266 14 0	17 21	3 15 9
56	Peak Hill ...	7,121½	1,953 14 0	1,656 0 0	514 17 0	2,170 17 0	6 2	1 5 10
96	Sandstone ...	4,026	2,393 0 0	2,028 8 0	680 3 0	2,708 11 0	13 10	2 16 11
16	St. Ives	1,738	657 19 0	557 14 0	227 1 0	784 15 0	9 1	1 18 5
52	Warriedar ...	2,132½	792 0 0	671 6 0	650 7 0	1,321 13 0	12 8	2 12 6
37	Wiluna	1,195¼	561 5 0	475 14 0	315 17 0	791 11 0	13 5	2 16 1
72	Yarri	2,726	2,036 4 0	1,726 0 0	390 4 0	2,116 4 0	15 3	3 4 3
5	Youanmi	160	99 2 0	84 0 0	45 15 0	129 15 0	16 5	3 8 10
115	Yalgoo	2,534¾	1,160 5 0	983 8 0	661 12 0	1,645 0 0	12 21	2 14 6
2,303		96,610	53,268 18 0	45,150 15 0	18,759 1 0	63,909 16 0	13 5	2 16 2

SCHEDULE 4.

Direct Purchase of Tailings.

Battery.	Tons purchased.	Amount.
		£ s. d.
Bamboo Creek	2,149½	1,964 11 10
Boogardie	3,376¼	4,087 10 0
Coolgardie	6,182½	4,987 12 5
Cue	6,022¾	9,144 6 4
Jimble Bar	2,305½	1,494 4 6
Kalgoorlie	6,266	9,285 12 6
Laverton	2,580	2,307 12 0
Meekatharra	2,996¾	3,734 16 2
Norseman	1,770	1,748 18 10
Ora Banda	4,553	8,705 19 9
Payne's Find	1,058½	354 10 5
Peak Hill	951½	538 4 4
Sandstone	2,526½	2,155 15 2
St. Ives	1,265¼	526 4 4
Warriedar	1,972	2,796 8 6
Wiluna	1,591	1,658 19 11
Yalgoo	925¾	726 9 9
Yarri	828¼	353 1 5
Youanmi	143	80 14 9
	49,464	£56,651 12 11

SCHEDULE 5.

Return showing Tailing payable and unpayable and Gross Contents for Year 1934.

Battery.	Tailing payable.		Tailing unpayable.		Unpurchased tailing.		Totals.	
	Tons.	Gross Contents.	Tons.	Gross Contents.	Tons.	Gross Contents.	Tons.	Gross Contents.
		ozs. dwt. grs.		ozs. dwt. grs.		ozs. dwt. grs.		ozs. dwt. grs.
Bamboo Creek	2,069	576 12 0	335	33 7 0	...	...	2,404	609 19 0
Boogardie	3,581	1,085 9 0	1,591	137 15 0	...	...	5,172	1,223 4 0
Coolgardie	5,708	1,593 18 0	4,028	333 4 0	...	...	9,736	1,927 2 0
Cue	6,169	2,369 9 0	2,953	231 4 0	...	...	9,122	2,600 13 0
Jimble Bar	2,336	606 19 0	89	5 16 0	74	10 12 0	2,499	623 7 0
Kalgoorlie	6,217	2,266 14 0	4,839	358 8 0	...	...	11,056	2,625 2 0
Laverton	2,740	649 5 0	2,377	186 5 0	...	...	5,117	835 10 0
Marble Bar	...	...	...	...	3,023	837 14 0	3,023	837 14 0
Meekatharra...	3,099	1,040 9 0	2,025	160 17 0	...	...	5,124	1,201 6 0
Mt. Ida	...	...	...	...	1,664	274 16 0	1,664	274 16 0
Norseman	1,747	477 11 0	791	63 8 0	...	...	2,538	540 19 0
Ora Banda	4,102	1,401 12 0	3,644	292 19 0	...	...	7,746	1,694 11 0
Payne's Find	935	153 11 0	1,169	101 2 0	163	24 9 0	2,267	279 2 0
Peak Hill	1,020	221 1 0	5,389	293 16 0	...	...	6,409	514 17 0
St. Ives	1,166	193 15 0	397	33 6 0	...	...	1,563	227 1 0
Sandstone	2,641	607 2 0	981	73 1 0	...	...	3,622	680 3 0
Warriedar	1,627	628 13 0	292	21 14 0	...	...	1,919	650 7 0
Wiluna	934	305 11 0	142	10 6 0	...	...	1,076	315 17 0
Yalgoo	1,199	327 11 0	868	70 1 0	212	64 0 0	2,279	661 12 0
Yarri	1,174	242 12 0	994	84 17 0	295	62 15 0	2,463	390 4 0
Youanmi	144	45 15 0	...	...	...	...	144	45 15 0
	48,608	14,793 9 0	32,904	2,491 6 0	5,431	1,274 0 0	86,943	18,759 1 0

SCHEDULE 6.

MILLING AND TIN

Statement of Receipts and Expenditure for Year ended 31st December, 1934.

Battery.	Tonnage Crushed.	Management.	Wages.	Stores.	Total Working Expenditure.	Cost per ton.	Repairs and Renewals.	Sundries.	Gross Expenditure.	Cost per ton.	Receipts.	Receipts per ton.	Profit.	Loss.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	£ d.	£ s. d.	£ s. d.
Bamboo Creek	2,679·25	246 18 6	1,406 8 6	734 2 4	2,387 9 4	17 10·7	310 19 8	338 17 10	3,036 17 10	22 8·0	1,477 12 10	10 1·2	...	1,559 5 0
Boogardie	5,752·25	270 18 5	1,684 18 0	771 6 1	2,727 2 6	9 6·6	237 16 5	339 17 11	3,304 16 10	11 5·8	2,595 3 9	9 0·3	...	709 13 1
Coolgardie	10,851·00	629 1 1	2,223 13 3	2,835 4 3	5,687 18 7	9 7·2	405 13 1	743 18 3	6,837 9 11	12 7·2	5,449 1 6	10 0·5	...	1,388 8 5
Cue	10,137·75	327 5 4	1,794 19 0	1,911 18 3	4,034 2 7	7 11·3	430 5 11	602 11 10	5,067 0 4	9 11·9	4,901 15 8	9 8·0	...	165 4 8
Darlot	...	...	...	...	...	...	...	...	...	...	16 19 9	...	16 19 9	...
Jimble Bar	2,777·25	153 4 3	912 18 8	341 14 6	1,407 17 5	10 2·5	121 2 2	214 13 3	1,743 12 10	12 6·6	1,759 2 2	12 8·0	15 9 4	...
Kalgoorlie	12,315·50	359 10 2	1,913 19 4	3,037 13 7	5,311 3 1	8 8·6	707 15 1	838 15 1	6,857 13 3	11 1·6	5,250 3 11	8 6·2	...	1,607 9 4
Laverton	5,708·25	209 16 3	1,734 4 7	1,254 1 9	3,198 2 7	11 2·1	752 16 9	360 3 5	4,311 2 9	15 1·4	2,864 0 8	10 0·3	...	1,447 2 1
Linden	...	...	...	...	...	...	...	2 6 3	2 6 3	...	69 5 3	...	66 19 0	...
Marble Bar	3,359·50	326 14 7	1,556 7 8	760 19 9	2,644 2 0	15 8·3	433 7 10	270 5 10	3,347 15 8	19 11·1	1,560 4 10	9 3·4	...	1,787 10 10
Meekatharra	5,645·50	258 7 2	1,746 12 8	1,567 16 5	3,572 16 3	12 3·6	271 16 3	380 12 11	4,225 5 5	14 11·6	2,718 0 7	9 7·4	...	1,507 4 10
Mt. Ida	1,855·50	234 19 7	764 19 0	302 9 10	1,302 8 5	14 0·4	58 14 10	130 11 0	1,491 14 3	16 0·9	1,124 11 10	12 2·8	...	367 2 5
Mt. Sir Samuel	...	...	...	...	...	...	...	...	...	...	22 5 6	...	22 5 6	...
Mulline	...	...	...	...	...	...	...	...	...	...	41 15 0	...	41 15 0	...
Mulwarrie	...	...	...	...	...	...	...	...	...	...	14 19 6	...	14 19 6	...
Norseman	2,838·25	239 17 11	1,123 15 8	751 11 10	2,115 5 5	18 5·2	271 13 10	242 3 5	2,629 2 8	18 6·3	1,313 15 11	9 3·1	...	1,315 6 9
Ora Banda	8,635·25	309 5 9	2,671 17 0	1,215 9 0	4,196 11 9	9 8·6	319 7 8	486 1 1	5,002 0 6	11 7·02	3,493 19 6	8 1·1	...	1,508 1 0
Payne's Find	2,583·50	170 7 4	1,057 1 5	559 3 9	1,786 12 6	13 9·9	256 1 2	181 4 8	2,223 18 4	17 2·5	1,342 7 10	10 4·7	...	881 10 6
Peak Hill	7,580·50	296 14 3	1,887 3 8	739 14 9	2,923 12 8	7 8·6	373 0 6	445 2 6	3,741 15 8	9 10·4	2,724 7 7	17 2·3	...	1,017 8 1
Pingin	...	...	...	...	...	...	...	...	...	...	10 0 0	...	10 0 0	...
Sandstone	4,026·00	257 9 11	1,343 2 11	489 2 10	2,089 15 8	10 4·5	107 16 10	292 6 1	2,489 18 7	12 4·4	2,008 18 6	9 11·7	...	481 0 1
St. Ives	2,014·25	262 17 2	938 2 4	748 0 5	1,948 19 11	19 4·2	639 17 1	214 16 4	2,803 13 4	27 10·0	915 18 3	9 1·1	...	1,887 15 1
Tuckanarra	...	...	...	...	...	...	...	...	...	...	95 15 0	...	95 15 0	...
Wiluna	1,220·25	85 12 6	302 18 0	580 6 7	968 17 1	15 11	132 0 6	93 12 10	1,194 10 5	19 6·5	580 10 4	9 6·9	...	614 0 1
Warriedar	2,082·50	160 13 9	623 0 10	544 19 5	1,328 14 0	12 9·1	198 0 6	131 13 4	1,658 7 10	15 11·1	1,164 16 1	11 2·2	...	493 11 9
Yalgoo	2,539·75	265 17 1	789 14 2	406 11 2	1,462 2 5	11 6·1	133 11 10	211 13 10	1,807 8 1	14 2·8	1,266 6 1	9 11·7	...	541 2 0
Yarri	2,692·00	184 9 3	1,214 18 8	818 11 5	2,217 19 4	16 5·6	148 14 3	211 6 11	2,578 0 6	19 1·8	1,571 4 11	11 8·0	...	1,006 15 7
Youanmi	160·00	17 0 0	120 7 2	157 3 11	294 11 1	36 9·7	5 11 6	6 14 0	306 16 7	38 4·2	89 1 6	11 1·6	...	217 15 1
	97,454·00	5,267 0 3	27,811 2 6	20,528 1 10	53,606 4 7	11 0·01	6,316 3 8	6,738 19 7	66,661 7 10	13 7·2	46,442 4 3	9 6·3	284 3 1	20,503 6 8
Tin Plant— Greenbushes ...	...	26 1 1	...	...	26 1 1	...	...	...	26 1 1	...	...	...	...	26 1 1
	97,454·00	5,293 1 4	27,811 2 6	20,528 1 10	53,632 5 8	11 0·02	6,316 3 8	6,738 19 7	66,687 8 11	13 7·3	46,442 4 3	9 6·3	284 3 1	20,529 7 9

SCHEDULE 7.

TAILING.

Statement of Receipts and Expenditure for Year ended 31st December, 1934.

Plant.	Tonnage.	Management.	Wages.	Assays.	Stores.	Total Working Expenditure.	Cost per ton.	Repairs and Renewals.	Sundries.	Gross Expenditure.	Cost per ton.	Receipts.	Receipts per ton.	Profit.	Loss.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	£ s. d.	£ s. d.	s. d.	£ s. d.	s. d.	£ s. d.	£ s. d
Bamboo Creek	1,710	86 7 9	403 2 1	58 6 2	157 3 9	704 19 9	8 3·0	46 12 4	85 5 6	836 17 7	9 9·4	1,772 3 0	20 8·7	935 5 5	...
Boogardie	5,668	156 18 3	958 7 6	80 18 8	492 2 7	1,688 7 0	5 11·5	15 6 4	165 2 11	1,868 16 3	6 7·1	4,035 9 3	14 4·9	2,166 13 0	...
Coolgardie	9,415	139 6 8	1,670 7 6	142 17 8	640 5 8	2,592 17 6	5 6·0	29 4 1	262 10 6	2,884 12 1	6 1·5	6,654 5 8	14 1·6	3,769 13 7	...
Cue	8,107	205 7 11	1,350 13 11	247 11 7	630 0 3	2,433 13 8	6 0·4	58 0 9	217 12 8	2,709 7 1	6 8·2	7,003 5 7	17 6·5	4,293 18 6	...
Jimble Bar	1,848	71 10 8	371 17 5	32 6 4	232 12 11	708 7 4	7 7·9	43 5 1	51 11 8	803 4 1	8 8·3	2,518 15 8	27 2·7	1,715 11 7	...
Kalgoorlie	15,360	285 5 2	2,150 11 7	157 0 0	997 5 0	3,590 1 9	4 7·0	16 4 10	484 3 3	4,090 9 10	5 3·9	8,392 17 4	10 11·8	4,302 7 6	...
Laverton	7,250	186 5 6	1,100 0 10	253 12 4	581 2 8	2,121 1 4	5 10·2	29 7 1	243 12 5	2,394 0 10	6 7·2	5,513 10 6	15 2·5	3,119 9 8	...
Meekatharra	6,415	192 8 5	1,380 2 1	83 3 8	393 16 11	2,049 11 1	6 4·6	39 11 8	223 10 3	2,312 13 0	7 2·5	5,451 4 3	16 11	3,138 11 3	...
Mt. Ida	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Norseman	3,416	122 17 11	513 15 1	97 13 0	348 7 4	1,082 13 4	6 4·0	51 15 6	139 18 3	1,274 7 1	7 5·5	2,320 19 1	13 7·4	1,046 12 0	...
Ora Banda	10,023	199 8 3	1,654 14 11	103 11 10	814 17 1	2,772 12 1	5 6·3	9 6 4	253 12 6	3,035 10 11	6 0·6	6,274 19 10	12 6·2	3,239 8 11	...
Peak Hill	5,673	143 16 1	982 8 7	49 3 2	417 8 9	1,592 16 7	5 7·1	64 8 0	171 19 4	1,829 3 11	6 5·3	2,060 17 11	7 2·7	231 14 0	...
Payne's Find	5,940	79 18 9	780 10 6	196 2 5	592 4 11	1,648 16 7	5 6·6	53 10 7	184 15 2	1,887 2 4	6 4·2	2,378 9 11	8 0·1	491 7 7	...
Sandstone	4,374	228 8 3	827 9 5	70 5 3	365 7 9	1,491 10 8	6 9·8	10 14 2	129 2 5	1,631 7 3	7 5·5	3,410 7 7	15 7·4	1,779 0 4	...
St. Ives	2,408	74 15 4	409 17 11	131 18 9	345 5 5	961 17 5	7 6·9	36 5 10	84 6 1	1,082 9 4	8 11·8	1,838 17 1	15 3·2	756 7 9	...
Warriedar	2,434	48 7 4	372 1 9	150 4 4	321 14 10	892 8 3	7 3·9	57 3 3	114 5 2	1,063 16 8	8 8·8	2,050 16 8	16 10·2	987 0 0	...
Wiluna	1,825	111 17 10	229 5 2	23 4 2	207 5 4	571 12 6	6 4·8	2 11 3	85 3 0	659 6 9	7 2·7	1,976 17 5	21 7·9	1,317 10 8	...
Yalgoo	290	3 2 3	47 17 2	42 10 6	57 14 6	151 4 5	10 4·8	2 16 6	46 10 5	200 11 4	13 9·9	508 18 9	35 1·1	308 7 5	...
Yarri	2,460	162 1 10	380 9 1	77 3 1	239 16 7	859 10 7	6 11·9	64 7 8	123 9 9	1,047 8 0	8 6·1	1,390 10 8	11 3·7	343 2 8	...
Revenue Suspense Account	...	...	...	...	...	...	...	...	...	...	...	1,500 0 0	...	...	...
	94,616	2,498 4 2	15,583 12 6	1,997 12 11	7,834 12 3	27,914 1 10	5 10·8	630 11 3	3,066 11 3	31,611 4 4	6 9·3	67,053 6 2	14 2	33,942 1 10	...

DIVISION IV.

Annual Progress Report of the Geological Survey of Western Australia for the Year ended 31st December, 1934.

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 1934.

STAFF.

The organisation of the Staff remains unchanged from that of the previous year and consists of two field officers, one technical assistant and a messenger.

In the twelve months under review there have been considerable changes of personnel. In March Mr. Blatchford resigned from the position of Government Geologist and I was appointed to fill the vacancy, taking up duties on 1st June. The position of Assistant Geologist vacated by myself was filled in October by the appointment of Mr. H. A. Ellis. On the resignation of Miss F. Armstrong the position of Technical Assistant was filled, in August, by the appointment of Miss B. M. Bowley.

FIELD WORK.

Government Geologist.

In February Mr. Blatchford inspected and reported on Welsh's Find near Yarri. In addition to ordinary office routine, I reported on the Geology and Petroleum Prospects of an area West of Dandaragan, Palmer's Find at Yellowdine, Lode Mining at Yinniding Creek, Toodyay district, and the Town Water Supply at Meekatharra.

Through the courtesy of the Western Mining Corporation I was able to make several short field trips to inspect the geological work being carried out by them in the Kalgoorlie district.

F. R. Feldtmann, Field Geologist.

During the greater portion of the year Mr. Feldtmann was engaged in work on his report on the Kalgoorlie area. On Mr. Blatchford's resignation Mr. Feldtmann was in charge of the Geological Survey until my appointment, and during my absence from the State in October was appointed Acting Government Geologist. During the latter part of April and the whole of May he was engaged in the examination of the Larkinville goldmining centre, and he also paid a brief visit to Spargo's Find. From 1st June to 20th August Mr. Feldtmann was engaged in examining sections of the Larkinville rocks, and in the preparation of maps of and a report on the Larkinville area. In August he accompanied me to Kalgoorlie to make a brief inspection of the broader geological features of the country in the neighbourhood of Kalgoorlie and Coolgardie.

H. A. Ellis, B.Sc., A.O.S.M., Assistant Geologist.

Since his appointment in October Mr. Ellis was fully occupied at Head Office in restoring the laboratory and bore core collection to workable order, marking and registering of 298 rock and mineral specimens and in attention to requests for technical information from members of the public. Mr. Ellis also commenced the compilation of existing geological data in map form in connection with a proposed programme of field work for 1935.

HEAD OFFICE.

Miss F. Armstrong, B.Sc., Technical Assistant.

In addition to the general routine work of the office much of Miss Armstrong's time was occupied with editing a new Geological Map of the State and Bulletin 95. The reading of the final proofs and the finalisation of all matters in connection with the new bulletin were carried out by Miss Armstrong after her resignation in August, her services being kindly made available by the Western Mining Corporation.

Miss B. M. Bowley, B.Sc., Technical Assistant.

Since her appointment as Technical Assistant in August Miss Bowley has in addition to attending to the general office routine been engaged in the following duties of a professional nature, the latter taking up a considerable amount of her time:—

Classifying and cross-indexing newly acquired rock and mineral collection.

Cataloguing by cross reference, articles in current and back number publications dealing with Australian geology.

Setting up an exhibit of the more important Western Australian minerals in Government House for the Royal visit, and rearranging portion of the Geological Survey exhibit in the Museum.

Making a card inventory of the Geological Survey publications and portion of the maps.

Preparing a map showing the total gold output up to 1928 for the Pilbara Goldfield.

Identification of fossils and attention to technical inquiries by members of the public.

PETROLOGY.

Since his appointment Mr. Ellis has made 132 rock-sections and made petrological determinations of some of them for the Forestry Department and the general public.

PUBLICATIONS.

During the year the following publications have been issued and are now available to the public, viz.:—

Geological Sketch Map of Western Australia based on the work of the Geological Survey and revised to 1933. Scale 50 miles to one inch.

Bulletin 95.—The Physiography (Geomorphology) of Western Australia, by J. T. Jutson, B.Sc., L.L.B., second edition, revised.

Annual Progress Report for the year 1933.

AERIAL, GEOLOGICAL AND GEOPHYSICAL SURVEY OF NORTHERN AUSTRALIA.

As a member of the executive committee of this survey I was absent from the State on two occasions, the first to attend the first meeting of the committee held at Canberra from 28th to 30th June and the second to attend a committee meeting held in Melbourne from the 29th to 31st October. The Melbourne meeting was held at the conclusion of an aerial reconnaissance flight by members of the executive committee over areas in Queensland, Northern Territory and Western Australia which it is proposed to include in the survey operations. In all some 12,000 miles were covered in this flight between 19th September and 20th October. My report on the Western Australian section of the flight was forwarded by the committee to the Hon. the Minister for Mines. Early in December I accompanied other members of the executive committee when they inspected the aerial survey work being carried out by the Western Mining Corporation in the Kalgoorlie district, and the geophysical work of the Electrical Prospecting Company of Sweden at Triton, Wiluna and Leonora.

The reports arising from the field work are attached, except in such instances when they were made for purely departmental use.

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

F. G. FORMAN,
Government Geologist.

REPORT ON WELSH'S FIND NEAR YARRI, NORTH COOLGARDIE GOLDFIELD.

(T. Blatchford, B.A.)

Location.—Welsh's Find is situated near the 37-Mile Peg on the cut road which connects Yarri to Yerilla. It lies about four and a half miles west of Yarri and seven and a half miles east of Yilgangi.

Topography.—The area in the immediate vicinity of Welsh's Find may well be described as typical flat goldfields country with a gentle slope towards the south-east.

The only high ground near the leases is a short east and west ridge which lies about half a mile north of the main camp. With this exception there are no conspicuous landmarks.

Geology.—The geology in the immediate vicinity of Welsh's Find appears to be fairly simple, the main rock members consisting of porphyritic granite, felspar porphyries, and fine-grained sediments.

The porphyritic granite may be regarded as the main country rock, though there is a fair development of sedimentary rocks in the ridge lying to the north of the leases.

The most important rock member is the quartz felspar porphyry, for it is in this class of rock that the gold occurs.

Quartz Felspar Porphyries.—This series of rock no doubt intrudes the porphyritic granite. As may be seen on the sketch map attached to this report,* the porphyry at the surface covers quite a large area, and the shaft at the S.W. corner of Lease 1086R proves that it extends further to the east for it was struck in the shaft at a vertical depth of 30 feet from the surface. In hand specimens it is quite evident that the porphyry has been submitted to intense shearing and mineralisation, the chief secondary mineral being quartz, often occurring in narrow veins along the lines of schistosity and pyrites. Coarse pink felspars are fairly common and are to be found embedded in a granular ground mass of quartz and felspar. No doubt the hardness of the rock is due to the impregnation of silica.

The occurrence of gold in this form of granitic rock is at least rare, and we have no record of a similar instance in this State On the other hand, gold has been found indirectly associated with porphyries, good examples of which are those in the Red Hill, Kanowna.

With regard to the Kanowna porphyries, these intrude the conglomerate beds, which contain the main quartz reefs. The Kanowna porphyries are themselves barren of gold, but contain narrow but extensively rich quartz veins, the most noted being the celebrated Tom Doyle's leader.

At Yilgangie, 7½ miles west of Welsh's Find, we have a similar occurrence of conglomerate almost identical in form and composition with the Kanowna type and also invaded by a hornblende quartz porphyry. This porphyry has been impregnated with irregular quartz veins which no doubt—judging by the prospecting done—carried a certain amount of gold, but probably insufficient to be payable. The porphyry at Welsh's Find differs from both of the foregoing in that the gold is more closely associated with the mineral content than the quartz, the quartz veins being fairly free from at least payable gold values.

From the foregoing it is evident that no porphyries should be passed by prospectors, particularly those types which exhibit shearing or foliation.†

Mining.—Up to the present very little mining has been done and practically no deep mining, the bottom of the deepest shaft being not more than 30 feet from the surface.

It is therefore impossible to state what the prospects are of obtaining any large tonnages. On the other hand, this point could easily and cheaply be

*Sketch Map not published.

†Attached as an appendix are petrological notes on samples of the porphyry and sediments of Welsh's Find.

decided by sinking or boring at several point into the porphyry. Regarding values, the only official battery returns to hand are as follows:—

L. Welsh, G.M.L. 1126R—124½ tons: 7 dwts. 3 grs. bullion over the plates; tails not known.

F. P. Maingay, P.A. 1080R—138¾ tons: 1 dwt. 5 grs.; tails not known.

R. Welsh, P.A. 1079—31½ tons: 8.4 dwts. fine gold per ton; tails not known.

All the stone raised on Lease 1126R seems to have been taken to the mill and been crushed, I was informed by the man in charge, for values up to 10 dwts. per ton.

From what can be seen at present, the main points to be decided are:—

1. Is the porphyry (a) a wide more or less vertical dyke, (b) one narrow flat dyke, or (c) a series of flat dykes.

2. Do the shearing and mineralisation extend to any appreciable depth, which will also solve the amount of tonnage likely to be available.

3. Over what area do the gold values extend.

All these could easily be proved by shallow boring at a comparatively small expense.

Description of the Rocks.

1/5342 G.M.L., 1126R. Felspar porphyry:

Felspar porphyry sheared and penetrated along planes of schistosity by stringers and veins of quartz. The quartz thus serves as a binding agent and renders the rock extremely hard. Composed of phenocrysts of microline, orthoclase, and albite embedded in a granular ground-mass of quartz and felspar. Abundant pyrite and some hydrated ferric oxide.

1/5341. P.A. 1092. Felspar porphyry:

More highly sheared than 1/5342, contains thin laminae of quartz along planes of schistosity. The rock is softer than 1/5342, in which the quartz occurs as fairly large veins up to an inch or more in width.

1/5341 may be a marginal phase of 1/5342.

1/5337. Sediments on hill half a mile north of Main Camp:

Composed of quartz, fine mica (sericite), chlorite, abundant ferric oxide (possibly hydrated), and tourmaline. The tourmaline is common and occurs as needles. The presence of tourmaline suggests contact metamorphism.

THE GEOLOGY AND PETROLEUM PROSPECTS OF PART OF O.P.A. 253H, NEAR DANDARAGAN.

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

O.P.A. 253H includes an area of 10,000 square miles, bounded on the south by a line from Eglington Rocks to Northam, on the east by the northern railway line from Northam to Buntine, and on the north by a line from Buntine to Green Head. The western boundary is the coast line from Green Head southwards to Eglington Rocks. This report is written after a traverse from Moora to the coast west of Dandaragan had been made to investigate supposed evidences of mineral oil in the coastal area. An inspection of this area showed that the supposed evidences, structure and an oil seepage, were non-existent, but as much of the area traversed has not been previously described and as certain geological features were noted which are of interest and some promise in the search for oil, the inspection did not prove a waste of time.

TOPOGRAPHY.

The area traversed shows four sharply defined topographic zones of striking contrast. These are (a) Plateau Zone, (b) Sand Plain Zone, (c) Swamp Zone, and (d) Coastal Sandhill Zone.

(a) *Plateau Zone.*—Between Moora and Dandaragan the country consists of an elevated plateau lying about 850 feet above sea level with a gently undulating surface covered with sand, and in places ironstone laterite (duricrust). The continuous covering of sand and laterite (due to decomposition *in situ* of the underlying rocks) effectively hides the character of the sub-surface formations. To the east, and marked by a general north-south line in the vicinity of Moora, this elevated plateau junctions on the main mass of the eastern tablelands, consisting of a complex of Pre-Cambrian granites and metamorphosed sediments. This junction is marked by a low scarp, probably a fault scarp, the country to the east being maturely dissected and about 250 feet above the plateau to the west.

From an elevation of about 600 feet above sea level at Moora, the plateau steadily rises to the west until it reaches an elevation of about 1,100 feet at its western edge. The western edge of the plateau is marked by the westerly facing Dandaragan Scarp. This runs in a general north-south direction about three miles west of Dandaragan and is probably a northerly continuation of the Poison Hill-Quinn's Pole Scarp to the west of Gingin. The origin of this scarp will be discussed at a later stage.

Drainage.—The main drainage channel of the Plateau Zone is the Moore River. This stream, flowing in a westerly direction from the interior tablelands, turns sharply to the south in the vicinity of Moora and follows the westerly escarpment of the granite until it reaches Mogumber, where it again turns sharply to the west and after cutting the Dandaragan Scarp flows south for a considerable distance, finally turning again sharply westwards and entering the ocean to the west of Gingin. The southerly course of the Moore River from Moora to Mogumber was probably initiated by the uplift of the Dandaragan-Moora Plateau and its consequent easterly slope prevented the river from continuing westwards as in the upper part of its course. The Moore River probably flowed at one time into the Brockman River, a tributary of the Swan, but has since been captured in the vicinity of Mogumber by a short westerly flowing stream, which cut back through the Dandaragan Plateau and thus diverted the Moore River into its present westerly course.

Westwards from the vicinity of Koolbung Well about ten miles from Moora, the Moora-Dandaragan road follows a valley of mature type which carries an intermittent stream which, however, swells to a considerable volume after heavy rains. This stream, although not shown or named on the Lands Department litho., is really the upper part of Minyulo Brook and is apparently an antecedent stream which in its erosion has kept pace with the uplift and easterly tilting of the plateau. The sudden diversion near

Dandaragan of this stream to a southerly course before its junction with the westerly flowing Minyulo Brook was no doubt caused by the same uplift.

(b) *Sand Plain Zone.*—The country for some 25 miles to the west of the Dandaragan Scarp consists of gently undulating sand plain with a general westerly (seaward) slope and covered by banksia and low scrub. It has an average elevation on its eastern side of about 500 feet and falls with a fairly even grade until it reaches the swampy ground on its western margin, where the elevation is by barometric readings from 50 to 100 feet above sea-level.

On the eastern margin of the sand plain lie several prominent hills of butte-like appearance, including Mt. Misery and Yandan Hill, both about 900 feet above sea-level, which are outliers of the Dandaragan Scarp. About six miles west of Mt. Misery lies Walyering Peak (731′) from which there extends a zone of high ground to the north. This will be referred to later because of the possibility of structure in this vicinity.

Drainage.—The sand plain west of Dandaragan is drained by Minyulo Brook which, after leaving the Dandaragan Scarp, takes a tortuous course around the west side of Mt. Misery and the east side of Walyering Peak and then flows in a south-south-west direction to Caro Swamp, from which it finds its way in a poorly defined channel southwards to the Moore River. There are also a number of poorly defined and insignificant watercourses which, flowing westwards, supply the swamps of the next zone.

(c) *Swamp Zone.*—This zone is really the relatively low-lying western edge of the Sand Plain Zone and is occupied by an irregular chain of swamps and small lakes fed by the run-off from the sand plain to the east, the flow of which is retarded on its way to the sea by a belt of sandhills between the sand plain and the coast. The water from these swamps and small west-flowing streams, in its attempt to reach the ocean, has had to travel underground, with the result that in a number of places underground caverns have been formed. Examples of such are the Namban Caves and the Stockyard Gully Caves, both to the North of the area traversed by me. These are described by W. D. Campbell.* Although no actual openings were observed, the hollow sound caused by passing horses in some parts of the area traversed suggests that caves also exist further south, though perhaps without accessible openings.

(d) *Coastal Sandhill Zone.*—The Coastal Sandhill Zone lies parallel with the coast and extends inland for varying distances. The Eastern edge of the sandhills where they meet the Swamp Zone was observed to be at least six miles inland at Coonmadodo, a resting place for travellers and stock on the old coastal stock route, due west of Dandaragan.

The sandhills lie in long irregular lines with axes parallel to the coast and reach elevations as much as 200 to 250 feet above sea level. There are two types of sandhills. The older or mature sandhills are partially consolidated and bear a vegetation of low scrub and tuart trees. The younger or juvenile sandhills are composed entirely of loose wind blown beach sand and are obviously still in the process of formation. The older hills are sometimes partially covered by dunes of more recent age, which have buried trees and scrub in their advance inland. In other places the mature type of hill has been attacked afresh by the wind and the material forming it has been removed and redeposited as a juvenile sand dune on the leeward side of the mature dune, the position of the old dune being marked by scattered hillocks of partially consolidated sand in which the false bedding caused by wind transport is clearly visible.

*"The Irwin River Coalfield and the Adjacent Districts from Arrino to Northampton"; by W. D. Campbell, G.S.W.A. Bull. 38.

GEOLOGY.

The rocks underlying the area examined may be classified as follows:—

Pre-Cambrian—Granite, gneiss and metamorphosed sediments.
Jurassic—Sediments with plant remains and crystalline limestones.
Cretaceous—Sediments including chalk with marine fossils and coprolite beds.
Tertiary or Sub-Recent.—Coastal limestone series.
Recent.—Sand and ferruginous laterite (duricrust) and sand dunes.
Age Uncertain—Glacial deposits.

Pre-Cambrian.—Granites, gneisses and metamorphosed sediments. These rocks occupy the dissected tableland to the east of Moora, the sediments, consisting of quartzites lying on the granite, dip steeply to the west and with a general north-south strike make up the western edge of the tableland. These rocks are part of the main Pre-Cambrian complex of the interior and in the present investigation are of no value as the occurrence of oil of economic value in such rocks is impossible.

Jurassic.—Rocks definitely of Jurassic age were not seen to outcrop anywhere within the area traversed, but strata probably of this age were cut in a bore, 2,230 feet in depth, which was sunk near Moora in 1913 in search of artesian water. A collection of portions of the core from this bore, now in the Geological Survey Collection, was examined by the writer and the notes made combined with notes by T. Blatchford, late Government Geologist, and R. A. Farquharson, one time petrologist to the Geological Survey, give a fairly complete account of the strata pierced. The following log is a composite one made up from the three sources named above.

Log by Moora Bore (Loc. 1¼ miles West of Moora Township boundary.)

Depth, feet.	Description of Strata.
0-56	white gritty sandstone.
56-62	gritty ferruginous sandstone.
62-86	yellowish micaceous clay.
86-170	grey micaceous clay.
170-266	uncompacted green sand.
266-286	dark gritty sandstone with carbonaceous matter.
286-355	uncompacted grey grit.
355-360	grey carbonaceous mudstone.
360-408	uncompacted grey grit.
at 415	band of hard dark red claystone.
408-417	argillaceous grit with carbonaceous matter.
417-458	grey shale with abundant woody matter.
458-485	grey micaceous mudstone.
at 508	grey micaceous mudstone.
at 525	grey micaceous mudstone with little carbonaceous matter.
525-534	grey carbonaceous mudstone (well preserved plant remains).
534-575	grey micaceous mudstone with pyrites nodules.
575-587	buff-coloured mudstone.
587-595	dark grey, very gritty, mudstone or argillaceous grit.
595-609	light grey arenaceous mudstone.
609-632	grey mudstone (plant remains).
632-696	grey micaceous mudstone (plant remains).
665-698	mudstone (plant remains).
696-726	yellow and grey arenaceous mudstone with little carbonaceous matter.

Depth. feet.	Description of Strata.
726-817	light grey arenaceous mudstone.
817-840	dark arenaceous mudstone.
840-840.5	lignite band.
840.5-864	dark micaceous mudstone with carbonaceous matter.
864-999	dark grey carbonaceous shale.
999-1008	arenaceous mudstone.
1008-1080	dark grey carbonaceous mudstone.
1080-1103	dark grey mudstone with bands of lignite.
1103-1145	dark grey carbonaceous shale.
1145-1169	coarse grained greensand with pebbles of quartz and felspar.
1169-1195	grey arenaceous and micaceous shale (with plant remains).
at 1269	coarse grained compacted greensand with large pebbles of quartz and quartzite.
1269-1300	light grey mudstone.
at 1304	pyrite nodules.
1304-1325	dark grey calcareous shale or argillaceous limestone.
1325-1370	grey micaceous crystalline limestone.
1370-1423	micaceous shale.
1423-1428	hard calcareous shale with septarian nodules.
1428-1441	calcareous carbonaceous and micaceous shale.
1441-1490	micaceous shale.
1490-1518	dark grey argillaceous grit.
1518-1542	dark grey and buff micaceous shale.
1542-1549	micaceous arenaceous shale.
1549-1626	micaceous shale.
1626-1709	micaceous shale.
1709-1712	micaceous crystalline limestone.
1712-1733	micaceous shale.
1733-1754	arenaceous and carbonaceous mudstone.
1754-1840	shale.
1840-1876	grey micaceous shale.
1876-1876.5	argillaceous and carbonaceous limestone.
1876.5-1909	calcareous carbonaceous arenaceous mudstone.
1909-1917	hard micaceous argillaceous and calcareous grit.
1917-1925	grey micaceous shale.
1925-1940	grey gritty micaceous shale.
1940-1954	carbonaceous mudstone.
1954-1974	grey micaceous and carbonaceous shale.
1974-1978	grey crystalline limestone.
1978-1981	calcareous shale with carbonaceous bands.
1981-2028	poorly compacted light grey calcareous sandstone.
2028-2050	mudstone.
2050-2116	poorly compacted sandstone.
2116-2118	grey calcareous sandstone.
2118-2202	grey calcareous sandstone with bands of shale.
2202-2207	grey micaceous mudstone.
2207-2230	poorly compacted argillaceous and calcareous sandstone.

Portions of this bore core from depths of 800 and 900 feet and bearing plant impressions were submitted to the late Mr. R. Etheridge of the Australian Museum in 1914, who determined the impressions as Taeniopteris and Otozamites. Miss K. Prendergast of the University of W.A., has found Taenopteris and Stenopteris in the core from a depth of between 665 and 698 feet and Otozamites between 1,109 and 1,195 feet. The strata pierced by the bore between these depths is, therefore, considered to be fairly certainly of Jurassic age. An inspection of the log will show that carbonaceous matter is present throughout almost the whole of the strata pierced, pointing to a probable lacustrine origin for the sediments. Alternations in the conditions of sedimentation between lacustrine and marine are suggested by the presence of glauconitic greensands between 1,145 and 1,169 feet and at 1,269 feet, and by the bands of crystalline limestone cut in the lower part of the bore. It is noticeable also that a distinct change occurs at about 1,300 feet, the shales and sandstones below this depth being predominantly calcareous while those above are definitely non-calcareous.

Coarse and fine-grained sandstones and micaceous shales outcropping at Mt. Misery and in the lower beds exposed along the Dandaragan Scarp have not so far yielded any fossil evidence of their age. They are possibly the westward extension of the Jurassic beds cut by the Moora bore.

Cretaceous.—The beds exposed in the upper part of the Dandaragan Scarp and covering the greater part of the Dandaragan district consist of ferruginous sandstones, micaceous shales, marls, glauconitic greensands and chalk. Between the chalk and the underlying sandstone (glauconitic in part) there is a layer rich in phosphatic nodules or coprolites, and apatised wood. Some of the phosphate is in the form of dufrenite which has no doubt been formed by interaction with the iron contained in the adjacent rocks. An account* of the occurrence of phosphatic material in the Dandaragan district has been written by Dr. E. S. Simpson.

The age of the beds is definitely fixed by the fossil organisms found in the chalk. A collection from Round Hill on Mr. Robert's property, "Kyanaba," is listed† by L. Glauert and includes the following forms:—

PORIFERA.
CALISPONGIAE.

Pharetronidea :
Peronidella (?) globosa (Eth. fil.).
Porosphaera globularis (Phil.).

ECHINODERMATA.
ELEUTHEROZOA-ECHINOIDEA.
Endocyclica.

Family *Cidaridae :*
Cidaris spp.

PELMATOZOA-CRINOIDEA.

Family *Uintacrinidae :*
Uintacrinus sp.

Family *Marsupitidae :*
Marsupites sp.

ANNELIDA.
POLYCHAETA.
Cryptocephala-Sabelliformia.

Family *Serpulidae :*
Serpula ampullacea, Sby.

MOLLUSCOIDEA.
BRACHIOPODA.
Testicardines.

Family *Terebratulidae :*
Terebratulina ovata (Eth. fil.).
Magas mesembrinus (Eth. fil.).
Trigonosemus acanthodes (Eth. fil.).
Magadina cretacea (Eth. fil.).

MOLLUSCA.
PELECYPODA.
Prionodesmacea.

Family *Mytilidae :*
Mytilus piriformis (Eth. fil.).

Family *Aviculidae :*
Inoceramus sp.

Family *Ostreidae :*
Ostrea, spp.
Gryphaea vesicularis (Lamk.).

Family *Pectinidae :*
Pecten ? sp.
Camptonectes ellipticus (Eth. fil.).

CRUSTACEA.
CIRRIPEDIA-THORACICA.
Lepadomorpha.

Family *Scalpellidae :*
Calantica (Scillaelepas) ginginensis (Eth. fil.).

*"The Mineralogy of the Dandaragan District and its bearing on Pastures and Stock," by E. S. Simpson, D.Sc., B.E., F.A.C.I., Government Mineralogist and Analyst. Journal of Agric. of W.A., Vol. IX., Sept., 1932, pp. 420-431.

†A list of Western Australian fossils, by L. Glauert, F.G.S., G.S.W.A., Bull. 88, pp. 36-71.

These beds are, therefore, definitely linked with the Gingin Cretaceous beds, the fauna being similar in both cases.

On Mr. Bower's Block 284 at South Dandaragan the coprolite bed lies immediately under the chalk and is underlain in turn by a slightly calcareous hard brownish grey sandstone. Both the sandstone and the material of the coprolite bed when struck with a hammer or rubbed together emit a strong fetid odour, which the writer thought might have a bituminous origin.

Dr. Simpson, Government Mineralogist and Analyst, has reported on a sample of the sandstone as follows:—"The sample emitted an odour, resembling phosphoretted hydrogen, when two portions of the sandstone were rubbed together.

"When the sample was extracted with light petroleum spirit, it yielded a trace (0.005 per cent.) of clear wax-like extract.

"Subsequent treatment showed this extract to be unlike petroleum or its known residuums in chemical properties. It is apparently of vegetable origin.

"The sample contains 10.0 per cent. of phosphoric oxide (P_2O_5)."

Tertiary or Sub-recent.—The surface in the Swamp Zone and around the base of the sand dunes is covered by a calcareous capstone and the rounded upper ends of calcareous "nigger heads," similar to those found associated elsewhere on the coastal plain with the sub-recent coastal limestone series. No natural sections in this formation were seen during the traverse, but a description* of the coastal country further to the north and of the caves which occur there in the coastal limestone series, leaves no reason to believe that they are greater in age than Sub-Recent or Tertiary.

Recent.—Included under this heading is the surface sand which so effectively hides the underlying rocks both on the Moora-Dandaragan Plateau and on the sand plain west of Dandaragan. This sand is derived from the weathering *in situ* of the underlying sedimentary rocks. The higher parts of the two areas mentioned above are covered by a ferruginous laterite or duricrust which owes its origin to the decomposition of iron oxide from solutions drawn to the surface by capillarity.

The most recent deposits are the coastal sand dunes of obvious aeolian origin and still in the process of formation.

GLACIAL DEPOSITS.

An interesting discovery was made in the vicinity of Caro Homestead. No rock outcrops are visible, but on a low mound of loose yellow sand a number of rock fragments were picked up. These fragments include granite, various types of greenstone, quartz and quartzite and hard shale. They vary in size from that of a pea to lumps weighing several pounds and are entirely unsorted. The harder rocks are rounded or oval in shape with, in a few instances, doubtfully facetted faces. The softer fragments of shale have smooth faces, in which deep grooves, similar to ice scratches, are clearly visible. The presence of rock fragments of greatly varying size, and consisting of such a large mixture of rock types, together with the facetting and scratching on the softer specimens, all point to a glacial origin for this deposit. One angular fragment of glauconitic greensand with dufrenite, similar to the material occurring at Dandaragan, was included in the specimens obtained. This would suggest that the deposit was post-Cretaceous in age. It has been suggested to the writer by Professor E. de C. Clarke that this fragment may be a remnant of the Cretaceous beds which could originally have extended this far west and that, therefore, the pebbles showing glacial characteristics may be older than Cretaceous. On the other hand, moraine-like deposits, which appear to be of recent origin, have been noted by W. D. Campbell* near Mt. Hill in the Greenough District.

His description of the deposits is as follows:—

"These deposits at Mt. Hill consist of moraine-like lines of rocks arranged along the beds of the two gullies in the northern portion and heaps like terminal moraines. The blocks of rocks composing the heaps are of local origin and do not show any polishing or grooving, but are collected into these rows in a trough-like manner with a continuous lateral ridge like ordinary glacial moraines. Their regularity is far greater than would result from an adventitious gathering of fallen rocks and they have not been arranged by water, for the blocks are not sorted to size in beds nor are they mixed with gravel or sand. The bed of the gully is wholly filled by those rocks and there are numerous conical pits up to five feet diameter at the top and ranging to about three feet deep. The only explanation that appears to be able to account for these deposits is that of snow glaciation which was sufficiently solid to transport blocks of stone but not to groove them."

It therefore appears possible that the deposits at Caro may be of recent age and belong to the same period of glaciation that was responsible for the formation of the Mt. Hill moraines.

STRUCTURE.

The structural features of the area examined are clearly shown in the accompanying section from west of Walyering Peak to the east of Moora.

At Mt. Misery and Yandan Hill the Jurassic (?) sandstones and shales have a distinct dip to the east of between 3°—4°. The beds outcropping along the Dandaragan Scarp, in the lower sections exposed, probably of Jurassic age, and at the top definitely of Cretaceous age, appear generally to be horizontal, but in several places, particularly directly east of Mt. Misery, they have a distinct but low dip to the east.

The absence in the Moora Bore of any strata which can be correlated with the outcropping Cretaceous rocks of Dandaragan suggests that east of the Dandaragan Scarp the Cretaceous and possibly the Jurassic beds also are probably in a horizontal attitude. There is nothing to suggest an angular unconformity between these two series. The difference in the amount of dip between Mt. Misery and the Dandaragan Scarp is easily explained by folding.

The great depth of sedimentary rocks where pierced by the Moora Bore, so close to the Pre-Cambrian rocks to the east and without surface evidence of inclined strata beneath the Moora-Dandaragan Plateau, suggests that the junction of the sediments with the Pre-Cambrian igneous and metamorphic rocks may be along a line of north-south faulting as shown in the sections.

The writer is unable to agree with or see the necessity for a second fault to the east of Dandaragan as suggested by Mr. Blatchford in his section.† If there

*Campbell, W. D., Op. cit.

*Op. cit. p. 86.

†"The Possibility of Obtaining Artesian Water in the Vicinity of Moora," by T. Blatchford. G.S.W.A., Bull. 48, p. 56.

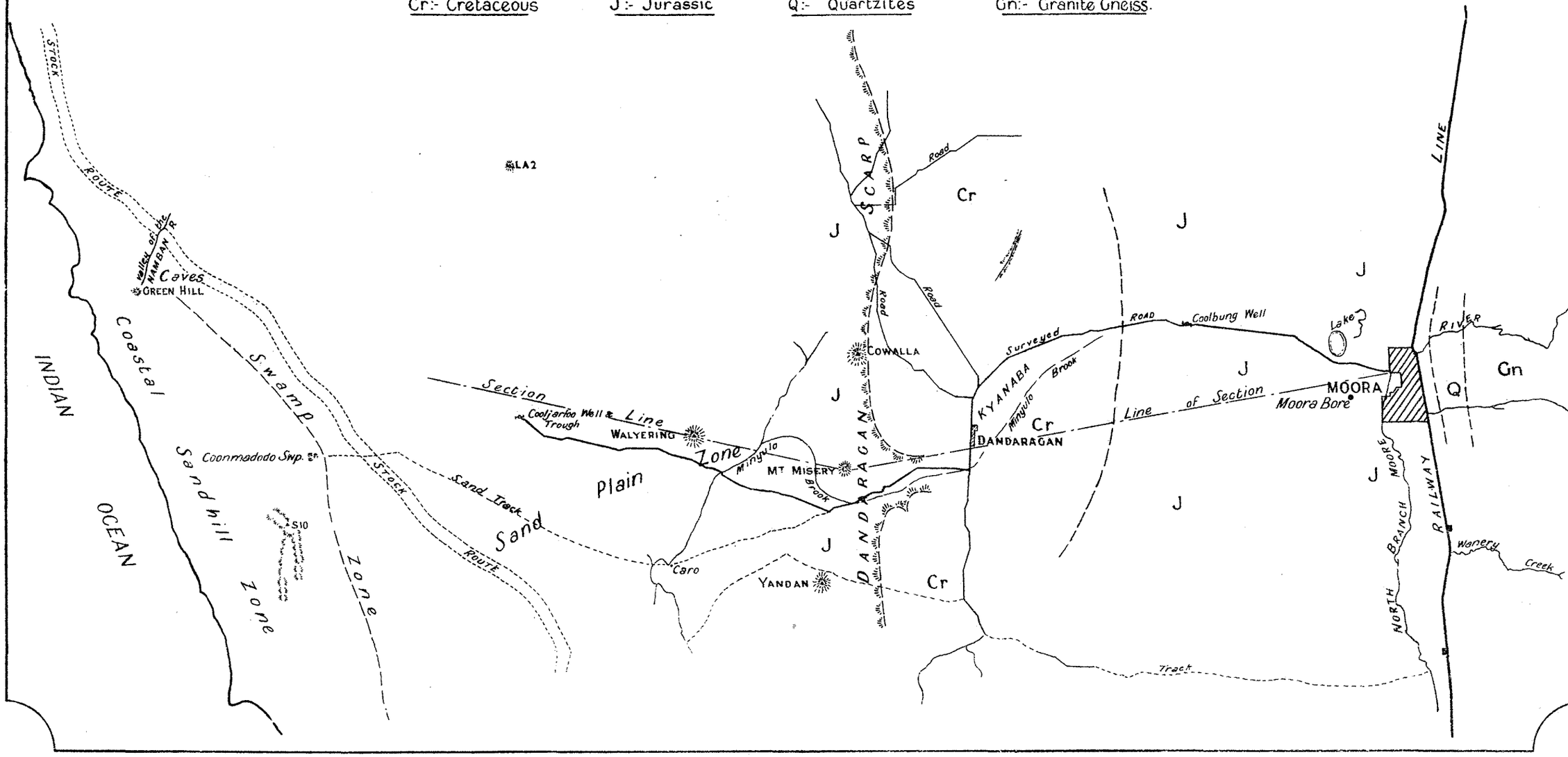
GEOLOGICAL SKETCH MAP

TO ACCOMPANY REPORT ON PART OF O.P.A. 253H NEAR DANDARAGAN, W. A.

Scale:- 300 Chains = 1 Inch

LEGEND

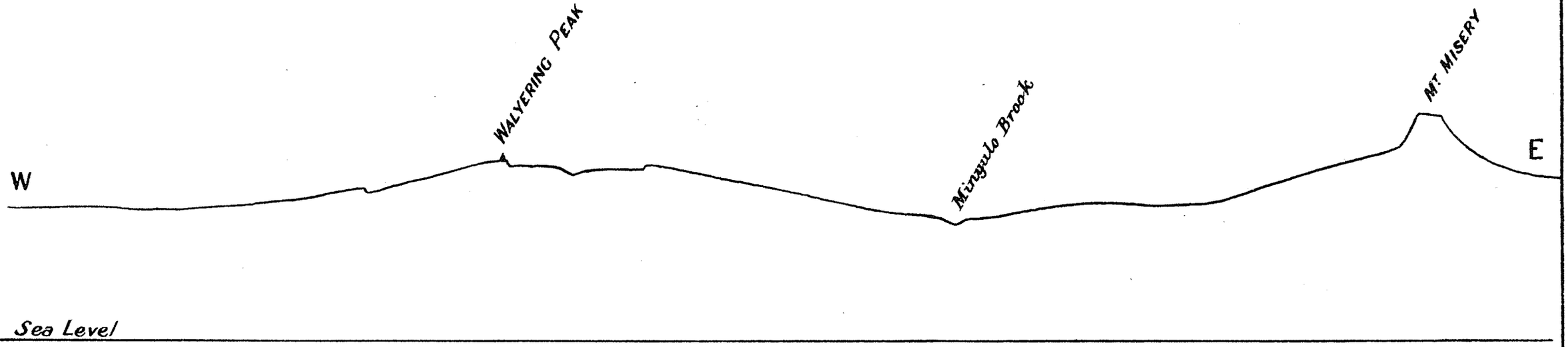
Cr:- Cretaceous J:- Jurassic Q:- Quartzites Gn:- Granite Gneiss.



SECTION THROUGH WALYERING PEAK AND Mt MISERY

SHOWING TOPOGRAPHICAL FEATURES MENTIONED IN TEXT

Scale:- Horizontal :- 1 mile = 1 Inch
Vertical :- 500 Feet = 1 Inch

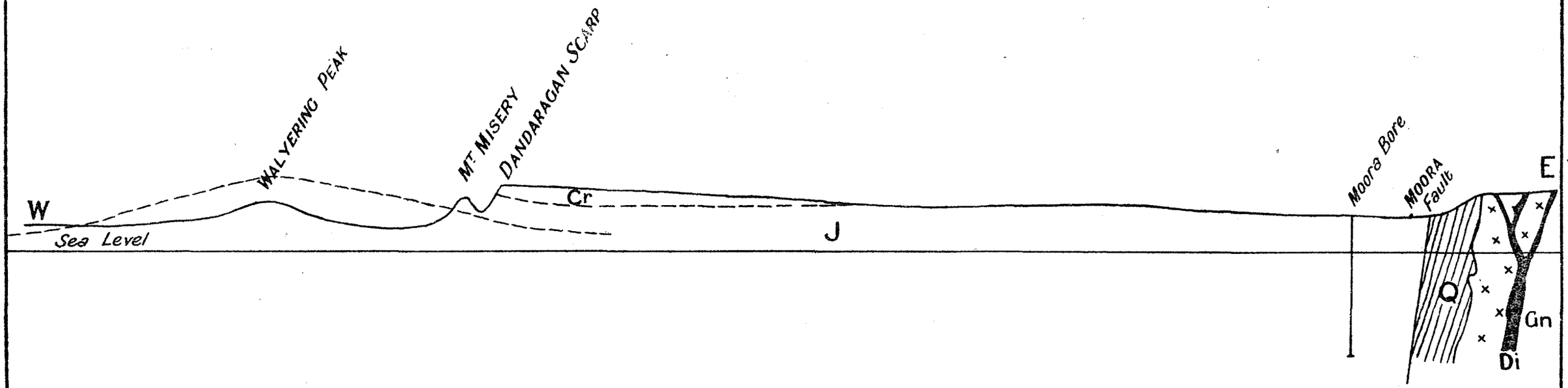


SECTION FROM WEST OF WALYERING PEAK TO MOORA

SHOWING STRUCTURAL FEATURES OF THE DISTRICT

Scale:- Horizontal :- 300 Chs. = 1 In.

Vertical :- 2000 Ft. = 1 In.



LEGEND

Cr:- Cretaceous Beds J:- Jurassic Beds Q:- Quartzites Gn:- Granite Di:- Greenstones

is a definite Dandaragan Ridge as suggested by Campbell and Blatchford, but which was not observed by the writer, it can best be explained by a normal erosion scarp in the soft Cretaceous beds which certainly do not extend eastwards to Moora.

The Dandaragan Scarp is considered to be a normal erosion scarp. Mt. Misery and Yandan Hill, both lying to the west of the Scarp, are suggestive of erosional outliers from the main mass, while the beds of which the upper part of Mt. Misery is made up are similar in all respects to the lower beds exposed in the main scarp. If there were a fault between the two with a downthrow to the west, one would expect to find Mt. Misery composed of Cretaceous or even younger rocks. There is nothing in the area to suggest this. In a report published by the writer in 1931* he suggested that the Poison Hill-Quinn's Pole Scarp, west of Gingin, which appears to be continuous with the Dandaragan Scarp was due to faulting, the evidence being the alignment with the main Darling Fault Scarp further south and the presence of a number of mound springs with a north and south alignment (roughly parallel with the scarp) on the sand plain to the west. The fact that the writer has since found that these springs do extend much further south, well out from the Darling Fault Scarp and apparently unconnected with faulting, and also the strong evidence obtained at Dandaragan lead him to alter his earlier views and to believe that the Dandaragan and the Poison Hill-Quinn's Pole Scarp are nothing more than normal features of erosion.

A striking feature in the sand plain and one which suggests reflected sub-surface structural conditions is seen in a mass of hills including Walyering Peak, about six miles west of Mt. Misery.

Viewed from some distance to the south the main hill is seen to be double-topped, Walyering Peak being the more westerly of the two, the other lying about 1¼ miles east being unnamed. There is a broad saddle between the two and the higher ground on both peaks is capped with duricrust. The striking feature of the peaks is that their outer slopes are gentle, conforming to the contour of the main hill while the slopes facing each other are steep and, although low, are of scarp-like appearance. The obvious easterly dip at Mt. Misery on the east and the appearance of dip slope topography in the two peaks themselves and in subsidiary hills on the western side of Walyering Peak suggests that the hills as a whole are a topographic reflection of a buried anticlinal structure. The features described above are illustrated in the accompanying sketch. From the top of Walyering Peak there is a similar suggestion of dip slopes to the south but to the north the hills run in irregular rolls as far as can be seen and further search to the north was not considered important until the suggestion of structure at the southern end was proved.

Owing to the complete mantling of the underlying rocks by loose sand and duricrust it was not possible on a reconnaissance to prove or disprove the presence of anticlinal conditions. It was noticed, however, that whereas most of the duricrust was of a coarse gritty nature and therefore formed in a sandstone or grit, there were fragments lying around the sides of the hills with a fine-grained laminated structure probably derived from a shale. It should, therefore, be possible by detailed survey with proper instruments to work out the structure of the underlying rocks.

*"Inspection of Gingin District for the Department of Agriculture," by F. G. Forman. G.S.W.A. Ann. Prog. Rep. for 1930, p. 8.

PETROLEUM PROSPECTS.

It can be said immediately that the area of igneous and metamorphic rocks of the interior tableland to the east of Moora is hopeless as regards petroleum prospects.

The presence of a supposed seepage of mineral oil in the coastal sandhills could not be confirmed owing to the failure of the original discoverer, Mr. Booter, to locate the occurrence. However, from his description and from my own observations of the locality it is highly improbable that an oil seepage exists.

The presence of a structure suitable for the retention of petroleum in commercial quantities in the vicinity of Walyering Peak can only be proved by detailed structural survey, assisted possibly by the sinking of shallow test pits or bore holes, by which to identify key horizons. Topographic suggestion of structure in this locality is certainly promising and justifies further work to supplement the at present meagre evidence.

As there are no naturally exposed sections in the area examined, very little of a definite nature can be said of the sub-surface formations. A study of the core from the Moora Bore leads one to expect that the sand plain country is underlain by strata of Jurassic age, which being predominantly argillaceous would serve well as cover rocks for the retention of petroleum.

The Jurassic strata are presumably underlain by rocks of Permo-Carboniferous age, by analogy with the Irwin River area further north where these two series are well exposed for study. Whether any of the Jurassic or Permo-Carboniferous strata are likely in the past to have been possible source rocks for petroleum the writer is unable to state, owing to insufficient personal knowledge of the areas in which these rocks outcrop.

Both the Jurassic and Permo-Carboniferous series where exposed to the north include porous beds suitable as reservoir rocks for the retention of oil, and there is little doubt that they should extend south under the area examined.

RECOMMENDATIONS.

If further work on the Dandaragan area is undertaken it must include not only the proving of the structure near Walyering Peak or the discovery of a suitable structure elsewhere, but a detailed examination of the large area of country to the north, where the rocks underlying the Dandaragan area presumably outcrop, with the object of deciding whether possible source rocks for the generation of petroleum are likely to exist.

Not until good structural conditions are found and the strata proved likely to be petroliferous, is further development of the area in any way justified.

PALMER'S FIND—YELLOWDINE, W.A.

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

LOCATION.

Palmer's Find is situated on a low rise on the western side of a salt lake about 8¾ miles S.S.E. of Yellowdine Siding on the Eastern Goldfields Railway, and about two miles east of the 8-mile peg on the road running south from Yellowdine to Parker's Range.

GEOLOGY.

The country rock in the vicinity of the find is a hornblende quartz schist, which is part of a long narrow band of basic rocks which extends southwards from the railway just east of Yellowdine.

The eastern boundary of the schists is hidden by the mud covered floor of the salt lake, but rocky headlines projecting into the lake east of the find indicate that the schists extend in this direction for at least a quarter of a mile.

To the west of the find, the rocks are hidden by a continuous soil covering, but the dark red loamy nature of the soil for some distance to the west, indicates that the schists extend in this direction, but for what distance is uncertain, as time did not permit of a search for the western boundary being made.

The light coloured sandy nature of the soil along the Parker's Range road between Yellowdine and the turn off to Palmer's Find, suggests in the vicinity, the presence of granite or some other rock of acid type.

The gold occurs in steeply inclined quartz reefs associated with pegmatite veins and small masses of granite, all of which are intrusive into the basic schists. The reefs strike north and south, but their dips are uncertain owing to the shattered condition of all the rocks near the surface, and the fact that the walls of the reefs have not been, at the present stage of development, anywhere definitely exposed.

THE REEFS.

At the time of my visit three quartz reefs were being developed, known as Whindfield's East, Whindfield's West and Egan's reefs. A fourth large composite reef of quartz and pegmatite forms the backbone of a low hill to the west of Whindfield's West reef. I was informed by Mr. Whindfield, senr., that low values occur in this reef.

WHINDFIELD'S EAST REEF.

This reef lies along the Western boundary of P.A. 3213 and is exposed in costeans over a length of about 300 feet, with a width of from 5 to 21 feet. At the Northern end of P.A. 3213 an open cut has exposed the reef for a length of 70 feet and a width of 16 feet, and high grade ore is being taken out.

Pan samples from various parts of the reef show good values, over 1 ounce to the ton. Assay results shown to me by the option holders, indicate that high values obtain over the full length of 300 feet at present exposed.

WHINDFIELD'S WEST REEF.

This reef on P.A. 3195 lies parallel to and about 60 feet west of Whindfield's East reef. It has been exposed in costeans showing high values for a length of 300 feet and has been developed by an open cut at its northern end for a length of about 60 feet. At the northern end of the cut the reef appears to be about six feet wide and makes a sharp bend to the east, towards Whindfield's East reef.

EGAN'S REEF.

This reef lies north of the other two on P.A. 3295. It outcrops for several hundred feet in length. It has been opened up at its southern end by an open cut over a width of nine feet, the stone to the bottom of the cut, 20 feet, all showing high values. Assay results shown to me by the option holders, indicate that the high values extend north of the open cut for a length of about 100 feet, north of which values are low.

The quartz in Egan's reef is characterised by a large amount of arsenopyrite which is spread throughout the stone. The quartz is pegmatitic in character, containing scattered crystals of felspar, while in places the quartz gradually merges into a typical pegmatite, though still carrying gold.

Granite and pegmatite are exposed on the surface on the eastern side of the reef from the open cut to a distance of about 100 feet to the north, and granite can be traced southwards to where it outcrops to the west of Whindfield's West reef. The impression I obtained was that Egan's reef is separated from the two southerly reefs by a continuous granite bar, but sufficient work has not yet been done to enable the true relationship of the three reefs to be stated with certainty.

CONCLUSION.

The even distribution of high values over a total length in the three reefs of 700 feet and the good width of the reefs make the find a most encouraging one, but the full extent of the discovery cannot be gauged until further work has been done.

Very few specimens were seen in which any free gold was visible, but all the stone tested gave uniformly high results when dollied, showing that the gold is evenly distributed through the body of the quartz, and is, therefore, not a product of secondary enrichment. The high values obtained at the surface can therefore be expected to continue with depth.

LODE MINING AT YINNIDING CREEK, TOODYAY DISTRICT.

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

At the time of Mr. Blatchford's last vist to the field, February, 1932, a considerable amount of prospecting had been done in shaft sinking, etc., but without success. The only appreciable amount of gold which had been obtained, apart from the alluvial in Yinniding Creek, were 20 ozs won from a narrow lens of quartz found by loaming up the side of the hill, but which was much broken and cut out completely.

Sclater's Workings (G.M.Ls. 11PP, 12PP, and 15PP).

The principal new workings are on G.M.L. 15PP, where an adit has been driven into the hill in a south-easterly direction for a distance of about 200 feet. An auriferous lode was cut in the adit workings 140 feet from the mouth, and this has been opened up by a south-west drive for a length of about 130 feet. The country rock exposed in the adit is a fine-grained light-coloured mica schist of sedimentary origin showing distinct bedding planes dipping to the south-east at an angle of 20 degrees. The lode formation on which the drive has been opened is a band of quartzite interbedded with the mica schist, and containing numerous veins and veinlets of iron-stained auriferous quartz running parallel to the bedding. The quartzite is usually hard and vitreous, but there

are occasional bands of very friable material which are easily crumbled in the hand and in places resemble loose quartz sand. The quartzite bands are occasionally drag folded, the attitude of the folds indicating the south-eastern limb of an anticline with a north-easterly pitch.

A section across the lode from footwall to hanging-wall is as follows:—Medium to fine-grained quartzite with numerous veins and veinlets of iron-stained auriferous quartz 4 feet, iron-stained micaceous knotted schist 2 feet, fine-grained quartzite 7 feet. The higher values are said to be found in the footwall section associated with the iron-stained quartz, while the knotted schist and the hanging-wall quartzite are said to carry occasional low values.

The footwall lode has been driven on for a distance of 130 feet on a bearing of 243 degrees magnetic, the full width (4 feet) of the lode being exposed. In the south-west face of the drive there is a sudden change in strike, the beds bending around to the east. This disturbance is probably a drag fold in the quartzites of greater magnitude than usual, and the lode will probably be found to resume its normal strike on the far side of the fold. Samples* for assay were obtained from two places across the lode, the results being as follows:—

Sample 1.—Ten feet back from south-west face of drive across the lode over a width of 4 feet; result, gold 16 dwts. 8 grains per ton.

Sample 2.—Twenty-six feet in from adit across the lode over a width of 4 feet; result, gold 9 dwts. 3 grains per ton.

No other samples for assay were taken, but a number of samples from various places along the drive were dollied on the spot and all showed good tails of gold in the dish.

On the hillside above the adit entrance there are two shafts about 70 feet apart and 20 feet vertical depth. These are said to have been on auriferous lode material in the bottom, and if so this must be a separate line from that worked from the adit, and would be cut at the level of the adit workings by extending the adit further south-east.

Fragments of quartz and quartzite, some carrying gold, can be followed along the hillside in a north-easterly direction from the vicinity of Sclater's adit on G.M.L. 15PP to near the north-eastern boundary of G.M.L. 12PP, a distance of about half a mile. At this point Mr. Sclater has obtained values in an outcrop of quartz and quartzite of similar appearance to the lode material in the adit workings, and at the time of my visit an underlay shaft following the dip of the lode had been sunk to a depth of about 20 feet.

Summary and Recommendations.

Quartz and quartzite fragments, some of which carry a little gold, can be traced through G.M.Ls. 11PP, 12PP, and 15PP, over a length of about half a mile.

On G.M.L. 15PP a quartzite lode has been opened up for a length of about 130 feet and a width of 4 feet showing promising values.

The lode found at a depth of 20 feet in the two shallow shafts above Sclater's adit is apparently a separate body from that worked from the adit and should be struck in the adit workings by further cross-cutting to the south-east.

Further prospecting of this find with the object of determining the length of the ore shoot and its character below the oxidised zone could be most easily carried out by putting down bore holes on the top of the laterite ridge south-east of Sclater's adit. At the same time such bore holes would reveal any other parallel ore bodies on the hanging-wall side of the known lode, and whose outcrop may be hidden by the laterite capping.

A valuable account of the geology and geography of the Jimperding area, including the area on Yinniding Creek where mining is at present being carried out, appears in the Journal of the Royal Society of W.A., Vol. XX., 1933-1934. This account, written by R. T. Prider, B.Sc. (Hons.), of the staff of the Department of Geology, University of Western Australia, is accompanied by a detailed map of the area, showing the boundaries of the old sedimentary rocks, which should be of interest and great value to prospectors.

*Subsequent detailed sampling by the State Mining Engineer, Mr. R. C. Wilson, gave consistently lower results than those obtained by the writer, the average of a number of samples giving 5.6 dwts for a width of 65 inches over a length of 85 feet.

THE LARKINVILLE GOLD-MINING CENTRE, COOLGARDIE GOLDFIELD.

(F. R. Feldtmann.)

INTRODUCTION.

Prior to the examination of the Larkinville area no geological work had been done in the Widgemooltha district, with the exception of a brief inspection of the Wannaway gold-mining centre by Mr. Blatchford in 1933, the nearest geological work being that by Honman south-west of Kambalda, the results of which were published in Bulletin 66, and that by Clarke around the St. Ives and Love's Find centres, published in Bulletin 90.

As the object of my visit was to examine briefly the gold occurrences of the centre and to give such advice as was possible to the prospectors, time did not permit a detailed geological survey of the centre and surrounding country. Mapping, for the purpose of elucidating the geological structure of the area, was therefore confined to the neighbourhood of the main group of leases, where most prospecting was being carried on, and to a small area around the Groundlark mine. In addition, the workings on Fleming's and Eastwood and Turner's P.As. were located.

My thanks are due to the leaseholders and prospectors of the centre, particularly to Messrs. Crawford and Pimley, the owners of the Groundlark, for the ready and generous assistance given during my examination.

GEOGRAPHY.

Location.—Larkinville gold-mining centre is situated in the Widgemooltha district of the Coolgardie Goldfield, nearly 39 miles south-east of Coolgardie and six miles north-west of Widgemooltha, as the crow flies, and 44½ miles from Coolgardie by rail. The post office and store, situated on the Skylark G.M.L. 5228, and approximately in the centre of the main mining area, is 2¾ miles north-east of the siding at the 396¼-mile peg on the Coolgardie-Esperance railway. The Groundlark G.M.L. 5236, at present the only producing mine in the area, is situated 1½ miles east-north-east of the siding and a trifle more than 1½ miles south of the post office.

A surveyed road, running in a general south-westerly direction, connects the old Coolgardie-Norseman road with the siding. This road passes to the south-east of the main mining area, and thence runs south to the Groundlark whence it runs south-west to the siding. A track to Logan's Find leaves the surveyed road 16 chains south of the Skylark, and runs north past the post office to the Coolgardie-Widgemooltha telegraph line. Another track runs east from the post office to the north-east corner of the Skylark, and then turns north to join the Coolgardie-Norseman road. This track is generally used instead of the surveyed road. A back track runs from the post office to the siding, west of the mining area.

Topography.—The country round Larkinville is irregularly undulating, but the ridges and hills are mostly of no great height, though fairly steep in places. The ridges are cut by narrow and, in places, steep gullies, and the individual hills and ridges are mostly separated by alluvial flats of varying width.

A ridge on which most of the mining area is situated, and which may be called the Larkinville ridge, runs practically due south from the northern end of the Skylark North G.M.L. 5240 to the northern end of the Groundlark, a distance of 1¾ miles. The northern portion of this ridge is fairly well defined, but it widens considerably and becomes less defined to the south. North of G.M.L. 5240 a narrow flat, used as a recreation ground, separates the ridge from what is evidently its extension northwards. The ridge is also broken at the southern end of the Skylark by a narrow alluvial gully running east.

Northwest of the surveyed road between the Groundlark and the siding are a number of hills higher and steeper than the Larkinville ridge, the most southerly and most prominent being a very steep but small hill rather more than a quarter of a mile north-north-east of the siding.

The drainage is in a general easterly direction towards Lake Lefroy, and most of the gullies run in this direction, but west of the northern portion of the main ridge a well defined alluvial gully, known as Matthew's Gully, runs due north towards the recreation ground flat.

The district is well timbered with salmon, gimlet, and other gums suitable for mining purposes.

Water is usually obtained by rail and cartage from Widgemooltha.

GEOLOGY.

General Statement.—The Larkinville mining area is situated in what is evidently the southerly extension of the greenstone belt shown by Honman* as starting approximately two miles east of Depot Hill and five miles north-west of Yilmia Trig., and running practically due south. This belt is bounded on the west by a belt of metamorphic rocks, shown as sediments on Honman's map, but probably also including remnants of the older volcanic series. On the east the greenstones are bounded partly by metamorphic rocks, and partly to the south by granite. The western boundary of the greenstone belt crosses the old Coolgardie-Norseman road between the 27 and 28-mile pegs, and lies about half way between the 28-mile peg and Spargo's Find. A strong outcrop of the greenstone was observed on the new road about a mile south-south-east of Spargo's. East of Spargo's the belt appears to be about a mile wide, but it widens considerably to the south. The width of the belt in the Larkinville area is unknown, but is probably several miles.

In the Larkinville area the greenstones range from ultrabasic to basic in composition, and consist of hornblendites and epidiorites derived from pyroxenites and dolerites or gabbros, the hornblendites apparently predominating. The greenstones are intruded by masses of biotite granite and by many smaller granitic dykes, including biotite granite, pegmatite, and aplite of greatly varying size. Other important geological features are relatively narrow bands striking nearly north and south of rocks of somewhat doubtful origin, including highly graphitic rocks—locally known as "blue lodes"—rocks somewhat resembling at the surface the jaspers of other mining centres, and fuchsite-quartz rocks. The jasperoid rocks are in places associated with the blue lodes, and the one band may consist at one place wholly of blue lode, at another of jasperoid material, and at other places of both. The blue lodes, however, predominate, and are fairly numerous in the main mining area. They are mostly of great length as compared with their width. They are somewhat irregular in strike, but the average strike is nearly due north. The dip is usually east at a very steep angle. Some carry a little gold, but not in payable quantities.

Only one band of the fuchsite-quartz rocks was observed. It appeared to be of considerable length and of greater width—fully 130 feet in places—than the blue lodes and jasperoid rocks, but its full extent could not be determined. It is associated with a band of the jasperoid rock.

Quartz reefs and veins are numerous in the area. They are usually lenticular in shape and of no great length. They vary considerably both in width and in strike and dip. On the whole a north-westerly strike appears to predominate, particularly among the auriferous reefs.

No ferruginous laterite similar to that capping the greenstones of many mining centres was observed, but veinlets of opaline or chalcedonic silica, apparently resulting from the decomposition of the ultrabasic rocks, are fairly common in places. Irregular veins of hard and apparently siliceous magnesite were observed in places in the oxidised rock, and in a few places fairly numerous fragments of magnesite were noticed on the surface particularly between the surveyed road and Mellor and Tierney's P.A.

The occurrence of fragments of magnesite and of opaline or chalcedonic quartz, together with a growth of ti-tree suggests the existence of small areas of serpentine.

The Hornblendites and Epidiorites.—The hornblendites and epidiorites of this centre appear to be variations of the one rock mass and to grade into each other. They are, with little doubt, of the same age as the younger greenstones of Kalgoorlie, and, in the hand specimen, bear some resemblance to the hornblendites and basic epidiorites of the North End, but they still more closely resemble the younger greenstones of some other centres, particularly those of Kunanalling. Outcrops are not

*Honman, C. S., The geology of the country south of Kalgoorlie: W.A. Geol. Survey Bull. 66, plate II., 1916.

uncommon, particularly on the higher ground, and most of these show comparatively little weathering. Completely oxidised rock was seen in only a few places, mostly in the immediate vicinity of the blue lodes and jasperoid rocks, and particularly on the eastern side of the main ridge of G.M.L. 5240. Exposures in potholes on the alluvial ground away from the blue lodes are relatively little weathered.

The rocks range from fairly pale greenish grey to dark grey in colour, and from very coarse to fairly fine in grain. Most of the hornblendites are of medium grain with occasional local developments of a very coarse grained facies in which the hornblende is largely arranged in rosettes or radiating sheaves of long needles. The rocks are mostly massive, but in places show a schistose structure in the immediate vicinity of the blue lodes and jasperoid rocks or along narrow shear zones containing quartz veins.

In section the hornblendites are seen to consist almost wholly of colourless magnesia-rich hornblende either in large or small prisms, large sheaves of needles, or in a confused mass of fairly fine sheaves. A trace of green hornblende is present in some, and some contain a little talc. Rutile grains are fairly numerous. The rocks also contain larger black grains, some of squarish outline and enclosed by a greenish halo, which may be chromite. A very few small felspars are occasionally present. Apatite is not uncommon.

With increasing proportions of felspar and a greater iron content in the original ferromagnesians the original pyroxenites passed into dolerites or gabbros now represented by the epidiorites, but in several of the specimens examined the felspars have been largely or wholly replaced by a mosaic of chalcedonic quartz, the lime and alumina having evidently been taken up by the hornblende during uralitisation. The hornblende is a pleochroic yellowish or brownish to bluish green variety, occurring as ragged and broken prisms or as acicular wisps and sheaves. Rutile is present in most of the specimens examined.

The rock from the outcrop on the road south-south-east of Spargo's is very similar to the Larkinville epidiorites. It is a fine-grained dark greenish grey rock showing small needles of actinolite in the hand specimen. In section it is seen to consist of numerous finely acicular wisps and prisms of pale yellowish green to bluish-green hornblende, some arranged in aggregates suggesting their derivation from larger crystals. The ground now largely consists of chalcedonic quartz mosaic with an occasional trace of felspar. Fairly numerous and small grains of rutile are present in the rock, which is typical epidiorite with little doubt derived from a medium grained gabbro or dolerite of the younger greenstone series.

The Blue Lodes and Jasperoid Rocks.—These rocks are described together because of their similar mode of occurrence, their common association in the field, and because their origin may, in part, be similar. As already stated, a band which consists at the surface wholly of blue lode in one place may in another consist wholly or partly of jasperoid quartz or of bleached schist with bands of white, grey, or iron-stained cherty quartz. The width of the bands ranges approximately from 2 to 22 feet. Eleven bands consisting wholly or mainly of blue lode were observed in the main mining area, and others may exist under the alluvial areas. Some of the bands could not be traced for any distance, but others are of considerable length. Two bands were also observed in and north of the Groundlark. In addition a prominent band consisting mainly of jasperoid material with subordinate graphitic rock, and flanked by weathered and bleached schist with cherty lenses, occurs on a low rise in the eastern portion of the Skylark and a somewhat similar band, possibly the northern continuation of the first, outcrops on the rising ground in P.A. 3367, north of the recreation ground. What is probably the widest and one of the longest bands of jasperoid rock outcrops at the south-west corner of P.A. 3423, west of the fuchsite-quartz rock. Its probable southern extension (not shown on the map) was observed some distance north-west of Mellor and Tierney's P.A. This band more nearly approaches in appearance the jaspers of other mining centres, but the banding is not so marked and the rock consists almost wholly of quartz with but little iron oxide.

The most prominent blue lodes are two forming the backbone of the northern portion of the Larkinville ridge and one on the eastern flank of the ridge in G.M.Ls. 5228 and 5240, and two in the western portion of G.M.L. 5234. The more westerly of these two last was traced north and south of G.M.L. 5234 for a total distance of about three-quarters of a mile, and it may be much longer.

In appearance the blue lodes range from highly graphitic dark neutral grey, almost black, compact fine-grained rocks showing only faint traces of banding, the bands being in places marked by broken films of a white mineral to more noticeably and evenly banded paler grey rocks, the bands being about one-tenth of an inch thick and alternately fairly pale grey and somewhat darker neutral grey in colour. In addition to the banding a finely schistose structure is noticeable in the paler rocks, the planes of schistosity cutting across the banding at an angle of about 30 degrees. In most of the exposures the banding is practically straight and parallel, but in places, for example on the low rise in the eastern portion of the Skylark, the rocks show a finely crumpled and contorted banding.

A specimen from a costean on the Skylark G.M.L. 5228, about 500 feet south of the north boundary, is typical of the nearly black, highly graphitic rocks. A section of the rock shows, under the microscope, a few threadlike bands or small lenticular areas of paler material, but most of the slide is entirely obscured by a dense mass of minute black grains of scales of graphite. Traces of felspars are visible in the pale bands, but these are largely obscured by kaolin. A few grains of rutile occur in the pale areas. Analysis of the rock shows that a large amount of felspar, mostly albite, is present. The percentage of graphite in the rock is exceedingly high. Analyses of this and of a fuchsite-quartz rock are given at the end of this report.

A specimen from a band a few feet east of the west boundary of G.M.L. 5240 is not quite so highly graphitic as the last, and is more distinctly banded. Some of the bands are a little paler, and consist of slightly coarser material than the bulk of the rock. In the section the darker portion is again

almost obscured by graphite, but a little felspar and much kaolinic material appear to be present as well as a number of minute scales of white mica arranged with their longer axes parallel and making a small angle with the banding of the rock. The coarser paler areas consist mainly of somewhat larger flakes of mica with a little felspar and kaolin, and a smaller proportion of graphite. A little rutile is present in the rock. The absence of potash from the analysis of the previous rock suggests that the mica present in these rocks is not sericite, but the soda-bearing variety paragonite.

A specimen from a point about 50 feet north of the south-east corner of G.M.L. 5240 is typical of the paler banded rock. The section shows the paler bands to consist of a fine-grained confused mass of felspar, kaolin, and white mica, thinly studded with minute grains of rutile and of a black mineral that is doubtless graphite. A few small indistinct quartz grains and small areas of quartz mosaic are also present. Under polarised light the paler bands present the appearance of a sea of indistinctly outlined albite in which are floating small flakes of mica. The darker bands consist of similar material, but appear to be more highly kaolinised and to contain less mica, and graphite is present in greater proportion. In places the graphite and kaolin are more thickly segregated in shapes suggesting former larger crystals.

No definite examples of the blue lodes were seen underground. In the south-west shaft on G.M.L. 5240 a crosscut east, in completely oxidised rock at a depth of 14 feet, cuts what is probably the line of a blue lode exposed 35 feet south in a pothole on the southern boundary of the lease. Except for rather indistinct banding and slightly paler colour, the rock differs little in appearance from the enclosing country. On the dump of the deep shaft on P.A. 3467, near the west boundary of the Groundlark, and approximately on the line of a jasperoid blue lode outcropping on P.A. 3660 to the north, a few fragments of a peculiar gritty friable fine-grained grey rock were noticed associated with fragments of a fine-grained biotite granite and weathered hornblendite or epidiorite. A specimen of this rock consists mainly of fairly fine-grained grey rock showing numerous small flakes of biotite, and containing small lenticular and rather indefinitely outlined thin bands of almost black, very fine-grained, apparently graphitic, material. In section the paler portion of the rock is seen to consist of very numerous scattered grains and granular areas of brownish green hornblende; numerous, but fewer, small flakes of reddish to yellowish brown biotite; a few small angular grains of quartz and a moderate amount of chalcedonic quartz mosaic, and possibly a little felspar. Unfortunately none of the fine-grained graphitic material appeared on the slide. The appearance of the fragments suggests that an older fine-grained rock has been caught up and partly absorbed by the hornblendite, and the composite rock later metamorphosed by the granitic intrusion.

Regarding the origin of the graphitic and jasperoid rocks, apart from the question of the source of the graphite and silica which are separate problems, three alternatives suggest themselves: either the rocks represent shear zones in the hornblendites and epidiorites along which the graphite or silica, or both, have been deposited, or they are altered remnants of older rocks, either true erosion sediments of rocks of the old volcanic series into which the hornblendites and epidiorites are intrusive. In considering the origin of the rocks it should be remembered that the specimens described are from outcrops that have undergone a considerable amount of weathering and kaolinisation. That the blue lodes are older than the granite dykes is evident from the fact that in the southern portion of G.M.L. 5228, two of the bars have been cut by two wide granite dykes, and can be traced not only north and south of the dykes, but also between the two dykes, although no trace could be found in the dykes themselves. Also in P.A. 3367 a pegmatite dyke can be seen to cut through the jasperoid bar.

The general appearance, structure, grain size, and mineral composition of the blue lodes differ from those of the greenstones, sheared forms of which can be seen in places near the blue lodes in G.M.Ls. 5228 and 5240, and the banding, which is probably original, is clearly older than the schistosity. Again, although the rocks have a slaty appearance, and the banding suggests a sedimentary origin, the mineral composition, particularly the quantity of albite present, is not characteristic of an altered true sediment. The rocks might be of the adinole type, representing shales that were albitised during the intrusion of the greenstones, but the composition of the latter rocks indicates that relatively little soda was present in the greenstone magma. The evidence, therefore, appears to favour the third alternative, namely, that the rocks represent altered remnants of the older volcanic series, the slaty appearance, banding, fine grain, and the finely contorted structure in places, suggesting sedimentary tuffs.

The association of graphitic schists and jaspers with tuffs and fine-grained agglomerates of the old volcanic series is very noticeable at other localities in the Coolgardie and East Coolgardie Goldfields, for example, near Mt. Hunt, south of the Boulder Belt where they occur in tuffs interbedded with fine-grained agglomerates and lavas of the older greenstone series; at Kunanalling, where graphitic schists occur in remnants of tuffs enclosed in hornblendite; near Black Flag, where both graphitic schist and highly siliceous jaspers occur in bedded tuffs intruded by porphyrite; and at Bulong, where they are associated with tuffs interbedded with agglomerates.

The source of the graphite is as yet uncertain. There is little doubt that it arose from an igneous magma. The occurrence of graphite along fault planes at Tyndall's Mine,* near Coolgardie, and on the hanging wall of the Brownhill-Oroya shoot at Kalgoorlie suggest that it was deposited subsequently to the intrusion of the younger greenstones, but these occurrences may be due to secondary concentration of the graphite. At Kalgoorlie it is associated with dykes of albite porphyry, but no dykes of this type were seen in the Larkinville area. It is clearly older than the Larkinville granite. A possible explanation is that the carbon was deposited from emanations from the volcanic magma.

*Blatchford, T., Burbanks and Londonderry Mining Centres: W.A. Geol. Survey Bull. 53, pp. 21, 22, 1913.

Some of the outcrops of hornblendite near the blue lodes are elongated parallel to the strike of the latter, suggesting that their shape was influenced by the bedding of the older rocks.

The bleached schist, bordering the blue lodes, in places may be either a sheared and weathered form of the intrusive greenstones or may be composite in character representing older rocks which have been partly absorbed by the younger greenstones.

A band of bleached schist striking east was observed a short distance east of the south-west corner of G.M.L. 5232, and immediately north of the south boundary. This band is west and on the line of the largest granite dyke in G.M.Ls. 5228 and 5232, which was doubtless responsible for the unusual strike of the schist. The schist is of finer grain than usual, and may be a remnant of the older rocks, but was too weathered for determination.

Another possible remnant is a peculiar small bare conical hill, locally known as "The Volcano," a short distance north-west of Mellor's P.A. The character and structure of the rock comprising the hill is entirely obscured by fragments of completely weathered rock, but the hill is quite different in appearance from any other seen in the district.

The Fuchsite-Quartz Rock.—The best exposures of this rock are in costeans and potholes near the south-west corner of P.A. 3423, east of a well-defined band of jasperoid rock at the head of the south-east branch of Matthew's Gully. The width exposed is about 130 feet, but the total width may be considerably greater. Fragments of contorted jasperoid quartz, containing quartz veinlets and thin broken darker bands with fuchsite, and intruded by granite were noticed some 500 or 600 feet farther north, and fuchsite was observed in the southerly extension of the jasperoid band, north-west of Mellor and Tierney's P.A., indicating that the fuchsite rock may extend over a length of more than half a mile.

The best specimens were obtained from a costean about 60 feet south of the south-west corner of P.A. 3423. They consist mostly of finely-banded highly siliceous emerald-green rock, the banding planes being marked by broken threadlike veinlets of fuchsite. Veinlets of white quartz occur in some of the specimens. Numerous small white specks, the shape of which suggest felspar crystals, show up on the surface of the fuchsitic planes.

Some of the rock is of a very pale greenish grey colour, and appears to be more finely banded. It contains less fuchsite and more of the decomposed white mineral, as well as of a dark reddish-brown iron ore associated with quartz veinlets.

Sections show the bright green rocks to consist mainly of a fairly coarse mosaic of interlocking plates of clear quartz of varying size. A considerable amount of pleochroic emerald-green or pea-green to sky-blue fuchsite, in large and small flakes, is present mostly arranged in broken lines, but in places as individual flakes or a mass of minute scales separating the quartz plates. Fairly numerous small highly refracting grains of a rich brown colour are probably rutile, although no titanium is shown in the analysis which is of a different specimen from those sectioned. One specimen contains a large number of grains of pale pink garnet and another shows a fair amount of brown iron ore mostly as a staining. Practically all the minerals show a linear arrangement.

A specimen of the fuchsite rock at its contact with a granite dyke contains, in addition to the fuchsite and quartz plates of the usual type, flakes of biotite and a number of felspars showing fine microcline twinning as well as a few larger quartz plates of a granitic type and unlike those of the normal fuchsite rock.

The fuchsite-quartz rocks are possibly of mixed origin. The fine banding is very similar to that of the blue lodes and jasperoid rocks and suggests that the rocks may have been either silicified acid tuffs or quartzites recrystallized during the intrusion of the greenstones. The chromium of the fuchsite may have been derived from the hornblendites, as analyses of the Kalgoorlie rocks show that the more basic members of the younger greenstone series contain a much higher percentage of chromium than the older greenstones. The formation of the fuchsite may be due to contact metamorphism, as it is suggested by the presence of garnet in one of the specimens. Granitic dykes are numerous in the vicinity of the rocks, and intrude them in places.

The Granite and Granitic Dykes.—A large mass of fairly fine-grained biotite granite occupies the north-eastern half and also the southernmost portion of the Groundlark and extends for a very considerable but undertermined distance to the east and south.

Granitic dykes are exceedingly numerous in the district. They range in width from two inches up to 200 feet, but most are between a foot and 20 feet in width. The largest and some of the smaller dykes consist of biotite granite of fairly fine grain, but most of the dykes of moderate width are either fairly typical pegmatites or coarse-grained pegmatitic aplites. The pegmatitic dykes are mostly highly felspathic but a few of the smallest consist mainly of quartz with a little felspar and may pass into typical quartz veins. Some very thin dykes of typical fine-grained aplite also occur. The pegmatites contain, as a rule, very little mica and that is mostly biotite.

In addition to the probable genetic connection of the gold-bearing reefs and veins with the granitic magma, and the intimate association of granitic dykes with most of the reefs, the granitic dykes are further connected with the gold deposits in that the larger dykes appear to have determined the positions of most of the alluvial gullies running east. Spargo's Gully starts near the western boundary of the Skylark, near the middle of the wider of the two large granite dykes near the southern boundary of the lease. The Half Mile and Mad Mile gullies, crossing the surveyed road, are underlain by large granite and pegmatite dykes; and a watercourse, along the eastern portion of which an alluvial deposit has been worked in and east of the Groundlark, starts near the north-west corner of that lease at the western extremity of a broad tongue of granite.

Some of the larger dykes are irregular in shape and split into a number of branches, but the smaller dykes are more even in width and more regular in strike. Most of the dykes strike approximately east but a few north of the Groundlark strike nearly north-west, and a very few, including a large granite dyke west of the Groundlark, strike approximately

north, parallel to the blue lodes, among them being a very narrow but persistent aplite dyke west of the blue lodes in the Skylark. In the few places where the dip of the east-striking dykes could be determined it was north at varying angles. The small aplite dyke on the Skylark dips east, mostly at about 60 to 65 degrees, and that is approximately the dip of the other north and south dykes exposed.

The pegmatites and pegmatitic aplites are mostly coarse-grained white rocks. In some the felspar is mainly microcline with a little albite. In others albite is the principal felspar, a little orthoclase being also present in places. Quartz is usually present in much smaller quantities than the felspar but the proportion varies. Some of the dykes contain a small amount of biotite, others a trace of muscovite in very small scales. Very few accessory minerals appear to be present. Small quantities of tourmaline were noticed in three of the smaller dykes but there appears to be little chance of finding the rarer minerals such as are associated with the pegmatites of the Coolgardie district.

Fragments of a dyke of unusual type were obtained from the dump of the deep shaft on P.A. 3467, west of the Groundlark, associated with fragments of hornblendite and graphitic rock. The dyke was stated to enter the shaft at a depth of 60 feet and to dip sharply east. It consists of a fine-grained white rock with very numerous and fairly evenly distributed minute scales of biotite containing eye-shaped or lenticular inclusions composed of small scales of almost black biotite. The inclusions are mostly between half an inch and 1½ inches in length. In section the rock is seen to consist of large plates of microcline and a few smaller felspars showing carlsbad and albite twinning, and numerous flakes of pleochroic golden brown to dark greenish brown biotite. A very little quartz is present as small grains between the felspar plates. The biotite inclusions probably represent fragments of the hornblendite caught up in the dyke and altered by contact metamorphism, and the biotite in the rock itself, which was noticed to be more thickly disseminated near the inclusions was probably formed from completely assimilated hornblendite.

Shearing and Faulting.—As already stated, except in the vicinity of the blue lodes and some of the granitic dykes, the rocks are but little sheared. The shearing probably took place during and immediately after the intrusion of the granite but prior to the formation of the quartz veins.

One of the few defined shear zones observed in the hornblendites is situated in the Skylark lease from about 40 to 60 feet west of the more westerly blue lode, to which it is approximately parallel. It could be traced to 750 feet north of the south boundary of the lease. Farther north the line may be occupied by a buck reef which can be traced from about 310 feet south of the north boundary of the lease to that boundary. The shear zone is mostly between 4 and 10 feet in width and dips east at about 80 degrees. It consists of actinolitic schist with glassy quartz veins of a pegmatitic type—felspar being observed in one of the veins, and carries a little gold but not in payable quantities. For nearly 100 feet north of the more northerly of the two large granite dykes near the south boundary of the lease, the line of the shear zone is wholly or partly occupied by a small granitic dyke, and between and south of the two large dykes it is occupied by a band of jasperoid or cherty quartz. The shear zone is probably due to later shearing along the northern extension of a line of weakness formed by a narrow band of the older rocks.

The ore shoot in Eastwood and Turner's P.A., north of the siding, occurs in a narrow well-defined shear zone striking about north 5 degrees west and dipping east at about 85 degrees. It contains a few small lenticular stringers of pegmatite and quartz. It is definitely younger than the granitic dykes as it cuts through a pegmatite dyke, 3 feet wide, north of the shoot.

The few faults observed are all small. They appeared to range in strike from north-west to north-east. The dip could be observed only in two cases, where it was in a northerly direction at fairly steep angles. Three apparent faults affect the blue lodes and jasperoid rocks, one opposite the new shaft on the Skylark, another about 130 feet south-east of the south-west corner of the Skylark and the third and largest in Spargo's Gully in G.M.L. 5231, from about 220 feet to 240 feet east of the south-east corner of the Skylark. As in each case the outcrops were partly obscured by rock debris, soil, or alluvium, it could not be determined definitely whether the displacement was due to faults or dragfolds. In Spargo's Gully the blue lode has been displaced horizontally about 14 feet, apparently along a fault striking north-east, but owing to the covering of alluvium the supposed fault plane could not be seen.

The faults are younger than the aplite dykes and auriferous quartz reefs as definite fault planes were seen to cut both.

THE GOLD DEPOSITS.

Introductory Remarks.—Larkinville centre has hitherto been noteworthy rather for the large alluvial nuggets it has produced—including Western Australia's largest nugget, the Golden Eagle—than for its auriferous reefs. The centre has been the scene of two alluvial rushes, the "Lakeside Woodline rush" in 1919—not to be confused with the earlier "Woodline rush" North of Bulong—and the more recent rush in 1930. The site of the first rush was stated to be about 200 yards east of Hehir's original P.A., evidently on the ground applied for by Messrs. Crawford and Pimley as G.M.L. 5234.

The later discovery was made in May, 1930, when, being aware of the previous discovery of gold at the centre, Messrs. M. Larkin, P. V. and J. Hehir, and W. H. Matthiessen, backed by Messrs. Crawford and Pimley of Carbine, were prospecting in the district. Good loams were obtained on the ground first pegged as a prospecting area by P. V. Hehir and afterwards applied for by him as G.M.L. 5240.

As a result of the discovery others hastened to the centre and Inspector Rockett, who visited the centre on the 13th June, reported that 17 prospecting areas had been pegged. Clough's reef on the Groundlark, rather more than 1½ miles south of Hehir's find was discovered shortly after. Early in October of the same year two alluvial slugs of 26¾ ounces and 10 ounces were discovered by M. Larkin about 200 feet N.W. of the S.E. corner of Hehir's P.A. The discovery gave further impetus to prospecting and early in November it was reported that 125 men where on the field. By the end of the year several large slugs, including one of 70 ounces, had been found. The now famous Golden Eagle nugget, the largest yet

found in Western Australia, was found by James Joseph Larkin, junr., on the 15th January, 1931. The nugget, which when first weighed at the Bank of Australasia in Kalgoorlie, weighed 1,135 ounces 15 dwts., and weighed 1,134 ounces 12 dwts. when handed to the Mint and contained 947.39 ounces of fine gold, was found about 18 inches below the surface, on the eastern slope of the main ridge, about 379 feet N. of E. from the S.W. corner of Hehir's P.A. and about 90 feet N. of the S. boundary. The Golden Eagle was bought by the Western Australian Government for £5,438 and after exhibition at various towns both in this State and in the Eastern States was finally disposed of to the Royal Mint for £6,520, including £2,413 premium.

The more intense prospecting of the district by a large number of men—one estimate stating that as many as 700 were on the field in February—led to the discovery of other alluvial gullies between the main centre and the siding in 1931.

The total amount of alluvial gold obtained from Larkinville is unknown and it is probable that much was not reported to the Mines Department. In a report dated 19th January, 1931, Inspector Winzar stated that at a rough estimate £7,000 worth of gold had been found on Hehir's P.A. and something over £1,000 worth from the run on Crawford's lease. By the end of February, at least 2,065 ounces of gold had been obtained in large slugs alone from the run on Hehir's P.A., now know as Eagle Gully, and, taking the other gullies, about which little information is available, into consideration, the amount of alluvial gold obtained must have been very considerable.

The main alluvial gullies are now practically worked out, although a few small pieces of gold may be picked up from time to time. At the time of my visit several old-age pensioners were still working in Spargo's Gully, but very little gold was being obtained.

The Alluvial Deposits.—The principal alluvial gullies are Eagle Gully in the south-eastern portion of G.M.L. 5240; Crawford's Gully in the southern portion of G.M.L. 5234; Spargo's Gully in the southern portions of G.M.Ls. 5228 and 5231; Matthews' Gully, west of G.M.L. 5232 (afterwards P.A. 3494) and P.A. 3423; the Half-Mile Gully about on the southern boundaries of former P.As. 2562 (Fox's) and 2609 (Kirk's); the Mad Mile Gully immediately south of the Half-Mile, of which it is practically the southern extension; a narow gully running through the eastern portion of the Groundlark G.M.L. 5236 and extending for some distance east; and Specimen Patch, the exact position of which was not determined but which is probably nearly three-quarters of a mile north-east of the siding.

With the exception of Matthews' Gully and Specimen Patch, all the gullies are situated on the eastern side of the main ridge and mostly run nearly due east. Eagle Gully starts in an easterly direction but after a short distance turns and runs north. Matthews' Gully, which runs north, is situated west of the main ridge, between it and another lower ridge to the west. Specimen Patch is situated on the north-western side of the complex of hills north-west of the surveyed road between the siding and the Groundlark.

As already stated, the positions of Spargo's, the Half-Mile, and the Mad Mile gullies were determined by the presence of large granitic dykes striking east, and the gully on the Groundlark lies along a watercourse which starts near the western end of a broad tongue of granite.

No well-defined wash in the form of round pebbles, such as characterises typical alluvial leads, was seen in any of the gullies the material consisting usually of a foot to three feet of soil underlain to various depths, but seldom to a total depth of more than four feet, by soil containing very small fragments of travertine, ironstone gravel, or weathered hornblendite. Where the underlying rock is granite, the upper layer of soil usually rests directly on the granite, though in a few places soil with travertine nodules separates the two. In the deeper ground of Eagle, Crawford's and Spargo's gullies the surface soil and fragmental layer, when present, are underlain by a darker red, more clayey soil.

The gold found in the gullies was stated to be mostly coarse, very little fine gold being obtained.

The Eagle Gully lead started near the head of a small watercourse, now more or less obliterated by the alluvial workings. The head of the watercourse is a few feet north of the south boundary of the Skylark North G.M.L. 5240 and about half-way between the south-west shaft on the lease and the backbone of the main ridge. The lead apparently ran slightly north of east for a short distance and then joined an alluvial channel running north from the eastern portion of the Skylark. The Golden Eagle was the westernmost nugget found and the other nuggets and slugs of fair size were distributed along a broad band running north-east from the site of the Eagle and extending over a length of about 400 feet, the nearest being one of 71 ozs. found about 80 feet E.N.E. of the Eagle. Other than the Eagle, the largest nugget was one of 113 ozs., found rather more than 200 feet N.E. of the Eagle. Apparently the only slug of any size found away from the main run was one of 13 ozs. picked up at a point about 580 feet N. of the south-east corner of the lease and about 270 feet from the nearest slug of any size in the main run.

Regarding the origin and source of the nuggets: Either they were formed by the secondary precipitation *in situ* from surface solutions of gold dissolved out of primary deposits, or they resulted from the weathering and disintegration of primary deposits carrying rich patches. The Golden Eagle was relatively thin as compared with its length and breadth, one side being slightly convex, the other concave. Part of the concave side was distinctly striated suggesting that it had been deposited in a schist lode or shear zone along which movement had taken place prior to its deposition. It is said to have been coated in places by a film of black, probably graphitic, material similar to that of the blue lodes, but this may have been of secondary origin as similar films were observed in cracks and on joint planes in the weathered hornblendite in the vicinity. The slugs found in Specimen Patch are said to have had fragments of quartz adhering to them and those found in Spargo's and Matthews' Gullies are said to have been associated with fragments of chocolate-brown to black iron ore similar to that of an outcrop, a few feet in length, seen immediately north-east of the south-east branch of Matthews' Gully. A characteristic feature of some of the ore bodies of the Larkinville area is that they contain very small and very rich patches carrying rough gold similar to that of the slugs and nuggets, a good

example being the ore pipe in Eastwood and Turner's P.A., and there appears to be little doubt that the nuggets and slugs of the Larkinville area were directly derived by weathering and disintegration from rich patches similar to those found *in situ* in some of the ore bodies.

As regards the actual source or sources of the nuggets of Eagle Gully, photographs of some of the nuggets—the Golden Eagle was the only nugget actually seen by me—show that they had suffered some attrition, the edges and protuberances being somewhat rounded, but so heavy a mass as the Golden Eagle could hardly have been transported any distance by running water, although it may have been displaced laterally through the removal of the underlying material if lying on a steep slope. When the original deposition of the gold took place the Larkinville ridge was doubtless very much higher than it is now and the shoots of which the nuggets formed parts may have been situated hundreds of feet above the present surface of the ground. If the original slope was steep and remained so during the wearing away of the ridge, the distance the nugget was transported would largely depend on the height of its original position above the present surface. It might therefore have come from a shoot associated with, or in the vicinity of, any one of the three blue lodes situated west of where it was found, though it is least likely to have been associated with the main and most westerly band. Whether any rich patches yet remain in the original vein or ore-pipe is open to doubt.

The 71 ounce nugget picked up on Brown's alluvial claim about 80 feet E.N.E. of the Eagle, and some of the smaller slugs found farther E.N.E. may have come from the same ore-pipe, but the 113 ounce and 66 ounce nuggets found on McWhinney's claim, and others E.N.E. of them are more likely to have come from a separate ore-pipe north or north-east of that of the Eagle. The distance over which the nuggets were spread suggests that their original position was considerably higher than the present surface of the ridge.

Crawford's Gully is situated within the area applied for by Messrs. Crawford and Pimley as the Skylark Extended G.M.L. 5234, east of and adjoining G.M.L. 5240. It starts immediately east of a small low rise on which the north-east peg of G.M.L. 5228 is situated. The deeper ground occupies the southern portion of the dryblown area. The site of the earlier Lakeside Woodline rush was in this gully. Little information is available as to the gold picked up, but, as already mentioned, Inspector Winzar's report of 19th January, 1931 stated that something over £1,000 worth of gold had been found in this gully and that quite a lot of ground remained to be worked. A slug of 20 ozs., found a short distance south-east of Crawford and Pimley's camp, is stated to have been the largest nugget obtained, and one of 10 ozs. was found near the eastern boundary of the leases. Most of the gold obtained appears to have been in small pieces. The original source of the 20 oz. nugget may have been near the blue lodes which run through the small rise on the western boundary of the lease and in the vicinity of which small dykes of pegmititic aplite were observed. Like the main ridge, the rise which is now only a few feet above the level of the alluvial ground was probably much higher when the gold was deposited and no rich patches may be left in the veins or ore-pipes from which the gold was shed. The 10 oz. nugget probably came from a different ore body. No information was obtained as to what material, if any, was adhering to the slugs when found.

Spargo's Gully runs through the southern portions of the Skylark G.M.L. 5228 and the Skylark East G.M.L. 5231. The head of the gully is situated in a low saddle separating the northern portion of the main ridge from the larger and higher portion south of G.M.L. 5228 and is about 80 feet west of the west boundary of that lease. The westernmost porton of the gully is underlain by the eastern half of the more northerly and widest of the two large granite dykes striking east, the alluvium consisting of about 15 inches to 3 feet of soil resting directly on the granite. Other smaller dykes underlie the gully in places, including one, striking diagonally to the gully, exposed in the workings immediately east of the east boundary of G.M.L. 5228, and a blue lode, apparently faulted, crosses the gully between 217 feet and 241 feet east of the south-east corner of that lease. The alluvium overlying the granitic dykes is shallower than that overlying the hornblendite, and where dykes crossed the gully below the source of the gold the slugs would probably be caught on the upstream sides of the dykes. In the eastern half of G.M.L. 5231 the gully is flanked by wide flats and its boundaries are ill-defined The main workings in this gully extend from about 135 feet east of the west boundary of G.M.L. 5228 to about 200 feet east of the east boundary of G.M.L. 5231, a distance of 26 chains, but the gold was said to have been practically restricted to that portion of the gully between the old road to the Groundlark, about 180 feet west of the east boundary of G.M.L. 5228, and a point about 300 feet east of that boundary. As already mentioned, the gold was said to have been associated with fragments of dark brown iron ore. The south-western portion of a small granitic dyke striking north-east and dipping north-west probably underlies the gully near the western limit of the auriferous portion, and the shoot from which the gold was derived may have been associated with, or in the vicinity of, this dyke.

The main line of workings does not penetrate the deepest portion of the gully. A pothole, a few feet north of the main workings and about 65 feet east of the bend in the main road to the Groundlark, has penetrated the alluvium, it was said, to a depth of about 10 feet, only six feet of which was visible when examined. The soil and lower layer of soil with small fragments of cement and ironstone are here underlain by dark red clayey material. Hornblendite, shelving steeply to the east-north-east, is visible near the bottom of the south-west end of the hole. Another large pothole from 20 to 35 feet north-east is evidently in shallower ground, and therefore appears to be a deep gutter close to the north-east end of the first pothole. Two other potholes apparently in deep ground lie about 40 feet and 90 feet, respectively, E.S.E. of the first hole. The gold found in the gully is said to have been mostly associated with the fragmental layer, and the potholes mentioned are all west—the easternmost

immediately west—of the western limit of the auriferous portion of the gully, nevertheless it is possible that gold may be found on the floor of the gutter if the original source of the slugs lay to the west of the point previously suggested as a possible source.

A little gold was obtained from a small north-west branch of this gully between the main road to the Groundlark and the back road to the siding and in consequence of this the southernmost (No. 1) shaft in G.M.L. 5228 was sunk above the branch on the crest of the ridge, but no payable deposit was found.

Unlike the other gullies, Matthews' Gully runs due north. The northern portion lies immediately west of the west boundary of the former Skylark West G.M.L. 5232. The head of the main gully is approximately 20 chains south of the south-west corner of that lease but a narrow branch extends south-east for about 400 feet, from a point about 950 feet south of the corner. The workings extend from the head of the gully to about 600 feet S.S.W. of the north-west corner of G.M.L. 5232, a total distance of 33 chains. The quantity of gold obtained from this gully is unknown, but the slugs appear to have been mostly small and restricted to the portion south of G.M.L. 5232, and particularly to the upper half of the gully between the fork and G.M.L. 5232. I was informed that the largest slug was one of 9½ ounces, obtained about 50 feet N.W. of the junction of the main workings with those of the south-east branch. Other slugs of 5 ounces 14 dwts. and 4½ ounces were obtained close to the largest slug. One slug of 5 ounces 16 dwts. was said to have been obtained about half way up the south-east branch and the source of the slugs may therefore have been near the head of this branch and near the western edge of the band of fuchsite rock which is here intruded by several granite dykes.

The Half-Mile and Mad Mile gullies were not examined in detail. As stated, they are practically one gully in which the gold was apparently distributed over a fairly wide area, but no information was obtained as to the size and distribution of the slugs. The northern edge of the workings crosses the surveyed road about 18 chains south of the angle in the road where it is joined by the road from the post office. The southern side is about 30 chains south of the angle. The alluvial workings extend for a considerable distance east and west of the road. The alluvium is underlain by large granite and pegmatite dykes. The source of the gold was probably in the vicinity of the granite dykes on the eastern slope of the main ride near the head of the gully.

Time did not permit an examination of Specimen Patch, situated on the north-west side of the complex hills between the siding and the Groundlark and north-east of Eastwood and Turner's P.A. The slugs picked up in this gully are said to have had fragments of quartz adhering to them indicating their derivation from a quartz reef or vein. The ground at the head of the gully was being prospected by James Cuthbert who stated that he had obtained gold in loams in the vicinity of a granite dyke.

The auriferous reefs and other ore bodies.—Quartz reefs and veins constitute most of the primary ore bodies of the area. Others include bands of fractured hornblendite or epidiorite carrying an irregular network of quartz veinlets; pipelike ore bodies in shear zones, containing very small rich patches; and thin veinlike bands of altered hornblendite in the vicinity of pegmatite dykes. With the exception of the last, the gold is associated with quartz in all the ore bodies examined. In places the weathered hornblendite is said to carry a little gold but this probably of secondary origin. The ore bodies are characterised by the small size and richness of the shoots, some of which are too small to be dignified by that name. The only reef so far discovered in which gold is distributed practically throughout, though richer in some parts than in others, is the main reef in the Groundlark.

Another noticeable feature is the close association of the deposits with granite dykes. The main reef in the Groundlark is partly in, partly on the walls of, a granite dyke. Some, for example those in Demorest's and Mellor's P.As. and a reef in the Groundlark, are on the footwall sides of pegmatite dykes. Others, such as Eastwood and Turner's ore body near the siding and a vein of altered hornblendite in Moore's P.A., cross pegmatite dykes nearly at right angles. The reefs, such as those in and south of Sudlow's P.A. and a reef in F. Lindsay's P.A. north of the Groundlark, which were not observed to be actually in contact with dykes are probably in the immediate vicinity of them. The close association of the reefs with the granitic dykes and the fact that a small aplite dyke in the Skylark carries gold in places points to the derivation of the gold-bearing solutions from the granitic magma.

The auriferous reefs and veins are mostly of no great length and vary considerably in strike and dip. The strike ranges from about N. 20° W. to a few degrees north of west and the auriferous quartz has evidently been deposited along lines of fracture with a strike about midway between that of the blue lodes and that of the main granite dykes. The quartz veins in the shear zone striking east of north, west of the blue lodes in G.M.L. 5228, are of a pegmatitic type and do not appear to carry gold.

The reefs in and south of Sudlow's P.A. mostly dip south-west at about 40°. That in Demorest's P.A. dips south-east at about 65°. The previously mentioned reef in F. Lindsay's P.A., which is very similar to Demorest's in appearance, dips east-north-east at about 88°. Two reefs in the Groundlark, south-east of the main reef, strike about west-north-west and dip steeply south-south-west but the main reef, which strikes more nearly west, dips north at angles ranging from about 48° to 66°.

The quartz of the auriferous reefs and veins appears to be of two types, both differing from the pale grey translucent quartz of the reefs of pegmatitic character. Some of the reefs, including those in and near Sudlow's P.A., are composed of clean white quartz. They have fairly well-defined walls, and one in Sudlow's P.A. is said to carry a little chromate of lead. Others, including Demorest's and that of F. Lindsay's P.A. are composed of translucent, glassy, colourless, white, or amber coloured much fractured quartz containing, in places, clusters of small rosettes of tremolite and occasional small vughs lined with chalcedony. The walls of these reefs are less defined than those of the first type and the quartz near the edges contains irregular veinlike inclusions of tremolite rock. The quartz composing the veinlets and lenses associated with the other auriferous deposits

is mostly similar to that of the second type of reef, but in a few it appears to be of a chalcedonic character.

The leases and prospecting areas.—The northernmost area being worked during my examination of the district was J. Moore's P.A. 3367, north of and adjoining G.M.L. 5240. It is practically identical with former P.A. 2529 taken up by R. Clough. The southern portion of the area covers an alluvial flat without rock outcrops, used as a recreation ground. The northern portion covers the southern end of a low hill on the line of the main ridge.

A jasperoid band from about 7 to 10 feet in width runs slightly west of north through the southern portion of the hill. Near the crest of the hill its place appears to be taken by a shear zone with quartz veins. This jasperoid band may be the northern extension of the band composed in part of blue lode, in part of schist with jasperoid and cherty quartz, which runs through the eastern portion of G.M.L. 5228, about halfway between the main road and the eastern boundary of the lease.

Four dykes of pegmatite or pegmatitic aplite were observed in this P.A. Three strike nearly due east. The fourth, which was traced over a distance of about 10 chains and has a maximum width of about 16 feet, strikes east-north-east and dips steeply north-north-west.

There are three shafts on the ground. The middle shaft, 22 feet in depth, is on the hanging wall side of the long pegmatite dyke. The gold occurs in a peculiar narrow veinlike formation, about two inches in width, striking approximately east-north-east and dipping steeply east-south-east, which cuts the pegmatite dyke. In and near the dyke this vein appears to consist mainly of dark greenish to brownish grey biotite. The pegmatite close to the vein carries much tourmaline in places and in others grades into quartz with veinlets of felspar. Some pale pink garnets, probably spessartite, were observed in a fragment of highly biotitic rock, associated with pegmatite and probably representing hornblendite partly assimilated by the pegmatite. What appears to be the same vein as that in the middle shaft cuts through the south shaft about 40 feet south-south-west. Here it is enclosed by hornblendite and consists of altered hornblendite with much tourmaline. The vein evidently represents a fracture, formed immediately after the intrusion of the pegmatite, along which boric vapours or solutions, probably carrying gold, made their way. The vein as a whole is too small and does not appear to carry sufficient gold to be worked profitably, but it is possible that a rich patch may occur at its junction with the pegmatite and particularly on the footwall side of the dyke.

The third shaft is approximately 280 feet north of the middle shaft. It is weathered hornblendite which was said to have a trace of gold, probably derived from a vein in the vicinity.

Further prospecting might be done in this P.A. The vicinity of the junction of the shear zone carrying quartz veins with the two more northerly pegmatite dykes is worth testing.

Sudlow's P.A. 3395 is situated south-east of P.A. 3367, but is separated from it by a narrow strip of ground. It is situated on the flat north-north-east of Eagle Gully and the northern end of the alluvial workings occupies the south-west corner of the area. The track to the Coolgardie-Norseman road runs through the middle of the area.

Two blue lodes which are the northern extension of those in the western portion of G.M.L. 5234 run through P.A. 3395 between the track and the west boundary. There are seven shafts in the area, of which three are on the more westerly blue lode. I am unaware whether any gold was found in these shafts, which were sunk by previous holders of the ground. Another shaft, about 20 feet south-east of the middle shaft on the blue lode is on a quartz reef striking approximately west-north-west and dipping south-south-west at about 40 degrees. The reef which averages eight or nine inches in width was evidently unpayable in the shaft, but if it crosses the blue lode the gold content might improve on the western side of the lode.

The two most southerly shafts are on a quartz reef striking approximately north 25 degrees west, and dipping west-south-west at about 40 degrees. The reef, which is about a foot in width, is situated between the two blue lodes. The gold content is variable, but on the average appears to be low, though occasional good prospects were obtained in panning off. Estimation of the gold content in the dish was said to be difficult owing to the presence of chromate of lead. The more northerly of the two shafts on this reef was about 20 feet deep. The reef was cut at about 10 feet and was followed for about 18 feet on the underlay. The reef has not been traced any distance north and south of the two shafts at the surface, and further trenching might be done in both directions. Much of this area is obscured by surface soil, but further prospecting might reveal other auriferous reefs.

The ground applied for by Messrs. Crawford and Pimley as the Skylark Extended G.M.L. 5234 is situated south of P.A. 3395, and south-east of G.M.L. 5240. Crawford's Gully runs through the southern portion of the lease. The more easterly of the previously mentioned blue lodes runs through the western portion of the lease from about 100 feet east of the west boundary near the southern end of the lease to about 250 feet east at the northern end. The more westerly blue lode crosses the west boundary about 270 feet north of the north-east corner of G.M.L. 5228. Other shorter blue lodes are situated a few feet east of the last, and two others east of the more easterly hitherto mentioned have been cut in long costeans in the south-west portion of the lease.

Two small dykes of pegmatitic aplite, with somewhat tortuous strike averaging approximately north-west, were also cut in the costeans between the two groups of blue lodes, and fragments of similar dykes, the outcrops of which were obscured, were observed on the alluvial dumps some distance east of the blue lodes.

There are three long costeans, at an average distance of about 60 feet apart, in the south-west portion of the lease. The northern costean is nearly 300 feet long, the others about 130 feet. Nothing payable was found in the costeans though traces of quartz were observed about 30 feet from the eastern end of the southern costean, and also in two places in the northern costean, one in the middle, the other close to the eastern end. Work was being done in a shaft close to the northern boundary of the lease on a quartz reef striking west-

north-west and dipping south-south-west. The reef had been followed in a trench, and in a second shaft, up to the more easterly of the two main blue lodes, but though it carries gold a payable shoot has not so far been discovered.

Further work on the quartz veins cut in the costeans might possibly reveal small patches of payable ore.

The Skylark East G.M.L. 5231, now abandoned, is situated south of G.M.L. 5234 and south-east of G.M.L. 5228. The eastern portion of Spargo's Gully runs through the southern portion of the lease. Most of the lease is situated on a soil flat with few outcrops, and other than the alluvial work, but little prospecting has been done.

The most promising locality for further prospecting is in the south-west corner of the lease in which is the southern extension of the blue lode-jasperoid band running through the eastern portion of G.M.L. 5228, and in which there are also a number of small pegmatite dykes.

The Skylark North G.M.L. 5240 covers P. V. Hehir's original P.A. Together with G.M.L. 5228 to the south, it is held by Messrs. Larkin, Hehir Bros., and Demorest. It is situated on the northern end of the main ridge, the backbone of which, marked by a prominent blue lode, flanked in places by cherty schist, in the southern half of the leases, is situated between about 100 to 160 feet east of the west boundary. The eastern half of the lease is on alluvial ground, and the main portion of Eagle Gully is situated in the south-eastern portion of the lease. The track to Logan's Find runs north through the middle of the lease.

This lease, together with G.M.L. 5228 to the south, was under option to the Western Mining Corporation, who sank three costeans on the backbone of the ridge at 112 feet, 312 feet, and 512 feet north of the south boundary, samples being taken for assay at five feet intervals. Although practically all the samples assayed were said to carry a little gold, nothing payable was discovered, the highest assay obtained being one of 1.83 dwts. from the western portion of the northernmost costean, and apparently from an incipiently schistose band of coarse-grained hornblendite about three feet in width.

A little gold was found in a small open cut 560 feet north of the south boundary of the lease, and about 30 feet east of the northern end of the outcrop of the main blue lode. The cut is in oxidised hornblendite carrying a few threadlike stringers of opaline quartz, but no defined formation likely to carry payable gold was found.

Two other blue lodes are situated respectively about 110 feet and 150 feet east of the main band.

Two shafts have been sunk in the southern portion of the lease, the more southerly, which is 14 feet deep, being situated from 35 to 40 feet north of the south boundary and a few feet west of the eastern blue lode. A crosscut cuts what is apparently the downward extension of the blue lode from 6 to 12 feet east of the shaft.

The second shaft, 60 feet north-east of the first and a few feet south-west of the site of the Golden Eagle, was put down in the hope of discovering the shoot or vein from which the Eagle was shed. The shaft and the workings therefrom are in oxidised hornblendite in which are shear or joint planes marked by small veins of chalcedonic quartz. A little gold occurs in one of these veins which dips east at a flat angle, but no payable ore has so far been located. Further prospecting was being done from this shaft by Messrs. Larkin and J. Hehir.

The Skylark G.M.L. 5228, south of G.M.L. 5240 and the first lease taken up at the centre, was also under option to the Western Mining Corporation who sank four costeans along the backbone of the main ridge in the northern portion of the lease in addition to two costeans previously sunk farther south by the holders of the lease.

A low saddle, occupied by the western end of Spargo's Gully, separates the northern portion of the main ridge from the main portion, in the southern portion of the lease, in which there are also several granite and pegmatite dykes mostly situated north of the main workings in Spargo's Gully, in addition to the large granite dyke in which the head of the gully is situated.

The main blue lode which forms the backbone of the ridge in the Skylark North bends slightly east going south, and in the middle of the Skylark the backbone is occupied by another band, from about 40 to 80 feet west of the first, composed of blue lode flanked by schist with cherty quartz. A small but persistent aplite dyke, mostly five or six inches in width and dipping east at about 65 degrees, is situated on the average about 25 feet west of this last blue lode. The dyke is said to carry visible gold in places and a shaft was being sunk by Messrs. P. V. Hehir and Demorest on the hanging wall side of the dyke at a point about 680 feet north of the south boundary. Some small quartz veins on the hanging wall side of the dyke also carry gold in places. About 120 feet south of the shaft and immediately south of a quartz blow about 8 feet wide the aplite dyke apparently splits into two branches which diverge slightly going south. A shaft has been sunk on each of the branches, that on the western branch at 464 feet and that on the eastern branch (No. 1 shaft) at 483 feet north of the south boundary. The deepest shaft on the lease is No. 2 shaft, 38 feet in depth, situated 514 feet north of the south boundary and immediately east of the eastern branch of the dyke. No payable ore body has so far been found either in the shafts or in the costeans although most of the rock exposed in both appears to carry a little gold. The highest assay obtained was one of 2 dwts. from the middle of the southernmost costean apparently from a narrow band of silicified schist between the two branches of the aplite dyke.

In the north-west portion of the lease a white quartz reef from 1 to 4 feet in width can be traced south for more than 300 feet from a point 50 feet east of the north-west corner. No work has been done on this reef which is of a "bucky" appearance and unlikely to carry gold in payable quantities. A lenticular vein, up to 6 inches in width, of translucent quartz with a pale greenish tinge, exposed in a trench from 312 feet to 332 feet south of the north boundary and a few feet south-west of the southernmost exposure of the buck reef, is of rather more promising appearance. It is associated with a narrow vertical shear zone which might be found to carry gold in places.

Several reefs up to about two feet in width are exposed in potholes near the eastern boundary in the north-east portion of the lease but all are of a bucky type.

The chances of finding a payable ore body in this lease do not appear to be very great. As already stated, none has been exposed in the shafts and costeans. The costeans, however, were sunk presumably with the hope of finding a payable body of sufficient length and width to be worked by a company, and apart from the auriferous reefs, the ore bodies of this centre are very small and not easily detected and might easily be missed in systematic costeaning. Probably the best place for further prospecting, preferably by systematic loaming, would be the vicinity of the smaller granitic dykes in the Eastern portion of the lease north of Spargo's Gully.

Demorest's P.A. 3423 is south of and adjoining G.M.L. 5228, but the north-west and north-east stakes are situated respectively 140 feet west of the south-west and southern corners of G.M.L. 5228 and the longer boundaries run in a south-westerly direction. A large granite dyke, up to about 90 feet in width, on which the south-west corner of G.M.L. 5228 is situated, runs through the northern portion of the area, splitting up into a number of branches in the north-eastern portion. Other smaller granitic dykes occur, including a series of somewhat irregular dykes with general easterly strike near the middle of the area. The band of fuchsite-quartz rock is exposed near the south-west corner and appears to extend for a considerable distance north.

A lenticular quartz reef exposed in an open cut from about 260 feet to 280 feet E.S.E. of the south-west corner of G.M.L. 5228, appears, next to the main reef of the Groundlark, to be the most promising so far discovered in the Larkinville district. The reef, which consists of glassy somewhat fractured quartz mostly white or colourless but stained amber-colour in places, strikes approximately north-west and dips north-east at about 65°. The walls are somewhat irregular and in places near the edges the reef includes fragments of hornblendite. The reef is exposed for a length of about 26 feet in the open cut. The maximum width exposed is four feet, but at both ends of the cut the width is only one foot and no quartz is visible in a costean 30 feet N.W. of the cut. In the southern portion of the cut the reefs has been followed to a vertical depth of 11 feet. It appeared to be widening underfoot. None of the quartz had been crushed at the time of my examination. The gold content is evidently irregular and most of the gold may occur in small shoots, but some of the quartz is very rich and much coarse gold was visible in some of the stone bagged. A pegmatite dyke about two inches in width lies on the hanging wall side of the reef in the open cut but dips slightly more flatly north-east.

The reef is worthy of further development, even if the shoot cuts out underfoot.

The Groundlark G.M.L. 5236, 1½ miles N.E. of the siding is held by Messrs. Crawford and Pimley and the executors of the late R. Clough. The southern, eastern, and most of the northern boundaries of the lease are on an irregular mass of granite extending a considerable distance to the east and south. The rest of the lease is in hornblendite.

The granite on the northern boundary forms a broad tongue, the western end of which appears to be about 70 feet east of the north-west corner of the lease.

The main reef is situated in the hornblendite area in the western portion of the lease about 130 feet S.W. of the south-western edge of the granite tongue. It is associated with a granite dyke from about 2½ to 8 feet in width, occurring in places on the footwall, in places on the hanging wall side of the dyke. The mean strike of the dyke and reef is nearly due east but they curve considerably near the eastern side of the westernmost open cut, the convex side of the curve facing north. The dip is north at angles ranging from about 48° to 66°. The reef, which can be traced for a distance of about 180 feet, has been worked in three open cuts and from a shaft about 30 feet west of the westernmost cut and about 55 feet east of the west boundary of the lease. The shaft is vertical to a depth of 22½ feet from the surface, at which depth it cut the reef which was then followed on the underlay. For about 18 feet below the vertical portion of the shaft, the dip of the reef was 48°, but it gradually steepened below to about 66° near the bottom of the shaft at a vertical depth of about 57 feet. A drive east from the bottom of the shaft connects with the workings from the open cuts and a drive also extends west for about 28 feet from the centre of the shaft. In the face of the west drive the reef appears to bend south and end on a shear striking north and dipping west at about 75°.

The reef has not been found west of the shear and its existence to the west is doubtful but it would be advisable to follow the shear south to see whether the reef crosses it or no. As the shear dips west, the extent of the reef westward should increase with the depth.

The width of the reef varies considerably. The maximum width is about 7 feet, a few feet east of the bottom of the shaft.

A little work has been done on two other reefs on the lease, situated east-south-east of the main reef. The more westerly of the two strikes approximately north-west and dips south-west but curves somewhat. It is about 3 feet in width and is on the footwall side of a pegmatite dyke from 4 to 6 inches in width. The reef has been worked in a shaft and small open cut. The second reef about 100 feet east of the first, strikes about N. 60° W. and dips south-south-west. It has been worked in a shaft about 20 feet deep. A crushing of 20 tons from this reef is said to have averaged 8 dwts.

Returns for the lease show that 984.5 tons of ore have been crushed for a total of 1,754.05 fine ozs. of gold, an average of 1.78 fine ozs. per ton.

I. Lindsay's P.A. 3467 is situated west of and adjoining the Groundlark. It is mainly in massive hornblendite, but a large granite dyke from about 20 to 40 feet in width runs north, through the eastern portion of the area, from the main granite mass near the south-west corner of the Groundlark. The dyke is about 16 chains long.

There are six shafts in the northern half of the area, all situated near the eastern boundary. The southernmost shaft, 95 feet in depth, is one of the deepest on the Larkinville area. It was sunk in the hope of cutting the western extension of the Groundlark main reef, but without success, although if the reef extends west of the shear zone previously men-

tioned it should have been cut in this shaft. The shaft cuts through a dyke of fine-grained biotitic granite, already described, at a depth, it was said, of about 60 feet and through altered biotitic hornblendite carrying small lenticular bands of fine-grained graphitic material at a depth of about 75 feet. Similar material was said to occur in a drive at the bottom of the shaft. The graphitic material may represent the southern extension of a well-marked blue lode which outcrops about 120 feet east of the west boundary of P.A. 3660, north of the Groundlark. No outcrops of this blue lode were seen south of a point about 290 feet north of the north boundary of P.A. 3467 but a narrow band of possible graphitic material, west of a small granite dyke, was observed in a shallow shaft close to the east boundary of the area and about 85 feet south of the north-west corner of the Groundlark. The shaft is slightly east of the line between the blue lode outcrop and the deep shaft.

The other shafts in the area are wholly in coarse grained hornblendite, with the exception of a shaft, 15 feet in depth, 35 feet north of the deep shaft. A granite dyke, evidently that cut in the deep shaft, enters the west side of this shaft at a depth of 7 feet. It dips east at 62°. The full width of the dyke was not exposed.

No payable reef has so far been found in this area nor does such seem likely to occur.

F. Lindsay's P.A. 3660, a small block of 12 acres, is situated north of and adjoining the western half of the Groundlark. The south-western corner of the area is situated 150 feet west of the north-west corner of the Groundlark. Two blue lodes outcrop in this area, the more westerly being that already mentioned. The more easterly is situated about 140 feet east of the first and can be traced over a greater distance, but it is narrower, ranging from about 2 to 9 feet in width. The shear zone at the western end of the drive on the Groundlark main reef may represent the southern extension of the line of this blue lode. Several small granite and pegmatite dykes, striking in various directions, occur in this area, particularly in the western half. The northernmost observed in the western half of the lease is one which extends east for about 240 feet from a point on the west boundary about 650 feet north of the south-west corner. Two shafts, said to be respectively about 50 and 20 feet in depth, were put down by the previous holders of the ground close to the eastern end of this dyke. The deeper and more easterly shaft is in white schist at the surface.

A crushing of 7 tons, stated to have come from this shaft, gave a return of 3.93 fine ounces. A shaft, 69 feet in depth, was put down by the present holder a few feet west of the western blue lode. It is wholly in hornblendite. A shallow shaft a few feet north-east of the last is partly in the blue lode. Visible gold was said to have been found in a quartz stringer near the edge of the blue lode.

Two fairly well defined quartz reefs striking approximately north-north-west are exposed near the middle of the area. The more westerly, which apparently crosses the eastern blue lode, is of somewhat bucky appearance and apparently does not carry gold. The more easterly, exposed in a pothole about 360 feet north of the south boundary, closely resembles Demorest's reef in appearance. It strikes approximately N. 20° W. and dips east at 88° and averages about a foot in width in the pothole. The reef was said to carry gold and judging by its appearance is worthy of further development.

Fragments of quartz were seen in various places on the surface of this area and further prospecting may reveal other auriferous reefs.

A prospecting area had been staked by Messrs. Mellor and Tierney north of F. Lindsay's P.A., but extending 8 chains farther west. A large irregular granite dyke is situated on the northern portion of the east boundary of this area, and other granite and pegmatite dykes, partly obscured by the surface soil, occur in the area. Prospecting work was being done from an underlay shaft sunk by the previous holders of the ground on the footwall side of the granite dyke striking approximately north and dipping east at about 65° or 70°. The shaft is mainly in weathered hornblendite carrying in places an irregular network of small stringers of chalcedonic quartz, some of which are auriferous. Apparently a little gold, probably of secondary origin and derived from the quartz stringers occurs in the oxidised hornblendite. The quartz stringers are too small and insufficiently rich to be payable and there does not appear to be much chance of the occurrence of a payable shoot in the immediate vicinity of the shaft but further prospecting, preferably by loaming might be done in the eastern portion of the area in the vicinity of the granite dyke and in those places where quartz debris occurs on the surface.

A considerable amount of prospecting was done during 1931 on that portion of Moran's former P.A. 2558 north of Mellor and Tierney's P.A. Some rough gold was obtained in altered hornblendite in a shaft some distance north of Mellor and Tierney's north boundary. Returns show that 19.33 fine ozs. of gold were obtained from specimens and a crushing of 16 tons gave a return of 30.77 fine ozs. Apparently the shoot cut out as no work was being done on the ground, but further sinking on the pitch of the shoot might reveal another shoot of rich ore.

Eastwood and Turner's P.A. 3615 is situated north of the siding on the north-west slope of the prominent hill, the top of which is about 23 chains north-north-east of the siding. The hill is composed of hard basic epidiorite of fairly fine grain, intruded in places by numerous small pegmatite dykes. Two shafts, one on the underlay, the other partly vertical and connecting with the underlay shaft, have been sunk about 220 feet north-west of the top of the hill on a shoot in a narrow shear zone striking about N. 5° W. and dipping east at about 85°. The shear zone cuts through a nearly vertical pegmatite dyke, 3 feet wide and striking nearly north-east, immediately north of the underlay shaft. The shoot is small and pipelike in shape and is mostly situated on the hanging wall side of the shear zone. It is marked by irregular short stringers of partly brown stained quartz and apparently also of pegmatite. It pitches south at about 55 degrees and has been followed on the underlay to a depth of about 45 feet. The walls of the shear zone were closely examined to see whether the pitch of the shoot was due to any intersecting vein or line of weakness, but none was observed. The gold so far obtained was mostly confined to two very small but very rich patches, one near the surface, the other about 30 feet from the surface on the underlay.

Returns for P.A. 3615 show that 0.15 tons were crushed for 133.12 fine ozs.

Fleming's P.A. adjoins the north-eastern portion of the southern boundary of P.A. 3615. The top of the steep hill is situated in the northern corner of the area.

Two shallow shafts have been sunk in this area, one about 430 feet east of the west corner and about 270 feet south-south-west of the top of the hill, and the other about 300 feet east-north-east of the west corner and about 280 feet south-west of the top of the hill. The first shaft is in somewhat weathered epidiorite on the hanging wall side of a pegmatite dyke, two feet in width, which strikes approximately west-north-west and dips north-north-east. The shaft is approximately on the strike of the narrow shear zone in P.A. 3615, but no definite trace of the shear zone was observed.

The second shaft, 184 feet west-north-west of the first and 22 feet in depth, is in very hard, fine-grained basic epidiorite. The western side of the shaft is on a small irregular pegmatite vein. A small rich patch of pipe-like form was found in a small irregular stringer of resinous-looking quartz at the south-east corner of the shaft, but was said to have been cut off by a flat seam of travertine about 5 feet below the surface. Below the seam the vein carried only a little gold. Although other rich patches may occur in this vein it is too small and the enclosing rock too hard for profitable working.

Small pegmatite dykes are particularly numerous east of the first shaft, and further prospecting in their vicinity may disclose other small veins carrying rich patches.

SUMMARY AND CONCLUSIONS.

The oldest rocks of the Larkinville district were most probably bedded volcanic rocks similar to those in other centres of the Coolgardie and East Coolgardie Goldfields, and consisting in part, at any rate, of tuffs of acid composition. The volcanic rocks were invaded and largely absorbed by a large mass of pyroxenite and gabbro or dolerite, subsequently converted into hornblendite and epidiorite of the same age as the younger greenstones of Kalgoorlie and similar to the intrusive hornblendites and epidiorites of other centres of the Coolgardie Goldfield.

At some period, possibly prior to their intrusion by the younger rocks, carbon from an igneous magma was deposited along bands in the tuffs.

The greenstones were subsequently intruded by masses of granite from which tongues of granite and pegmatite forced their way mainly along east and west fractures in the greenstones, some, however, of the smaller dykes following the lines of weakness formed by bands of the older volcanic rocks. Immediately after the intrusion of the granite a minor amount of shearing took place along the more or less north and south lines, parallel to the bands of the older rocks, and in some cases along those bands. Quartz veins of a pegmatitic character, a few containing some felspar, were next intruded along some of the shear zones. The final products of the granite magma were veins of somewhat glassy quartz, carrying irregularly distributed gold, which were deposited along minor fractures striking in north-westerly directions.

The ore bodies are of two types, namely, quartz reefs and small pipelike shoots mostly associated with stringers of resinous-looking quartz, and carrying small rich patches. Both usually occur near, some actually on the walls of, small granite or pegmatite dykes.

The Larkinville district is essentially one for the prospector. No lode or reef sufficiently large and of sufficiently even grade to be worked profitably by a large company has been found, and it is unlikely that such occurs. The reefs are short and more or less lenticular in shape, and the shoots of payable ore, though rich in some, are small. The main reef in the Groundlark is the only one so far discovered in which the gold appears to be relatively evenly distributed. This reef has proved to be very rich, but has only been traced for a distance of about 180 feet, though it will probably extend farther west at depth.

Next to the reefs on the Groundlark the reefs of most promising appearance are those in Demorest's and F. Lindsay's P.As. A small but rich shoot has already been found in Demorest's reef, and further development work might reveal a similar shoot in Lindsay's reef. Other reefs may occur on both these areas.

The belt of auriferous country is of considerable length, and although much prospecting has been done along the main ridge small rich patches similar to those found in Eastwood and Turner's and in Moran's P.As. might easily be missed, and doubtless similar ore pipes or veins exist in which the rich patches do not occur at the surface.

In future prospecting the close association of the reefs and other auriferous formations with small granite and pegmatite dykes should be remembered.

The following are analyses of a banded graphitic rock ("blue lode") and of a fuchsite-quartz rock.

Rock ...	Banded graphitic rock	Fuchsite-quartz rock.
Field No. ...	L 16	L 29
Lab. No. ...	2994/34	2995/34
Locality ...	G.M.L. 5228, costean 500 feet S. of N. boundary	Trench 65 feet S. of S.W. corner of P.A. 3423.
SiO_2 ...	60·48	92·57
Al_2O_3 ...	15·20	4·16
Fe_2O_3 ...	0·31	·33
FeO ...	...	·06
MnO ...	*Nil*	*Nil*
MgO ...	0·24	·29
CaO ...	0·92	*Nil*
Na_2O ...	6·33	·18
K_2O ...	*Nil*	·90
H_2O- ...	2·17	·03
H_2O+ ...	1·92	·78
TiO_2 ...	0·35	*Nil*
CO_2 ...	0·08	*Nil*
P_2O_5 ...	*Nil*	*Nil*
FeS_2 ...	0·05	*Nil*
Cr_2O_3 ...	...	·45
V_2O_3 ...	...	·06
Graphite ...	11·75	...
Total ...	99·80	99·81
G.	2·26	2·65
Analyst ...	C. R. Le Mesurier	C. R. Le Mesurier.

INDEX.

DIVISION V.

School of Mines of W.A.

Kalgoorlie, 7th December, 1934.

The Under Secretary for Mines, Mines Department, Perth.

I have the honour to submit, for the information of the Hon. Minister for Mines, my report for the year 1934.

ENROLMENTS.

The individual enrolment during the year reached a maximum of 330 and although, as usual, there was a falling off as the year progressed, this was to some extent compensated for by the enrolment of new students during the second and third terms.

Unfortunately, it is still necessary that certain subjects can only be given in alternate years, a state of affairs which in some cases has had the result of delaying the completion of diploma or certificate courses by several students. This condition of affairs can only be remedied by the appointment of another full-time member of the teaching staff, since the time of the present staff is fully occupied, and each year more students are proceeding to the more advanced classes. The appointment of an additional lecturer would raise the school to the status of 1930, and would not only enable more classes to be given each year, but would also allow the present staff to devote more time to the teaching of the advanced classes than is at present possible and would give the lecturers an opportunity of keeping their teaching up to date. A staff of five full-time lecturers cannot possibly conduct each year all the classes laid down in the syllabus for the Diploma courses, and, therefore, students proceeding to diplomas often find it necessary to spend an extra year at the school for the sake of taking one subject necessary to complete a course. This is a great disadvantage at the present time, not only to the students, but also to the school, because of the present great demand for qualified technical men to fill important and responsible positions on mines which are now being developed, a demand which the school cannot always satisfy, and because students who have only one or two subjects necessary to complete a course are unwilling to leave Kalgoorlie on account of the difficulty of continuing their studies without personal instruction. This disability which the school and the students are suffering should be removed as soon as possible by the appointment of a full-time officer to the teaching staff.

In my report for 1933 I pointed out the necessity for this additional appointment, which still exists and is all the more necessary on account of the continued increase in enrolments.

REVENUE.

The total revenue for the school year has been approximately £611, of which £240 consists of fees received for the conduct of metallurgical investigations.

STAFF.

At the beginning of the year Mr. S. Edelman, B.Sc., was appointed to the newly created position of assistant lecturer in methematics and chemistry. Mr. Edelman, who has had several years' experience in the teaching of these subjects up to University standard, has conducted the classes in Preparatory Mathematics, Mathematics I., and Chemistry I. with entire satisfaction to the students and the school.

Early in the year Dr. Larcombe resigned the position of lecturer in Geology which he had occupied since the latter part of 1907. This position has been filled by the appointment of Mr. G. S. Compton, B.Sc., A.W.A.S.M., who had previously conducted classes in geology and kindred subjects, as well as chemistry, metallurgy, and assaying at the Perth Technical College. In consequence of the increased demands made on the staff by prospectors seeking advice or assistance, Mr. Compton has spent considerable time in carrying out very thorough mineralogical determinations of a great variety of minerals and ores and in giving practical advice to prospectors.

The increased enrolment at the school and the demand for instruction in all subjects render it essential that the school be brought up to its previous efficiency by doing away with the necessity for dealing with the two grades of certain of the advanced subjects in alternate years. This efficiency can only be obtained, as previously pointed out, by the appointment of an additional member of the teaching staff who would relieve some of the lecturers of junior work which they are now required to conduct, and whose appointment would enable the senior lecturers to conduct classes in all the senior subjects each year. Such appointment would also eliminate the delay in completing Diploma and Certificate courses often experienced by students, due to the impossibility of conducting classes every year in certain subjects and the consequent necessity of students waiting an additional year, very often for only one subject, to complete a particular course.

The appointment of an additional lecturer, as assistant in engineering, would not only be advantageous in the above directions, but would also, possibly, admit of the Principal devoting more time to the administrative side of the school work, for which at present very little time is actually available.

The time of the staff is, under the present conditions, so fully occupied with class work that it is impossible for them to keep apparatus in proper order and to set up the apparatus necessary for class demonstration purposes. Assistance, by the appointment of a cadet, is desirable in this direction and it is suggested that if an assayer is appointed to the metallurgical laboratory, the cadet now engaged in that department should be transferred to the other departments to assist the lecturers in setting up and dismantling and keeping in proper order and condition the apparatus necessary for lecture demonstrations and for class use.

Mr. C. D. Slee, instructor in fitting and turning, who had held that position continuously for several years, resigned during the latter half of the year and the position was filled by the appointment of Mr. W. J. Troup, who had previously conducted these classes.

The part-time instructors, Messrs. A. R. E. Bosustwo (internal combusion engines), J. B. McNeill (engine driving), and C. D. Slee and W. J. Troup (fitting and turning) have carried out their duties satisfactorily.

METALLURGICAL LABORATORY.

During the past year thirty-nine investigations have been completed by the metallurgical staff, the majority of which have consisted of investigations into the cyanidation of old residues from mines in all parts of the State. The demand for work of this kind shows no sign of diminishing, and it is gratifying to know that the Commonwealth Government has realised the advisability of assisting existing metallurgical laboratories to extend the scope of this work by making available through the Commonwealth Council for Scientific and Industrial Research an annual grant to the metallurgical laboratory of this school as well as to those of the Melbourne University and the South Australian School of Mines. Negotiations in this direction have been proceeding for some time between Dr. Rivett, the Chief Executive Officer of the Council for Scientific and Industrial Research, and these laboratories for the purpose of increasing the equipment and facilities at present possessed by these laboratories. It is hoped that when the school reopens in February, 1935, this joint scheme will have taken definite shape and that additional metallurgical apparatus will be installed and an assistant research metallurgist will be appointed to assist in carrying out the investigational work which is essential before designing treatment plants.

Besides the investigations conducted on ores and metallurgical products of Western Australian origin, investigations have been conducted to determine suitable methods of treatment of a gold ore containing pyrite and galena from North Queensland, and of a refractory gold ore from the Dark River district of North-Eastern Victoria. Detailed reports on all these investigations have been issued to the persons concerned.

Unfortunately, it has not been possible since 1932 to publish a bulletin showing the work of the metallurgical laboratory and it is to be hoped that the necessary funds will be made available to publish at least the more important of these reports for the benefit of the gold mining industry in general.

The following list shows the nature of the investigations carried out during the year:—

Tests on Battery Water for Mr. A. J. Thomson, Patricia Gold Mine.
Cyanidation of Tailings for Mr. W. Taaffe, Kalpini.
Extraction of Gold from Ore for Broad Arrow Mines, Ltd.
Cyanidation of Sand and Slimes for Imperial Mining Co.
Cyanidation of Tailings for Mr. M. Dunne.
Cyanidation of Tailings for Mr. H. H. Truman.
Cyanidation of Tailings for Mr. S. M. Bevilaqua.
Cyanidation of Tailings for Mr. J. Rowe.
Cyanidation of Tailings for Mr. F. C. Overheu.
Extraction of Gold from Ore for Mr. R. C. Spargo.
Cyanidation of Tailings for Australian Mining Trust.
Determination of Gold present in Ore as Free Gold and combined with Sulphides for Western Mining Corporation.
Amalgamation and Cyanidation of Ore from Saturn Gold Mine for Mr. W. J. Parkinson.
Amalgamation and Cyanidation of Ore for Corinthian Gold Mine.
Cyanidation of Tailings for Mr. H. Roberts.
Slimes Settlement Tests for Ora Banda Amalgamated.
Examination of Cyanide Solutions for Yundermindera Sands Syndicate.
Cyanidation of Tailings for Australian Mining Trust.
Determination of Water-soluble Gold and Distribution of Gold in Tailings for Australian Mining Trust.
Cyanidation of Tailings for Mr. N. F. Rosen.
Cyanidation of Tailings for Mr. W. Taaffe.
Cyanidation of Tailings for Mr. S. M. Bevilaqua.
Cyanidation of Tailings for Mr. S. M. Bevilaqua.
Cyanidation of Ore from Big Bell Gold Mine for Mr. H. Greenwood Thomas.
Cyanidation of Tailings for Phillips River Prospectors' Association.
Cyanidation of Tailings for Yundamindera Sands Syndicate.
Cyanidation of Tailings from Augusta Gold Mine for Mr. D. Marie.
Cyanidation of Ore from Big Bell Gold Mine for Mr. H. Greenwood Thomas.
Strakes Concentration of Ore for Sugar Gum Gold Mine.
Cyanidation and Flotation of Tailings for Australian Mining Trust.
Cyanidation of Tailings for Associated Northern Ora Banda.
Treatment of Ore from Georgetown Gold Mines, Queensland.
Treatment of Ore from Dark River District, Victoria, for Clarke & Co.
Treatment of Ore from Temora Gold Mines, New South Wales.

Treatment of Sulphide and Oxidised Ore from Mount Magnet Gold Mines.
Treatment of Refinery Sweep from Royal Mint, Perth.
Treatment of Ore from Lady Shenton Gold Mine.
Treatment of Sulphide and Oxidised Ore from Ora Banda Amalgamated.
Treatment of Ore from Norseman Gold Mines.

In connection with Metallurgical Laboratory investigations, the number of assays and chemical determinations carried out during the year has been as follows:—

Assays for Gold	1,165
Chemical Determinations ..	850
Total	2,015

The Lecturer in Geology has rendered assistance to the Metallurgical staff in the determination of the mineral character of ores submitted for investigation. Such a mineral determination is of great importance and assistance in the conduct of investigations into methods of treatment.

Towards the end of the year the Cadet in the Metallurgical Laboratory, Mr. H. R. Dunstan, received an appointment outside the school and his position was filled by the appointment of Mr. P. S. Braham.

The Department has now decided to appoint a full-time assayer to the staff of the Metallurgical Laboratory, to carry out all assays which the research staff have previously carried out to the delay and detriment of the investigational work. This officer will also be able to assist in conducting experimental work and will thus be receiving a valuable training in metallurgical principles and practice and in the conduct of experimental work.

PUBLIC ASSAY DEPARTMENT.

The assistance offered to prospectors by the School has again been made great use of and during the year the number of free assays and mineral determinations carried out for prospectors has been as follows:—

Assays for Gold	1,682
Assays for other metals, etc. ..	23
Mineral determinations ..	200
Total	1,905

In addition, a great amount of assistance and advice has been given to prospectors in all parts of the State, comprising geological, mining, and metallurgical advice, and every effort has been made to help prospectors, battery owners, and cyanide operators in carrying out their operations efficiently and economically.

STUDENTS' ASSOCIATION.

As a result of membership of the Students' Association having been made compulsory, the Association has now an excellent membership and has been able to do good work in fostering and advancing the social and sporting side of school life.

The Association is now endeavouring to obtain the assistance of the Chamber of Mines, the Australasian Institute of Mining and Metallurgy and the managements of the various mines in establishing a technical library in Kalgoorlie for the use of mining men generally.

BUILDINGS.

The interior of the whole School requires renovating, as no internal painting has been done for several years, and in the chemical laboratories in particular, the fumes have commenced to attack the iron ceilings seriously. In addition, in order to reduce expenditure on electric light to a minimum and to take full advantage of both daylight and electric light, it is advisable that all rooms should be painted dead white so that a minimum of light may be absorbed by the walls and ceilings.

Equipment.—For many years past the money available for expenditure on new equipment required for teaching purposes has been almost non-existent, and if the School is to maintain its prestige and reputation it is essential that a considerable sum be spent in renewing and replacing obsolete and worn-out apparatus, without the provision of which class work cannot be properly demonstrated by the lecturers nor can the practical work of the different classes be efficiently conducted.

This renewal of obsolete equipment should take place over a number of years so that the expenditure in any one year should not exceed a reasonable limit.

In the same way, the expenditure on technical books and journals has been reduced to a point at which it is impossible for the staff to keep in touch with modern practice and therefore to equip students with the essential up-to-date knowledge of scientific progress. A definite amount set aside each year for this purpose would greatly improve the efficiency of the teaching and would enable the students leaving the School to be better qualified to undertake technical work in any of the branches of engineering, whether mining, metallurgical, mechanical, or electrical, in which the School awards diplomas and certificates.

Correspondence Classes.—Repeated requests are received from prospective students in all parts of this State and also from other States for assistance in studying for some of the courses of the school. These requests invariably would involve the conduct of correspondence classes which, with the existing staff, cannot for a moment be considered. Even if the school were to make an attempt to comply with these numerous requests, the appointment of a separate staff would be necessary and therefore it is impossible to accede to these requests. It is unfortunate that prospective students who live in parts of the State remote from Kalgoorlie should be debarred from obtaining the technical training they desire and, recognising the disabilities under which these prospective students are labouring, the School has made every effort to assist them by submitting suitable courses of study, by recommending suitable books for study, and in some cases assisting them by supplying notes of lectures in certain descriptive subjects.

There seems to be no other way in which these students can be assisted unless they give up their present employment and come to Kalgoorlie on the chance of securing suitable employment here. In some cases this has been done and the School has been able, through the assistance of the managements and technical staffs of the Kalgoorlie mines, to place

these men in positions where they have been able to attend classes at the School and to make practical use of the training so received.

At large centres, such as Wiluna, it should be possible for certain classes to be conducted by the technical officers of the mines, under the control of a local advisory committee, and the School would be prepared to assist in every possible way in furthering such a scheme which would not only benefit the students themselves but would also ultimately improve the efficiency of the employees of the mines.

Employment of Students.—In consequence of the rapid revival in gold mining, there has been an unprecedented demand for qualified men to undertake responsible technical positions on many of the mines now being opened up. In many cases it has been possible to fill these positions with satisfaction to the companies concerned and it is pleasing to record the fact that in no case has a student of the School who has been appointed to one of these positions failed to give satisfaction. Many of these positions have been important technical and administrative positions and it is hardly necessary to record the fact that the School is deeply appreciative of the recognition accorded it in this way by companies operating in Western Australia.

Through the valued and valuable assistance of ex-students of the School who are now holding responsible technical positions, the School has, in a large number of instances, been able to obtain employment and promotion for intending and deserving students.

This is only one way in which students who have passed through this School have shown their appreciation of what the School has done for them and I am pleased to be able to place on record my appreciation of the assistance in this direction which has always been accorded to me not only by ex-students but also by the managements of most of the mines.

In conclusion, it is my duty to express my appreciation of the work of the whole of the staff during the past year, as without their enthusiasm in their work and their endeavours to assist the students in every way, it would not have been possible to have reported this past year as one of the most successful, as well as one of the most strenuous, years in the history of the School.

Statistics dealing with the enrolment of students and the results of the annual examinations are attached to this report.

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

DIVISION VI.

Annual Report of the Inspection of Machinery Branch, Mines Department, for the Year 1934.

The Under Secretary for Mines.

For the information of the Hon. Minister, I am submitting herewith 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, 1934.

It is with great regret that I have to record the death, on 6th November, 1934, of the late Deputy Chief Inspector of Machinery, Mr. W. Churchill. I had known him personally for many years; the Department has lost an efficient and experienced officer, whose unfailing courtesy endeared him to all the staff.

This report has been submitted by Mr. G. Moore, who was appointed Deputy Chief Inspector of Machinery as from 1st December, 1934.

The volume of work carried out by this branch of the Department has shown a further increase, and it is pleasing to be able to record that the total number of accidents to persons caused by machinery was only 22; unfortunately, three of these were fatal.

The financial position has also improved, the excess of revenue over expenditure for the year being £1,911 9s. 4d.

I have already, in my report as State Mining Engineer, referred to the regrettable death on the 14th August, 1934, of Mr. A. M. Howe, who was also Chief Inspector of Machinery.

RICHARD C. WILSON,
Chief Inspector of Machinery.

22nd June, 1935.

To the Chief Inspector of Machinery.

Sir,

I have the honour to submit for the information of the Hon. Minister for Mines the following report on the operations of "The Inspection of Machinery Act, 1921," in the districts proclaimed thereunder, together with statistical tables for the year ended 31st December, 1934.

For the convenience of reference the report is divided as follows:—

1. Inspection of Boilers, New Construction, Maintenance.
2. Explosions—Interesting Defects—Tests.
2. Inspection of Machinery.
4. Prosecutions under the Act.
5. Accidents to persons by Machinery or Boilers.
6. Engine-drivers' Examinations and Kindred Matters.
7. General—Staff—Mileage.
8. Revenue and Expenditure.

DIVISION I.

Inspection of Boilers.

The total number of registered boilers, including various types of steam pressure vessels and receivers for compressed air or gas, which are shown by our records to be fit for use, was 3,878 at the close of the year on 31st December, 1934, compared with 3,784 on 31st December, 1933, giving a net increase of 94.

On 14th September, 1934, Wyndham was proclaimed, by notice in the *Government Gazette,* as a district subject to the provisions of "The Inspection of Machinery Act, 1921"; an Inspector visited the district in October. This accounts for the reduction of the number of useful boilers in unproclaimed areas to 41 on 31st December, 1934, compared with 52 on 31st December, 1933. This figure 41 only includes registered boilers which are known to have been sent to unproclaimed areas, some of these may not be serviceable now and there may be a few of which we have no record.

There were 119 boilers added to the register during 1934; of these one was an old boiler previously condemned which was repaired and made fit for use again, two previously registered were returned from the Eastern States, three previously on our register but which had been under the jurisdiction of another Departemnt in this State were transferred back again. 113 new registrations were made, the country of origin being—25 from United Kingdom, one from U.S.A., 20 from the Eastern States, 30 from sources not as yet known and 37 built locally. The proportion of new registrations in 1934 which were constructed in W.A. is nearly 33 per cent., which compares favourably with 14 per cent. for 1933. The types built locally were two vertical stationary, six return multitubular stationary underfired, nine locomotive portable rectangular firebox, two locomotive, one digester, nine air receivers, seven steam jacketed vessels and one waste heat boiler.

The deductions from the register were 25. Of these, 21 were condemned, two sent to other States, two transferred to other Departments. Deducting this figure 25 from the 119 added to the register gives 94, the net increase previously mentioned.

There were 1,713 thorough inspections made during 1934. This was an increase of 146 compared with 1933. There were 153 more thorough inspections made in the districts worked from Perth office, but seven less from Kalgoorlie office; this latter was due to the Inspector at Kalgoorlie being on sick leave for three weeks at the end of the year, so that there were 22 boilers overdue for inspection at 31st December, 1934. Had these boilers been inspected on the due date the figures would have been 15 more

inspections in the Kalgoorlie district and 168 more for the whole State than were inspected in 1933.

The number of reports of working inspections furnished was only 21 but many more boilers and pressure vessels were inspected under steam pressure for which separate reports were not made.

The total number of certificates granted for boilers was 1,727 in 1934 compared with 1,577 in 1933; an increase of 150 for the whole State and 160 at Perth office and 10 less at Kalgoorlie office than 1933. As mentioned before, this decrease of 10 at Kalgoorlie office would probably have been an increase of 12 but for the unfortunate indisposition of the Kalgoorlie Inspector at the end of the year.

The number of repair notices issued during the year was 436 compared with 332 for 1933, an increase of 104.

Return No. 1, *showing Operations in Proclaimed Districts during year ended* 31*st December*, 1934.

(BOILERS ONLY.)

	Districts worked from Perth.	Districts worked from Kalgoorlie.	Unproclaimed Area.	Totals. 1934.	Totals. 1933.
Total number of useful Boilers registered ...	2,596	1,241	41	3,878	3,784
New Boilers registered during year	97	16	...	113	73
Boilers reinstated	1	...	...	1	2
Inspections for year— ...					
Thorough	1,427	286	...	1,713	1,567
Working	16	5	...	21	22
Boilers condemned during year—					
Temporarily	32	3	...	35	22
Permanently	14	7	...	21	13
Boilers sent to other States during year	2	...	...	2	2
Boilers sent from other States during year ...	2	...	...	2	1
Transferred to other Departments	2	...	...	2	...
Transferred from other Departments	3	...	...	3	1
Number of Notices for Repairs issued during year	399	37	...	436	332
Number of Certificates issued, including those issued under Section 30, during year	1,441	286	...	1,727	1,577

New Construction.

The only construction of an unusual nature was the building of a complete narrow gauge locomotive for the Sons of Gwalia Gold Mine woodline. This work was carried out at the Government Railway Workshop at Midland Junction.

New construction with all welded seams has again been confined to unfired pressure vessels; the majority being small air receivers.

Repairs.

Electric arc welding has played a large part in the carrying out of repairs on various types of boilers. The most important work executed was the construction of two new flues for a Lancashire boiler. Each section was electric welded before flanging. No trouble was experienced with the weld during flanging. These flues had not been fitted to the boiler before the end of the year. Portable arc welding plants are coming more into use and have considerably reduced the cost of repairs in many cases. The repairs executed have chiefly been the building up of pitting, grooving and external wastage, also butt welded seams for small patches on stayed surfaces, etc.

Maintenance.

Generally the maintenance has been good, but in a few isolated cases unsuitable feed water has been the cause of rapid deterioration.

Return No. 2, *showing Classification of various types of useful Boilers in Proclaimed Districts on* 31*st December*, 1934.

Types of Boilers.	Districts worked from Perth.	Districts worked from Kalgoorlie.	Unproclaimed Areas.	Totals. 1934.	Totals. 1933.
Lancashire	48	50	...	98	102
Cornish	219	369	...	588	590
Semi-Cornish	34	15	...	49	49
Vert. Stat.	366	286	...	652	650
„ Port.	73	9	...	82	81
„ Mult. Stat.	40	20	...	60	58
„ „ Port.	26	3	...	29	30
„ Pat. Tubular ...	8	...	...	8	8
Loco. Rect. Firebox Stat.	96	47	...	143	141
„ „ „ Port.	274	37	...	311	306
„ Circ. „ „	145	4	...	149	147
Locomotive	78	41	...	119	115
Water Tube	115	115	...	230	226
Return Mult. Underfired Stat.	99	53	...	152	143
Return Mult. Underfired Port.	3	5	...	8	7
Return Mult. Int. Fired Stat.	43	5	...	48	46
Return Mult. Int. Fired Port.	2	...	...	2	2
Egg ended and other types not elsewhere specified	42	17	41	100	109
Digesters	84	5	...	89	76
Air Receivers	374	146	...	520	462
Gas Receivers	4	...	...	4	4
Vulcanizers	210	8	...	218	220
Steam Jacketed Vessels ...	213	6	...	219	212
Total registration useful boilers	2,596	1,241	41	3,878	3,784
Total boilers out of use 31st December, 1934...	1,155	924	41	2,079	2,152

DIVISION II.

Explosions. Interesting Defects, etc.

A small air receiver used for starting a suction gas engine exploded while being pumped up by means of the gas engine cylinder. In this case the engine was under load while the receiver was being pumped up, the only possible explanation being that sufficient unburnt mixture to cause the explosion was pumped into the receiver. Luckily no one was hurt and the material damage was small. This practice of pumping up the starting receiver while the engine is working is decidedly dangerous, and the makers of practically all internal combustion engines warn users not to do so.

A locomotive boiler was considerably damaged through shortage of water caused by a piece of brass stud ⅜in. diameter becoming jambed in the blow-off cock, while blowing the boiler down, thus preventing the cock from being shut off, and before the fire could be drawn, the firebox crown, tube plate and tubes were badly overheated, necessitating extensive repairs. A peculiar feature in this case was that the ½-inch copper firebox crown plate was bulged upwards between each of the crown girders to an amount of ¼-inch.

The blow-off bend of a Cornish boiler fractured when the engine-driver was preparing to fire up. No damage was caused to the boiler, the pressure was only 70 lbs. at the time the blow-off bend fractured. This bend was of cast iron and had no reinforcing rib. The probable cause of the fracture was that the waste pipe was buried in the ground and not free to expand or contract.

A locomotive portable boiler attached to a log hauler was turned on its side while under steam, but

very little damage was done to it, and after minor repairs were effected the boiler was fit for use again.

The firebox crown of a locomotive portable boiler on a dragline excavator was slightly damaged through shortage of water, due to the fireman misjudging the angle at which the boiler was standing, so that the crown was exposed at the tube plate end. The fusible plug did not act in this case.

DIVISION III.

Inspection of Machinery.

The total number of groups of useful machinery registered on 31st December, 1934, was 10,754 compared with 10,076 on 31st December, 1933, showing an increase of 678 groups for 1934. The bulk of this increase was the registration of 421 new groups driven by electric motors and 227 driven by oil engines. Of the remainder, 14 new groups driven by steam, 15 driven by gas engines and one by compressed air were registered.

The total number of groups inspected during the year was 7,830 compared with 7,555 for 1933, an increase of 285. This figure would have been greatly exceeded had there not been a large number of groups overdue for inspection at the end of the year due to there being one Inspector less at Perth for the last seven weeks of the year, and also to the indisposition of the Inspector at Kalgoorlie.

During the year 348 notices were issued to owners for the guarding of machinery and repairs or alterations to lifts, etc.; this number was 23 less than for 1933.

Return No. 3—Showing Operations in Proclaimed Districts during Year ended 31st December, 1934.

(MACHINERY ONLY.)

——	Districts worked from Perth.	Districts worked from Kalgoorlie.	Totals.	
			1934.	1933.
Total registrations, useful machinery ...	9,021	1,733	10,754	10,076
Total inspections made	7,072	758	7,830	7,555
Certificates (bearing fees)	3,138	226	3,364	3,201
Certificates (steam without fees)	229	17	246	242
No. of extension certificates issued under Section 42 of Act ...	...	...	...	...
Notices issued (machinery dangerous) ...	331	17	348	371

Further progress has been made during the year with a view to making the enclosure doors of automatic lifts safer, by fitting two electro mechanical locks to each enclosure door, and where practicable to fit a retiring cam to the car; the aim has been to conform as far as practicable to the Lift Code of the Standards Association of Australia.

The total number of lifts registered was 261 at 31st December, 1934, compared with 258 in 1933, three more passenger lifts having been completed, while permits were granted for the erection of two passenger lifts.

Return No. 4—Showing Classification of Lifts on 31st December, 1934.

Type.	How Driven.	Totals.	
		1934.	1933.
Passenger ...	Electrically driven...	141	138
	Hydraulically driven	1	1
Goods	Electrically driven...	110	110
	Hydraulically driven	3	3
	Belt driven ...	6	6
		261	258

Several new treatment plants have been completed on the goldfields and are now operating, and more are in the course of construction. Practically all the new plants erected outside the Golden Mile are driven by oil engines, the only steam driven units being winding engines. Lack of adequate supplies of firewood is the deciding factor.

The timber industry and also butter and cheese making are progressing steadily, and in the metropolitan area building is again active, but this branch is only concerned in the latter in the matter of cranes and hoists used during building operations, and new lifts installed when the building is completed. The alterations to one large city shop which were required to permit the building of an extension, necessitated the underpinning of the steel framework of a 32-passenger lift, to permit the construction of a new lift well alongside the existing one, to accommodate two lifts to be erected in the new extension. This work was carried out successfully.

The steady increase in the number of machinery groups registered shows that there has been a general revival in industry.

Return No. 5—Showing Classification of Various Sources of Power-driven Machinery in Use or likely to be Used again in Proclaimed Districts for Year ended 31st December, 1934.

Classification.	Districts worked from Perth.	Districts worked from Kalgoorlie.	Totals.	
			1934.	1933.
No. of groups driven by steam engines ...	697	361	1,058	1,044
No. of groups driven by oil engines	1,614	171	1,785	1,558
No. of groups driven by gas engines	128	105	233	218
No. of groups driven by compressed air ...	8	37	45	44
No. of groups driven by electric motors ...	6,570	1,059	7,629	7,208
No. of groups driven by hydraulic pressure ...	4	...	4	4
	9,021	1,733	10,754	10,076

DIVISION IV.

Prosecutions under the Act.

It was not found necessary to institute legal proceedings against any person for breaches of the Act during the year. The majority of owners willingly

co-operate with the officers of this Branch to make their plants safe, but a small minority sometimes require a little persuasion before complying with our requirements.

In a few cases it was necessary to take strong measures to collect fees, but I am glad to say the proportion is small and shows signs of decreasing as conditions improve.

DIVISION V.

Accidents to Persons caused by Machinery or Boilers.

During the year 22 accidents were reported and inquired into by Inspectors, of which three were fatal, compared with a total of 29 with four fatal for 1933.

One fatal accident occurred on a treatment plant on a gold mine and was due to the deceased's left arm being caught between a residue conveyor belt and the pulley, while he was attempting to clean some of the residue off the pulley by means of a short scraper, without stopping the conveyor. This is a very dangerous practice. A permanent scraper was afterwards fitted to keep any of the residue from collecting on the pulley. Deceased died about twenty-four hours after the accident as a result of his injuries.

Another occurred through the deceased's left arm becoming entangled in the rope when shifting railway trucks by means of a warping winch. No one actually saw what happened, but it was probably due to the rope being wet by rain and slipping on the warping drum. Deceased may have been trying to take an extra turn of the rope on the drum. He was killed instantly.

The third fatal accident was due to the bursting of a circular saw when the deceased was cutting firewood. The saw was driven by means of a 12/20 h.p. tractor. This plant was in the country and was not registered. The accident may have been due to any one of a number of causes. On inquiry it was found that the saw had been run at a peripheral speed of about 13,500 feet per minute, or about 50 per cent. in excess of the usual limit. The saw appeared to have had at least three radial cracks in it prior to the accident, one being about 7 inches long. Both spindle bearings were broken and one bearing cap showed signs of a small old crack. Plants similar to this are fairly numerous, and as they are only used occasionally, the owners think that they do not come under the Act. Also since the depression, a number of small circular saw plants for cutting firewood have been brought into use, driven by means of a belt from one of the back wheels of a motor truck which is jacked up for the purpose. As there is no means of governing the speed, these plants are a potential source of danger. It is to be hoped that when better times come the owners will use stationary oil or petrol engines fitted with governors. As these plants are generally off the beaten track, Inspectors rarely get to hear of them until an accident happens.

Once electrical equipment has been passed as complying with the regulations and connected to the main, apparently no provision has been made for further periodical inspections to see that the elecal equipment is maintained in a safe condition. As the result of an accident which is not included in our returns as it was not caused by moving machinery, but which resulted in a workman losing his life through faulty earthing of the weatherproof cover of a starting switch, the officers of this branch have issued a number of notices to owners to have electric motors and starting switches efficiently earthed by a qualified electrician. Section 19 of the Act gives an Inspector the power to require the owner to make repairs or alterations when "any appliance or contrivance connected or used with such machinery, or any part thereof, is or appears to an Inspector to be faulty or defective in any particular." With the exception of testing the efficiency of the earthing devices, we have neither the equipment nor sufficient staff to undertake any further responsibility for the maintenance of electrical installations, other than obvious danger points which can be detected by visual inspection.

The remaining 19 accidents were fortunately not of a very serious nature, and could have been avoided had the injured persons used greater care when operating the machines. In the case of the four non-fatal circular saw accidents, the injured persons had no idea how their hand came in contact with the saw. There was only one accident due to a buzzer. If all these machines were fitted with circular cutter heads and the operators would at all time use the guards provided, accidents should not occur with these machines.

There were no accidents to persons caused by winding engines, due to any defect in the engines, or to any cause under the control of the winding engine driver.

There was only one accident due to a locomotive. In this case the guard in charge of the train slipped when removing a piece of wood from the line and was caught by the locomotive and dragged a short distance. His injuries, luckily, were not very extensive or serious.

Return No. 6—Showing Persons Killed or Injured by Boiler and Machinery Accidents in Proclaimed Districts during Year ended 31st December, 1934.

Numbers within brackets denote fatal accidents.

Class of Machinery.	Districts worked from Perth.	Districts worked from Kalgoorlie.	Total.
Tie Working—			
Cannister-making Press ...	1	...	1
Cannister Wiring Machine ...	1	...	1
Metal Working—			
Emery Wheel	1	...	1
Guillotine	1	...	1
Drilling Machine	...	1	1
Sawmilling and Woodworking—			
Circular Saw	5 (1)	...	5 (1)
Buzzer	1	...	1
Docking Saw	1	...	1
Shaper	1	...	1
Malt Treatment—			
Gear Wheels	1	...	1
Kiln Turner	1	...	1
General—			
Belting	...	1 (1)	1 (1)
Diamond Drill	...	1	1
Box-closing Machine ...	1	...	1
Lathe	1	...	1
Printing Machine	1	...	1
Capstan	1 (1)	...	1 (1)
Locomotive	...	1	1
	18 (2)	4 (1)	22 (3)

DIVISION VI.

Engine-drivers' Examinations and Kindred Matters.

This section of the work of this Branch showed a great increase in the number of certificates granted, due in a great measure to the revival of the mining industry, but there is still a shortage of winding engine-drivers. The total number of certificates granted during 1934 was 364 compared with 225 in 1933; an increase of 139.

Examinations were held as follows:—Perth 4, Kalgoorlie 2, Leonora 2, Wiluna 1, Meekatharra 2, and Bunbury 2. Examinations were held at all advertised centres except Geraldton.

The Board of Examiners spent 30 days in Perth dealing with applications for Competency Certificates, correcting examination papers, and other matters connected with engine-drivers. In addition, the travelling Board spent 16 days actually conducting examinations and a further 22 days in travelling and inquiries connected with engine-drivers and boiler attendants.

A total of 405 applications were received and considered by the Board, compared with 271 during 1933; an increase of 134 applications.

Complaints, Inquiries, etc.

There were eight complaints of various kinds concerning 16 persons, made during the year, in regard chiefly to the employment of persons who were not the holders of the required certificate. Some of these complaints were, on inquiry, found to be without grounds. None of them were of a serious nature and all were satisfactorily adjusted.

The personnel of the Board was again changed during the year. The position of chairman was taken by the present Chief Inspector, Mr. R. C. Wilson, on 1st March, 1934, and the present Deputy Chief Inspector of Machinery, Mr. G. Moore, took office on the death of Mr. W. Churchill, the late Deputy Chief Inspector of Machinery, on 6th November, 1934. Mr. Breydon had resumed duty at the beginning of the year.

Return No. 7—Showing Total Number of Engine Drivers and Boiler Attendants' Certificates (all Classes) Granted in 1934, *compared with* 1933.

	Number Granted.	
	1934.	1933.
Winding Competency, including Certificates issued under Regulation 40 and Section 60 of Act	19	5
First Class Competency, including Certificates issued under Regulations 40 and 45 and Sections 60 and 65 of Act	29	11
Second Class Competency, including Certificates issued under Regulation 40 and Section 60 of Act	31	25
Third Class Competency, including Certificates issued under Regulation 45 and Sections 60 and 63 of Act	30	27
Locomotive Competency	16	3
Traction Competency	...	1
Internal Combustion Competency	67	27
Crane and Hoist Competency	9	8
Boiler Attendant Competency	143	112
Interim	6	1
Copies	8	1
Transfer	6	4
Totals	364	225

DIVISION VII.

Amendments to the Act were submitted to Parliament by the Hon. Minister but were not passed. This was unfortunate because electric winding engines are not adequately provided for, and this omission urgently requires to be rectified.

About the usual amount of work on behalf of other departments was carried out during the year, chiefly inspecting and valuing machinery and boilers.

Work in connection with the Standards Association of Australia has again not had the attention it deserves, owing to the increase of current work, changes in staff, etc.

Inspectorial Staff.

The death of the late Deputy Chief Inspector of Machinery, Mr. W. Churchill, which occurred with tragic suddenness on 6th November, 1934, necessitated temporary changes in the duties of the staff until the permanent positions could be filled. The Senior Inspector, Mr. G. Moore, took over the duties of Deputy Chief Inspector of Machinery, Mr. R. J. Ross those of Senior Inspector, Mr. R. W. Frankish took the South-Western district and Mr. W. H. Sherman the Great Southern district. Messrs. W. J. Jordan, D. R. MacGregor and J. F. Winzar continued in their previous positions. Mr. W. J. Jordan, the Inspector for the Kalgoorlie districts, had to take three weeks' rest in December on account of eye trouble, and as there was one Inspector short at Perth office he could not be relieved. As previously mentioned this caused the cancellation of a number of inspections.

Clerical Staff.

The Clerk-in-Charge, Mr. H. W. Gibson, returned from long service leave and resumed duty in March. Mr. J. W. Smith took over his old duties from Mr. Parry who was transferred to another department. There were no other changes in the clerical staff.

Mileage.

The total mileage travelled in the various districts during the year 1934 was 52,659, compared with 44,987 for the year 1933; an increase of 7,672 miles. The above total was made up as follows: 5,659 miles by rail, an increase of 3,574 miles; 42,619 miles by road, a decrease of 225; and 4,381 miles by water, an increase of 4,323. The increase of rail travel was due to special trips having to be undertaken. There were 630 less miles travelled by road in the districts worked from Perth, but 405 more in the districts worked from Kalgoorlie. The large increase in the miles travelled by water was due to an Inspector visiting Wyndham for the first time. The road mileage will of necessity increase greatly on the goldfields owing to the revival of mining. Centres which have not been visited for years are being developed and plants erected, and other centres which were only visited once per year will require at least two visits in future.

Return No. 8 *showing Distances Travelled, Number of Inspections Made and Average Miles Travelled per Inspection for year ended* 31*st December*, 1934.

——	Rail Miles.			Road Miles.			Water Miles.			Total Miles.			Total Number Inspections.			Average Miles per Inspection.		
	1934.	As compared with 1933.		1934.	As compared with 1933.		1934.	As compared with 1933.		1934.	As compared with 1933.		1934.	As compared with 1933.		1934.	As compared with 1933.	
		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.		Increase.	Decrease.
Districts worked from Perth ...	4,885	3,176	...	32,582	...	630	4,381	4,323	...	41,848	6,869	...	8,515	620	...	4·91	·48	...
Districts worked from Kalgoorlie	774	398	...	10,037	405	...	...	...	...	10,811	803	...	1,049	...	200	10·30	2·29	...
Totals ...	5,659	3,574	...	42,619	405	630	4,381	4,323	...	52,659	7,672	...	9,564	620	200	5·50	= Average all Districts, 1934	
																4·91	Average all Districts, 1933	
Increases or Decreases ...	...	Increase 3,574		...	Decrease 225		...	Increase 4,323		...	Increase 7,672		...	Increase 420		...	Average Increase ·59 miles per inspection	

DIVISION VIII.

Revenue and Expenditure.

There was a further increase in revenue and a decrease in expenditure for 1934 compared with 1933, as shown in the table below.

Revenue increased by £641 5s. 7d., each item showing an increase.

Expenditure decreased by £264 18s. 6d., each item showing a decrease. Incidentals would have been higher by £232 10s. 9d. had the cost of a new car, which was delivered in December, been charged to 1934, but the account was not received in time to be included.

The financial result of the year's work is very gratifying, as the balance of revenue over expenditure was £1,911 9s. 4d., compared with £1,005 5s. 3d. for 1933.

Return No. 9 *showing Revenue and Expenditure for Year ended* 31*st December*, 1934.

Revenue.			Expenditure.		
——	1934.	1933.	——	1934.	1933.
	£ s. d.	£ s. d.		£ s. d.	£ s. d.
Fees for Boiler Inspections ...	2,557 6 0	2,290 9 11	Salaries	3,735 15 4	3,809 13 11
Fees for Machinery Inspections ...	3,648 16 7	3,489 8 0	Incidentals	1,031 3 4	1,205 16 11
Engine Drivers Fees	467 13 0	291 18 0	Engine Drivers	88 5 8	104 12 0
Incidentals	92 18 1	53 12 2			
Increase—£641 5s. 7d. ...	6,766 13 8	6,125 8 1		4,855 4 4	5,120 2 10
			Profit—£1,911 9s. 4d.		

In conclusion, I desire to tender my sincere thanks to officers of Government departments of both the State and the Commonwealth for assistance rendered in connection with the administration of the Act, and to record my great appreciation of the good work of all members of the staff of this branch, which has helped to create a record, both for the amount of work performed and revenue earned since the passing of the present Act in the year 1922.

G. MOORE,
Deputy Chief Inspector of Machinery.

22nd June, 1935.

DIVISION VII.

Annual Report of the Chemical Branch, Mines Department, for the Year 1934.

The Under Secretary for Mines.

I have the honour to present, for the information of the Hon. Minister for Mines, my annual report for the year 1934.

STAFF AND EQUIPMENT.

Mr. H. E. Hill, A.I.C., A.A.C.I., was appointed on the 12th March to be Supervising Chemist, Foods, Drugs, and Toxicology. On the 20th March Mr. J. C. Hood and myself were appointed honorary inspectors under the Factories and Shops Act, 1920.

The technical staff now includes, in addition to myself, three supervising chemists, three senior chemists, nine chemists (permanent), three chemists (temporary), and three mechanical assistants. The staff was strengthened during the year by the appointment of a cereal chemist with considerable experience, both scientific and practical.

The condition of the equipment referred to in my last report continues to be extremely unsatisfactory as a result of the reduced vote allotted to the Chemical Branch, and the difficulty experienced from time to time in obtaining authority to expend even those reduced funds in vital directions. Particularly unsatisfactory is the condition of the library, which in some directions is quite out of date. The stoppage of subscriptions to valuable scientific magazines is deplorable, as without them we are always a year or two behind the rest of the world in our knowledge of new discoveries of material, application and technique.

VOLUME OF WORK.

This continues to maintain the high level of the last three years, 5,578 samples being registered for chemical and physical investigation. In addition the various senior officers of the Branch are called upon for a large amount of information and advice on scientific problems by visitors to the department and by correspondents.

The revenue received in the way of fees was £1,365 6s. 5d.

The various samples received are classified in the accompanying table.

Source and Allocation of Samples.

Source. Department, etc.	Section 1. Foods, Drugs, and Toxicology.	Section 2. Mineralogy and Geo-Chemistry.	Section 3. Agriculture and Water Supply.
Premier's	1	3	3
Mines	27	935	...
Health	125	3	7
Agriculture ...	62	4	638
Public Works ...	12	3	128
Chief Secretary ...	...	3	2
Forests	61	...	303
Police	115	...	...
Metropolitan Water Supply and Sewerage	14	7	185
Tender Board ...	221	2	4
Government Laboratory	11	46	45
King's Park Board	...	...	1
Rottnest Board of Control	...	1	...
Industries	4	...	...
Aborigines	1	...	...
Factories	3	...	...
Fisheries	2	...	...
Postmaster General	3	...	...
Main Roads Board	6	...	...
Public Hospitals ...	16	...	...
Public Pay ...	31	1,526	247
Public Free ...	11	747	9
Totals	726	3,280	1,572
Grand Total ...	...	...	5,578

The most numerous groups of materials dealt with in each section were:—

(1) Foods, Drugs and Toxicology Section—

Toxicological exhibits ..	120
Human milk	56
Tan barks	49
Limes and limestones* ..	36
Bovine milk	34
Cattle dips	26

* Temporarily undertaken by this Section.

(2) Mineralogy, Mineral Technology and Geochemistry Section—

Gold ores and tailings ..	2,852
Minerals for determination	297
Assay weights checked ..	43
Copper ores for assay ..	23
Tin ores for assay ..	19
Tantalum ores	21

(3) Agriculture, Water Supply, and Sewerage Section—

Soils	633
Waters	527
Wheats	128
Flour	85
Bran	50
Sewage	47

Details regarding these and other samples will be found in the attached reports of the sectional supervising chemists.

DEPARTMENTAL COMMITTEES.

Meetings of the following committees were attended by myself or my deputy, and various problems arising therefrom were investigated:—

State Committee of the Commonwealth Council of Scientific and Industrial Research.

Advisory Committee on Foods and Drugs.

Advisory Committee on Metropolitan Water Supply.

Oils Committee of the Tender Board.

INVESTIGATIONS OUTSIDE THE LABORATORY.

In September I spent three days at Ravensthorpe and Kundip for the first time obtaining first hand information regarding the mineralogy of the district. As a result of complaints regarding an alleged inferiority in locally made rabbit-proof galvanised netting, I inspected the process of manufacture and examined the products, finally suggesting certain minor improvements.

Mr. J. C. Hood during long service leave in England was able to inspect the Government Laboratory in London, and get in touch with the factory inspection officers and wholesale chemical apparatus dealers, obtaining much information of value to the Branch. The same officer visited a number of city factories on a preliminary survey of the atmosphere prevailing in them.

PUBLICATIONS.

The following technical papers were read or published by members of the staff:—

Dean, G. E. M.: Pelshenke Test as a measure of Flour Quality. Read to Australian Chemical Institute.

Pericles, J. (with L. J. H. Teakle and G. W. Wickens, of the Agricultural Department); Nitrogen Supply of an Apple Orchard. Jour. Agr. of W.A., Vol. XI.

Rowledge, H. P.: A new method for the Determination of Ferrous Iron in refractory Silicates. Jour. Roy. Soc. of W.A., Vol. XX.

Simpson, E. S.: Glauconite, its Distribution and Uses. Chem. Eng. and Min. Review, July, 1934.

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

Simpson, E. S. (with L. J. H. Teakle): Notes on the Dartmoor Agricultural Area. Jour. Agr. of W.A., Vol. XI.

Southern, B. L., and Cole, H. T.: Soil Texture. Read to Royal Society of W.A.

In addition, a revision of the folder "Mineral Resources of Western Australia" was begun by myself at the end of the year and the new edition should be published early in 1935.

INTERNATIONAL CONVENTIONS AND DANGEROUS COMPOUNDS.

Several "Geneva Conventions" were considered during the year, notably the proposed addition of aliphatic hydro-carbons and their halogen derivatives to the list of causes of industrial diseases. Also the proposed addition to the list of dangerous narcotics, subject to international control, of certain derivatives of morphine, as well as codeine, thebaine and ecgonine.

The international method for the determination of morphine drawn up by a committee under Professor Van Itallie, has been adopted in the laboratory.

The new craze for using fat-reducing ("slimming") drugs without medical prescription or supervision has resulted in several deaths in Great Britain recently. In a report on this matter to the Commissioner of Public Health it was suggested that a certain measure of control should be exercised over the use of dinitrophenols and dinitrocresols for this purpose, and the public warned of the danger of using them indiscriminately. In Great Britain these compounds were gazetted as poisons on the 11th April, 1934, and on 20th July "Dinitrophenols and dinitrocresol and their salts" were added to the list forming part I. of the Fifth Schedule to the Western Australian "Pharmacy and Poisons Act Compilation Act, 1910," which entails considerable restrictions on their sale.

TOXICOLOGY.

It is satisfactory to record a marked decrease in the number of poisoning cases and toxicological exhibits dealt with this year, there being only 38 human cases investigated, all of which, with one exception, were suicides or attempted suicide. One death was proved to be due to the swallowing of an unusually heavy dose (about 50 grains) of phenyl-ethyl-malonyl-urea. This was the first such case recorded in the State. Curiously enough the same drug was almost certainly the cause of an entirely independent case, direct proof however being unobtainable, owing to the rapid absorption and alteration of the drug in the digestive tract. In most of the other cases poisons in common use for domestic purposes were the causes of death.

In the single charge of attempted murder the accused had stirred into his employer's food large quantities of the brightly coloured, and therefore perfectly obvious, Paris green.

FOODS.

The foodstuffs, including condiments, etc., dealt with during the year included:—

Bacon, baking powder, bread, butter, buttermilk, chutney, cocoa, coffee and chicory, cornflour, cream of tartar, custard powder, dripping, essences, fish paste, honey, jam, jelly crystals, meat, mustard, oatmeal, pepper, pickles, salt, sauces, self-raising flour, spices, and vinegar.

About one-half of the samples were collected by inspectors under the Health Act, whilst most of the remainder were samples of supplies for public institutions, either those deposited by contractors with the Tender Board, or actual supplies collected by officers of this Branch at various institutions in the metropolitan area.

In the large majority of cases the samples proved to be of satisfactory quality, excepting vinegar. In the case of this commodity there are several ways of producing the genuine article, and several degrees of imitations of the genuine. After consultation with manufacturers' representatives in 1933 no satisfactory means have been evolved for regulating the sale of vinegar under such names and descriptions as will ensure that the purchaser is fully aware of the exact nature of the material purchased. The existing regulations are unsatisfactory, being far less detailed than those in force in New Zealand and South Africa.

A distinct improvement has been noted in the quality of the locally made jam supplied this year under contract to the Government, and amounting to about 40 tons. Occasional samples are, however, still found which are undercooked, deficient in sugar or deficient in characteristic flavour. Two samples of "melon and pineapple" which were condemned were pure pie melon jams slightly flavoured with synthetic "pineapple essence."

In the case of a locally canned fish it was found that the label was quite misleading as to the nature of the contents. Some very unsatisfactory samples of pickles were examined, some of the constituents being completely raw. A "tomato chutney sauce" and a "tomato sauce" were found to be adulterated with starch. Three other tomato sauces were condemned, one containing benzoic acid, another apple pulp, and a third both of these prohibited constituents. Short weight is a fault found all too frequently in all lines. Such practices tend ultimately to ruin both the local and export markets.

The Food Standard Advisory Committe considered amongst other matters the allowable percentage of crude fibre in cacao products, and recommended it to be raised from 6⅓ per cent. to 7 per cent. Regulation 36 (2) was amended accordingly, and gazetted on the 11th August. The recommendations regarding tripe made in 1933 were approved and gazetted as Regulation 22 (20) on 8th June. Another material considered was the imitation cream produced by emulsification of butter and milk with a handpower machine recently put on the local market.

The samples of "jelly crystals" (mixtures of gelatine, sugar, citric acid and essences in proportions ready for use) submitted with tenders for Government supplies proved to be all unsatisfactory for one reason or another. A standard specification for this line was therefore prepared and adopted by the Tender Board. This was as follows:—

"Jelly crystals, assorted, in packets to make one pint, best local. Gelatine content to be not less than 19 per cent., and liquified mixture to set firmly on standing overnight at 18deg. C. (64deg. F.). To be of full and true flavour, containing not less than 4 oz. of approved flavouring in every 56 lbs. of mixture."

MILK.

Of the 34 samples of milk submitted by the Health Department and Local Health Boards, 22 were under standard. In a number of cases the analytical results were confirmed by freezing point tests. In one case some milk had been mischievously contaminated with a considerable amount of pipeclay.

Of the fifty-six samples of human milk examined in connection with the child welfare movement, most were close to normal in composition, but several were abnormal in fat content or in other respects.

DRUGS.

Several samples of barium sulphate were examined to determine if they were safe to use as opacifiers for X-ray photography of the digestive tract. All but one were free from barium or lead compounds soluble in dilute acetic acid, but one contained an appreciable trace of copper with a trace of soluble barium.

Two samples of thyroid tablets were examined, neither of which complied with the B.P. (1932) standards. Complaints regarding their efficacy had been made by medical practitioners.

Other samples included "Bonjean pills," aspirin and medicinal paraffin.

MISCELLANEOUS GOVERNMENT SUPPLIES.

These include soap (plain and medicated), disinfectant, floor polish, boot polish, plate polish, laundry starch, laundry blue, black lead, candles, and oils of various kinds. After analysis recommendations were made to the Tender Board as to which brand was the most satisfactory for Government use, and subsequently actual deliveries were checked against contractors' deposited samples. In almost every case locally manufactured articles have been found of sufficient merit to warrant their use in Government institutions.

PUBLIC WATER SUPPLIES.

The Metropolitan Water Supply Advisory Committee continues to function, and the greater part of the time of one chemist is employed on its problems, owing largely to the multiplicity of sources of supply, which include hill streams, artesian bores, and one shallow well. The fact that there is a seasonal variation in the quality of water supplied to the city owing to the use of bore water as a supplementary supply in summer only, creates difficultes in certain industries, on which we are frequently consulted. Most of these difficulties will disappear with the completion of the Canning River dam.

Public water supplies in the country accounted for 127 water samples which were analysed. Most of these were certified as of good potable quality.

Some important observations have been made during the last two years upon the effect of the cement

of reinforced cement pipes and cement-lined iron pipes upon the composition of the water flowing through them. The cement contains free lime and easily hydrolysed calcium and sodium salts, and the net effect upon water carrying an appreciable amount of common salt in solution is to increase the hydroxyl ions very appreciably. The effect was first noticed in the metropolitan water supply when short lengths of cement lined pipes were being laid for the first time. The pH of the water passing through them for the first few weeks was observed to rise from between 6.5 and 7.0 up to 8.5 or 9.0

An unusual combination of circumstances produced very serious effects at Ora Banda. Owing to the failure of the local supply at the end of 1933 about 42 miles of new 4-inch reinforced cement pipes were laid from Kalgoorlie to convey Mundaring water, which at its source has a pH of 6.9 with total salts 300-350 parts per million, of which 250-300 are potential NaCl. Local liming and evaporation alters these figures for the water as it leaves Kalgoorlie to pH 9.0, total salts 350-400 p.p.m.

After filling the new Ora Banda main, heavy rain fell there, and the main was closed at the outlet for several months. On filling a reservoir from it later on, serious complaints were made of the quality of the water. On examination it was found to have developed a pH of over 13 with total solids 3,725 p.p.m. of which Ca represented only 6, and Mg 12. Na amounted to 1,827, OH to 1,255, and CO_3 to 264. It took several months' use of the pipes to bring this water down to normal. Meanwhile the water in the reservoir was rendered drinkable by following the writer's advice to add natural "kopi" (finely divided gypsum) to it in calculated quantities. This advice was based on the fact that practically the whole of the alkalinity was attributable to potential NaOH and Na_2CO_3. The latter was destroyed immediately by addition of $CaSO_4$, and as fast as the NaOH picked up carbonic acid from the air, instead of remaining in the water as a hydrolysable salt, it was precipitated as $CaCO_3$. By this means the water in the reservoir was brought to a pH of 8.5 to 9. One recent sample of the treated water with a pH of 8.4 showed no caustic alkalinity, but carbonate equivalent to 7 parts Na_2CO_3 per million, which is eminently satisfactory.

PRIVATE WATER SUPPLIES.

Over 200 samples were derived from drills or wells on private properties, sent to determine to what extent they could be used for domestic purposes, irrigation and stock watering.

New mining operations led to the submission of 38 samples to determine their value for boiler purposes. As these were derived from a semi-arid region their quality was far below the standards laid down in well watered regions in Europe and America. Even within one small area, however, the water in different wells varies considerably, and of necessity the best of them is selected for use, and special precautions taken to prevent corrosion, scale accumulation, and any dangerous rise in the salt concentration of the water in the boiler.

GOLD MINING.

The number of samples received for gold assay, 2,852, constitutes a record. This is a result of the boom in gold mining and prospecting due to the enhanced price of gold in terms of Australian currency. For practically the whole year the local Mint price for gold exceeded £A.8 per fine ounce, reaching a maximum of £A.8 16s. 7½d. for one week in October. Prior to March, 1930, the fixed Mint price was £4 4s. 11½d. per fine ounce.

A very large amount of prospecting of old and new gold finds and abandoned mines by means of diamond drills is now proceeding. Many of the companies engaged in this enterprise prefer to have Government certificates of the assay values of the cores recovered.

The most important new gold find made during the year appears to be that at Palmer's Find, eight miles south of Yellowdine siding on the main Kalgoorlie railway, and only 24 miles S.E. of Southern Cross where gold mining was actively pursued over forty years ago. It is evident that there is always a possibility of discovering new gold formations on old and frequently traversed fields.

NEW MINERAL RECORDS.

Amongst the 300 minerals, collected by prospectors and members of the staff, and examined with a view to determining their identity, and possible commercial value, were several of more than passing interest.

New Mineral, Tabba.—What is probably a new mineral species, rich in tantalum, has been found at Tabba, and is being investigated in detail as opportunity occurs.

Manganocolumbite, Ravensthorpe and Balingup.—Further specimens have been obtained of the black tantalum mineral occurring in small quantities in pegmatite veins at these two places. These have enabled them to be identified in each case as manganocolumbite (niobate and tantalate of manganese).

Apatite and Dufrenite, Gingin and Hill River.—Numerous specimens of nodular apatite (fluophosphate of lime) and associated dufrenite (hydrous phosphate of iron) collected near Poison Hill, four miles north of Gingin, indicate the extension of the phosphate bearing bed, at the junction of the chalk and lower greensand, in a northward direction from Molecap Hill towards Dandaragan.

Similar specimens from the Hill River prove its extension still further to the north beyond Dandaragan.

Garnet, Rothsay.—A band of very coarsely crystalised garnet in greenstone at Rothsay is of good commercial quality and in sufficient abundance for the manufacture of abrasives. The mineral species is *andradite* (silicate of lime and iron).

Cobaltite and Erythrite, Ravensthorpe.—These two minerals previously recorded from Kundip have been observed in two auriferous reefs at Ravensthorpe. The former is a sulpharsenide of cobalt, the latter a hydrous arsenate of cobalt, derived from the former by weathering.

Ilmenorutile, Poona.—This extremely rare mineral, a compound of oxide of titanium with niobate of iron, has been detected in concentrates from an old tin mine.

Allanite, Norseman District.—Some large detrital specimens of allanite (silicate of lime, iron, aluminium and cerium) have been obtained on the outcrop of a pegmatite vein in this district.

Kyanite, Middle Chittering Valley.—Some magnificent specimens of kyanite (silicate of aluminium), suitable for the manufacture of refractories, were obtained from two new places in this district. There appear to be enormous deposits of kyanite rock suitable for concentration in this district.

SOILS.

Of the 633 soil samples analysed, 43 were for private individuals, advice being asked as to why they were proving to be infertile. An excessive amount of common salt was the usual adverse feature. In some cases excessive acidity was observed.

Of the remaining soils, about one-half were submitted by the Department of Agriculture, the other half by the Forests Department. Those from the former were mainly in connection with soil surveys of Herdsman Lake near Perth, Lake King and Carnarvon.

The Forests Department's samples were mostly from plantations of exotic conifers (*Pinus radiata,* etc.). These are being examined with a view to determining the best soil conditions for the growth of such trees, and the reasons for their failure to thrive in certain situations. Finality has not yet been reached in this investigation.

FERTILISERS.

An unusually high proportion, viz., 27 per cent., of fertilisers failed to reach the guaranteed standards this year. Most of these were blood and bone. The materials comprised superphosphate, potato manure, sulphate of ammonia, sulphate of potash, potassium chloride, nitrate of soda, dried blood, blood and bone, bonedust, wholemeal, fish meal, bird guano, and stable manure. Every sample of superphosphate examined more than satisfied the guarantees. This is by far the most important fertiliser used in the State.

Most natural mineral phosphates contain a small amount of fluorine as an essential constituent. This is especially true of rock phosphate, the source of all superphosphate made in the State. In the raw rock the fluorine amounts to 2.5 to 3.0 per cent. Unfortunately this constituent has recently been shown to have harmful effects upon stock and to a less extent upon plants. During the year therefore some determinations were made of the fluorine content of locally used rock phosphate, and derived superphosphate and dicalcium phosphate (used as a constituent of stock licks). Preliminary figures obtained were:—

	Fluorine
Rock phosphate	2.59 to 2.83%
Superphosphate	1.49 to 1.78%
Dicalcium phosphate ..	0.08 to 1.60%

Dicalcium phosphate and superphosphate containing over one per cent. of fluorine are not suitable for use as ingredients of stock licks.

CEREALS.

A large amount of work was done on local wheats and wheat products. Samples received were: wheat, 128, flour, 85; pollard, 6; bran, 50. One-half of the wheat samples were examined in connection with Royal Agricultural Show competitions, most of the remainder came from the State experimental farms. Certificates were issued in connection with three shipments of flour to China.

Comparative analyses of the f.a.q. commercial standard wheats from New South Wales, Victoria, South Australia and Western Australia will be found in Mr. Hoare's report on page 85.

SECTIONAL REPORTS.

I append reports by the three Supervising Chemists giving details of the work performed in their individual sections. These officers are to be congratulated on the manner in which they have carried out their duties in an exceptionally heavy year, under adverse circumstances as regards expenditure on equipment and literature.

EDWARD S. SIMPSON, D.Sc., B.E., F.A.C.I.,
Government Mineralogist and Analyst.

Perth, 15th February, 1935.

SECTION I.—FOODS, DRUGS, AND TOXICOLOGY.

By H. E. Hill, A.I.C., A.A.C.I.

During the year 726 samples were examined, compared with 774 for last year. The decrease is due mainly to the shortage of staff experienced in the section during the year. For the first six months (during the first three of which Mr. F. J. Malloch was in charge) the normal staff of five was depleted to four by the non-filling of a vacancy, in addition to which the absence of Mr. Hood during five months of the year on long service leave and sick leave was felt considerably. Much projected work had to be left untouched. Mr. J. Pericles, a registered analyst under the Health Act was transferred to the section early in July.

Ninety-three different kinds of samples were examined, some of the more important of which will be mentioned.

Government Contract Samples.—The most numerous class of samples examined during the year comprised foodstuffs and stores for the Government Tender Board. Many of these materials are purchased only after examination in this laboratory. This year 221 samples were received, an increase of 37 over last year. These included jams (23), soaps and other cleaning materials (23), polishes (20), jelly crystals (17), vinegars (8), paints (10), salts (12), essences (10), flysprays (9), as well as many other materials, including starch, disinfectants, cocoa, honey, cornflour, custard powder, and self-raising flour.

In the case of foodstuffs and soaps compliance with the Food and Drug Regulations of the Health Act is the first requirement. Some of the former are commented on under the heading of "Foods and Drugs." For other materials suitable tests are devised, and in all cases determinations of quality are made by tests and careful comparison, having regard where possible to the conditions under which the materials are proposed to be used.

In the case of jelly crystals it was found possible to compile a specification as to gelatine content and setting property, which has been adopted by the Tender Board in calling tenders. In a number of other instances much information has been accumulated during the past three or four years regarding the quality and composition of materials purchased by the Government, and it is hoped that it will be possible in the near future to compile further specifications and minimum requirements.

An important part of this work, to which increasing attention is being given, is the checking up during the year, when the contracts are in operation, of the quality of the goods actually supplied, to ensure that they are equal to the samples on which the contracts were let. Officers of the section visit Government institutions during the year and take samples at will. By this means it has been possible to assist in keeping up the standard of supplies, and in several cases the substitution of inferior goods has been detected and checked. A number of complaints have also been followed up.

In connection with this class of work a number of samples of drugs and chemicals which have been submitted by the Drug Officer, Department of Public Health, in connection with supplies for hospitals may be noted. Two samples of thyroid tablets were found not to comply with the standards of the British Pharmacopoeia for thyroid extract. Of three samples of barium sulphate used in X-ray work two complied and one did not. These and other samples at present in hand indicate the need for examination of such materials.

Foods and Drugs.—Two hundred and fifty-eight samples of food and drugs were examined during the year, of which 125 were for the Department of Public Health and most of the remainder for the Government Tender Board. The most important are as follows:—

Milk.—Thirty-six official samples were submitted by the Health Department and various local authorities. Of these 23 passed and 13 failed to comply with the requirements of the Food and Drug Regulations. In a number of cases the Hortvet cryoscope was used to determine the freezing point, as it is the custom with the authorities where doubtful or border-line results have been obtained to submit a sample to this laboratory for a cryoscopic test to establish its genuineness or otherwise.

Vinegar.—Fifteen samples of vinegar were submitted during the year. Seven samples were examined for the Department of Public Health, of which one complied and six failed to comply with the Food and Drug Regulations. Eight samples were analysed for the Government Tender Board. Of these seven complied and one failed. The vinegar position is still unsatisfactory, several manufacturers persisting in passing off as a genuine fermented product one consisting largely of commercial acetic acid with or without fermented sugar or spirit, plus a mere flavouring of malt. A number of successful prosecutions were instituted by the Health Department during the year and other proceedings are in train. Unfortunately the small fines inflicted by the magistrates even for repeated offences, and the fact that usually only the name of the retailer, and not that of the maker, appears in the Press, make the proceedings a very light affair for the real offenders.

Butter.—Twelve samples of butter were examined, all of them being for the Superintendent of Dairying, Department of Agriculture. Eleven samples were examined for water content, of which six exceeded the limit of 16 per cent. imposed by the Dairy Industry Act, the highest containing over 20 per cent. of water. One sample was submitted for complete analysis.

Human Milk.—Fifty-six samples of human milk were analysed for various infant welfare clinics and the King Edward Maternity Hospital. A large percentage of these were of normal composition, but the analyses appear to be of considerable assistance in diagnosing the ailments and adjusting the feeding of infants.

Drugs.—Only two samples were submitted by the Department of Public Health, although a number of others, which will be dealt with later, were examined for the Police Department. A sample of well-known "female ailment" pills which were suspected of finding use for the purpose of procuring abortion were found to contain aloes, the alkaloids of ergot, an oil resembling oil of savin, ferrous sulphate, and liquorice, compounded with French chalk. As the label on the package did not comply with Regulation 72, section (1) of the Food and Drug Regulations by declaring the presence of the two potent drugs, ergot and oil of savin, suitable action was taken by the Health Department.

One sample of liquid paraffin was found to comply with the requirements of the British Pharmacopoeia, including the newly inserted viscosity limits.

Toxicology and Police Cases.—One hundred and twenty (120) exhibits were examined for the Police Department and Perth Hospital, chiefly in connection with cases of poisoning and suicide, compared with 189 last year. This work continues to absorb considerable time, a good deal of which is taken up when negative results, involving the careful elimination of the different classes of poisons, are obtained. The poisoning cases fall into the following groups:—lysol 8, cyanide 4, strychnine 2, iodine 1, methylated spirit (with a dyestuff of the triphenylmethane class, viz., magenta, in the form of spirit dye) 1, arsenic 1, Paris green 1, rat poison (corrosive sublimate and arsenious oxide) 1, luminal 1, negative 18.

The first case of luminal poisoning noted in this State occurred during the year when a youth, an epileptic, who was receiving 3 grains a day in 1 grain doses, died by the self-administration of a number of 1 grain tablets. The exact amount taken could not be ascertained, but there was some evidence to show that not more than 50 grains were taken. The interval before the approach of symptoms was about three hours, and death took place during coma in 27 hours. The post mortem appearances were fatty degeneration of the liver and some signs of irritation in the stomach. From the stomach wash-out three-twentieths of a grain of luminal were recovered. Luminal appears to be rapidly absorbed and changed in the human body.

A number of other materials were examined for the Police Department, several in connection with offences under the Police Offences (Drugs) Act. Two specimens of powder were found to be cocaine hydrochloride. This was being illegally sold in Perth, and proceedings instituted by the police resulted in a conviction. One sample of opium taken by Customs officers in a raid on Chinese was found to contain 6.5 per cent. of morphine. Three samples of pills were examined for the presence of abortifacient substances, and one for cocaine and morphine. A sample of supposed aphrodisiac was found to consist practically entirely of acetylsalicylic acid (aspirin) slightly coloured.

A cleaning agent known as "Brown's Electric Stick" which had been bought in considerable quantities by large and small stores in Perth from a person who claimed to be an agent was submitted by the police. When examined this was found to be nothing more than common household soap cut into small sticks and enclosed in tinfoil with a yellow wrapper. The cleaning powers attributed to this material were quite consistent with those shown by soap. However, proceedings instituted by the police were successful in obtaining a conviction on the grounds of false representation, the defendant having claimed to be the representative of an English firm manufacturing a special cleaning agent, whereas actually he had made the sticks in Perth from locally-purchased household soap.

Sealing of exhibits.—Attention is directed to the sealing of exhibits. In many cases where they should be, they are not sealed at all, and in all the others the mere fastening of the package or bottle with red or adhesive tape and a blob of sealing wax cannot be regarded as proper sealing. A seal mark is an impression in wax made by some implement, preferably a seal, which cannot easily be imitated and which can if necessary be compared with the original. It is desirable where the proper procedure is to be followed that this method of sealing be used wherever possible.

Tan bark and timbers.—Forty-nine samples of barks from different species of eucalypt, chiefly mallets, were examined, most of them for the Forestry Department in connection with a survey of the tan-bark resources of the Narrogin, Newdegate, and Ravensthorpe districts. Determinations were made of the tannin content with, in most cases, results substantially in accordance with those obtained by the Forests Products Laboratory when domiciled in this State.

Calorific value of timber used for firewood.—Fifteen samples of timber as supplied to the Goldfields Water Supply pumping stations were examined for the Forestry Department. Determinations of calorific value on the dry and wet basis, nominal density and basic density (a figure calculated from the oven-dried weight and the volume when soaked, and considered to be the most useful density figure for the characterisation of timber species) were made. In connection with the supply of firewood it had been contended that the calorific value of young regrowth did not compare favourably with that of firewood split from mature trees. Accordingly, samples of dry split wood from large trees, consisting of one billet from towards the heart and one towards the sapwood from each of three trees, and also samples of small round wood consisting of three billets of average diameter and three split billets were submitted for examination. The laboratory investigation was carried out by Mr. Hood in collaboration with Mr. F. Gregson, Forestry Utilisation Officer. The results, a summary of which is shown in the following table, showed that there was no appreciable difference between the two classes of firewood both on the dry and wet basis:—

	Old Jarrah billets. (Mean of six samples.)	Young Jarrah, round & split. (Mean of six samples.)	Marri (Redgum). (Mean of three samples.)
Moisture—			
Content when received ...	18·85 %	15·25 %	22·9 %
Calorific Value—			
B.T.U.'s gross, Dry basis ...	8817	8822	8535
Calc. to original moisture content	7156	7474	6580

The calorific values of woods, even of different species, apart from the presence of resins and essentials oils, appear to more or less approximate to one another when calculated on the dry basis, and the main factor in buying wood is the moisture content. In the case of the present investigation the young wood, being thinner, had dried out more quickly than the heavier billets with a consequently better fuel value before artificial drying.

Sanitation of Factories.—During the year Dr. Simpson and Mr. Hood were appointed inspectors under the provisions of the Factories and Shops Act. This was to facilitate inquiries made by this Branch on behalf of the Chief Inspector of Factories into the risks of poisoning in certain industrial processes. As it is likely that considerable investigation along these lines will be required in the near future a preliminary survey of a number of processes in Perth was made by Mr. Hood, who subsequently, during his long service leave in England took the opportunity of prosecuting further inquiries at the Home Office Factories Department, the Government Laboratory, and several other centres. He also selected some apparatus which is required by the laboratory for the chemical examination of fumes and gases.

A sample of paint made from bitumen and mineral turpentine was examined for constituents likely to cause harmful vapours, and two samples of glazing slips used in pottery-making were analysed for soluble lead compounds.

Miscellaneous Samples and Minor Investigations.

Cattle dips.—During the year twenty-six cattle dips were tested for arsenic content for the Stock Branch of the Department of Agriculture. These tests assist the department in maintaining a constant 0.20 per cent. arsenious oxide content in the dipping fluid used for cattle imported from the North-West.

Volumetric apparatus.—Six pieces of volumetric apparatus, two burettes and four flasks were standardised for the Dairy Branch of the Department of Agriculture.

Liquors.—Fifteen (15) samples of liquors were examined for the Liquors Inspection Branch of the Police Department. These comprised one gin and two whiskies, all three adulterated with water. There were also nine samples of brewed beverages, of which four were hop beers containing more than 2 per cent. of proof spirit, the makers of which were proceeded against by the police for infringements of the Licensing Act. One lager beer and one bitter beer were examined for the presence of quassia with a negative result. Three samples of beer and one stout, one of the former being a new brand on the market, were examined as to compliance with the Food and Drug Regulations, with satisfactory results.

Lime and Limestones.—Thirty-six (36) samples were examined during the year, twenty-four of which were lime purchased by the State Batteries Branch of the Mines Department for use in the cyanide treatment of gold ores where lime is used as an antacid. The remainder were samples for the Government Tender Board and the public. A sample of quicklime made by a new local company from hard capstone gave a free lime (CaO) content of 97.0 per cent., the total lime amounting to 97.9 per cent., the best local lime yet submitted to this laboratory.

Galvanised Wire Netting.—Six (6) samples were examined during the year, two for the Under Secretary for Lands and four for the Economic Council, Department of Industries. Three of the latter were taken by Dr. Simpson during a visit paid to the local factory to examine the machinery and methods of manufacture in connection with suggestions that the locally-manufactured article, particularly where the salt content of the soil is above normal, does not last so long as the imported wire. Compared with imported wire the local netting was found to be of fair average quality. Further improvement, however, might still be made by paying more attention to the annealing of the wire after drawing, and to the attainment of a more uniformly heavy coating of zinc.

Ethyl petrol.—Two samples of commercial first-grade anti-knock motor spirit which have been placed on the market during the year were examined as to their content of lead tetra-ethyl and similar organic lead compounds. Lead tetra-ethyl to the extent of one part in 9616 and one part in 3704 by volume respectively was found. This indicates that these petrols are in accordance with the recommendations of the British Departmental Committee on Ethyl Petrol. That Committee, recommended, among other safety provisions, on account of the toxicity of lead compounds, that the quantity of lead tetra-ethyl in fuel sold for ordinary commercial purposes should not exceed one part in 1300 parts of petrol by volume. It is proposed to check these petrols on the market from time to time.

Enamelled ware containing antimony compounds.—At the end of 1933 two samples of cordials—lime juice and raspberry flavour—which had caused sickness and vomiting in persons consuming them were found to be seriously contaminated with copper derived from the copper vessel in which the citric and tartaric acids used had been dissolved by boiling water. In following up the sources of possible contamination the Health Department officials were asked to submit any samples of enamel ware used in the preparation of these acidulous drinks. Accordingly three enamelled buckets were sent in for examination. These were tested to see if any poisonous metal was liable to be dissolved from the enamel by subjecting them to the action of boiling 1.25 per cent. solutions of citric and tartaric acids. In each case it was found that an objectionable amount of antimony was dissolved when the acid solution was kept boiling in the bucket for one hour. The quantities dissolved ranged from 0.20 to 0.83 grains per gallon. The use of antimony oxide in cheap enamels on culinary utensils involves grave risk to human beings. The better class enamel-ware contains tin oxide, which is considered the best opacifier on account of its small toxicity. In any case, however, such drinks should not be made in enamelled vessels unless the temperature is kept low and the time of contact reduced to a minimum. Acid drinks should never be stored in enamelled vessels.

Locally-grown pyrethrum flowers,—A sample of pyrethrum flowers, *Chrysanthemum cinerariaefolium*, grown at Herne Hill, was examined for the Government Entomologist by Mr. Hood. The sample consisted of dry, apparently immature, flowers with small stalks attached, varying in length from one quarter to one and a half inches. The content of pyrethrin I. (which is by far the more toxic of the two active principles of pyrethrum) was found to be 0.24 per cent. In this respect the sample fell just below the group of medium toxicity containing 0.26 to 0.36 per cent. of pyrethrin I. in a classification of pyrethrums made at the Rothamstead Agricultural Experimental Station, England.

As one of the main uses of pyrethrum is the manufacture of fly sprays, the sample was also tested by making up two experimental sprays. One followed a recognised commercial formula, and the other utilised 20 grams of flowers to make 200 millilitres of spray—a concentration found to be efficient in previous trials with good commercial pyrethrum in this laboratory. The sprays made were tested on flies against a good commercial spray, using the technique developed in the laboratory for testing sprays. That made by the first formula was found to be slightly superior to the manufactured spray, but the second formula gave a spray which was considerably slower in taking effect.

It appears that an improvement in W.A.-grown pyrethrum could probably be effected by allowing the flowers to mature fully and by minimising the amount of stalk present.

Miscellaneous advice and assistance.—In a number of cases advice and assistance have been given to Government Departments by means of tests and samples. For the Metropolitan Water Supply Department some bitumen-lined water pipes (tubing) were subjected to heat and other tests so that an opinion could be given on their suitability for reticulation purposes.

Assistance has been given to the Government abattoirs by making available the services of Mr. Chapman to examine the decolourising earth used in tallow purification, conduct corrosion tests, and assist in the making up of sodium chloride brine for the new cooling plant to replace the calcium chloride brine used in the old plant.

Advice was given to the Perth Hospital laundry on a suitable method of cleaning some badly stained sheets, and in a number of other instances information has been given to Government departments and the public.

SECTION II.—MINERALOGY, MINERAL TECHNOLOGY AND GEO-CHEMISTRY.

(By H. Bowley, F.A.C.I.)

Three thousand two hundred and eight samples were entered for examination in this section for the year 1934, being a considerable increase on the number received during the previous year. There was a slight falling off in the number of tailings samples received from the State Batteries Branch but the samples classified as "Public Pay" increased from 904 in 1933 to 1,526 for the year under review with a consequent appreciable increase in revenue. In order to cope with the additional work it was found necessary to appoint a part time laboratory assistant towards the end of the year.

The conditions in the sampling room have been very much improved by the installation of an exhaust fan and hopper to remove the dust emanating from the fine grinding machine, whilst some protection against poisoning by the toxic gases used in the laboratory has been provided by connecting up the fume cupboard, used for sulphuretted hydrogen, with the exhaust fan. Consideration should be given to the question of connecting up all fume cupboards used for noxious fumes with a similar installation, so as to provide reasonable working conditions for all the chemists employed in this section.

Gold Assays.—Altogether 2,852 samples were received for gold assay this year as compared with 2,373 for the previous year. These were classified as:—

Public Pay	1,484	(862)
Public Free	504	(451)
Official	864	(1,060)

The figures in parentheses are those for the previous year (1933). The marked increase in the number of samples received, was largely due to the number of pay assays submitted, these consisted mainly of cores from bores put down by private companies on various unworked mines. Assays were made of cores from:—

Frasers G.M.L., Southern Cross; Star of the East G.M.L., Gabanintha; Apex G.M., Marble Bar; Gem Consolidated G.M., Harbour View G.M., and Hillsborough G.M., Kundip; North Kalgurli United G.M., Kalgoorlie; Big Blow G.M., and Tindals G.M., Coolgardie; Sunny South G.M., Jimblebah; McTavish G.M., Kookynie; Triton G.M., Reedy; Youanmi G.M., Youanmi; Granites Development, Wiluna; Yellowdine Option, Yellowdine.

It was expected that the launching of the Prospecting Scheme by the Government would result in a considerably greater number of free assays being carried out for prospectors. That the facilities provided by the Government in this laboratory have not been availed of to a far greater extent may be due to the fact that a large number of persons now engaged in prospecting are probably not aware of the conditions under which free assays are made. In order to encourage bona fide prospecting, a limited number of samples will be examined free of cost from each single locality within the State from land not registered as a mineral lease, provided that the exact locality where the sample comes from is disclosed, and that the sample is of sufficient promise to warrant an assay being made at the expense of the State.

Valuation of Gold Cyanide Solutions.

Some interesting figures were obtained by the use of three different methods for determining the gold content of a sample of pregnant cyanide solution from a gold treatment plant. The methods were:—

1. *Lead-zinc Method.*

Weigh approximately 50ml. of solution. Add 10 ml. of 10 per cent. solution of lead acetate and 4 grams of zinc shavings. Boil for a minute. Add 20 ml of concentrated hydrochloric acid. When action ceases, bring to boil again. Wash spongy lead precipitate with distilled water and transfer to filter paper. Dry and cupel with the necessary amount of silver for parting.

2. *Charcoal Method.*

Weigh about 50 ml. of solution. Add 1.5 grams of finely powdered wood charcoal and stir well. Filter off charcoal and wash with distilled water. Remove most of the charcoal from filter paper and ash filter paper. Mix the charcoal and ash with 40 grams litharge and a little borax. Fuse in fireclay crucible and cupel lead button after addition of the necessary silver for parting.

3. *Electrolytic Method.*

Weigh about 50 ml. of solution, transfer to a beaker and precipitate the gold by electrolysis. The cathode consists of a cylinder of clean lead foil, and the anode of an iron nail, 3 to 4 inches in length. An excess of ammonia is added and the solution electrolysed for 4 to 5 hours with a current of about 2 volts. When precipitation is complete the cathode is washed, dried and cupelled with the required amount of silver for parting.

The results obtained for gold were:—

Method.	Lead-zinc.	Charcoal.	Electrolytic.
Dwts., per ton	6·80	6·86	7·31

Fluorine in Phosphates.—After an extensive examination of the various methods available for determining the fluorine content of phosphatic materials, and the adoption of some necessary modifications to suit the materials examined, the following results for fluorine were obtained. These are considered to be correct to at least two significant figures.

Rock Phosphate and Superphosphate.

Mark	Ocean Island.	Ocean Island.	Nauru Island.
Rock Phosphate—	%	%	%
Phosphoric oxide P_2O_5	39·88	39·52	38·95
Fluorine, F ...	2·83	2·82	2·59
Superphosphate—			
Phosphoric oxide P_2O_5	24·43	24·22	24·00
Fluorine, F ...	1·78	1·70	1·49

On calculating the amount of fluorine in the superphosphate on the basis of the ratio of fluorine to phosphoric oxide in the rock phosphate, and assuming that in each case the superphosphate was manufactured only from the rock shown immediately above, the following figures were obtained:—

Fluorine found	1·78	1·70	1·49
Fluorine by calculation	1·73	1·72	1·62
Difference	+ ·05	— ·02	— ·13

Authenticated samples of a natural rock phosphate from Ocean Island, and the superphosphate manufactured from it, gave on analysis:—

	Rock phosphate.	Superphosphate.
	%	%
Phosphoric oxide P_2O_5	39·76	23·54
Fluorine, F	2·80	1·52

The loss of fluorine in manufacture in this case being 0.14 per cent., representing 5 per cent. of the total fluorine present in the natural rock phosphate.

Dicalcic phosphate.

	%	%
Phosphoric oxide P_2O_5	39·28	39·08
Fluorine, F	·08	1·60

Tantalite.—Twenty-one samples of tantalite were examined during the year, the North-West Division being, as usual, the main source of this type of ore.

Samples were received from the following localities:—

North-West Division.

Tabba Tabba, Wodgina, Moolyella, McPhees Range, and Mt. Francisco.

Central Division.

Gibraltar, Londonderry, and Larkinville.

South-West Division.

Ravensthorpe, Balingup.

Those received from Tabba Tabba and Wodgina represented, in the majority of cases, parcels of manganotantalite produced for the market.

One specimen from M.L. 312, Tabba Tabba, consisting of a colourless transparent mineral with a submetallic lustre, associated with a dull cream-coloured alteration product, and what appeared to be intergrowths of quartz and felspar, is probably a new mineral species. An exhaustive examination is now being made of a specially selected specimen showing evidence of a crystalline form with a prism angle between 57deg. and 60deg.

Of the two samples received from Gibraltar, one consisted of dull manganocolumbite, and the other of glassy manganotantalite. The Larkinville specimens consisted of pebbles of manganocolumbite ranging in specific gravity from 5.50 to 5.57 and containing approximately 15 per cent. of tantalic oxide.

A black mineral, occurring in a spodumene pegmatite on W.R. 17 at Ravensthorpe, proved to be manganocolumbite with 35 per cent. of tantalic oxide. Crystals of manganocolumbite associated with beryl and microcline with some quartz and muscovite were received also from the felspar-beryl vein at Ferndale (Balingup). The specific gravity of the manganocolumbite ranged from 5.55 to 6.40.

Sillimanite.—A series of burning tests were made of four samples of sillimanite bearing material obtained from the extensive deposits of sillimanite schist situated at Goyamin Pool (Chittering Valley), in order to determine their suitability for use as refractories.

Description of samples.

No. 1. Sillimanite quartz mica schist.

No. 2. Sillimanite associated with a large amount of biotite mica, obtained from No. 1 by levigation.

No. 3. Sillimanite associated with an appreciable amount of biotite mica, obtained from No. 1 by levigation.

No. 4. Sillimanite crystals with much less mica obtained from No. 1 by levigation.

Briquettes made from No. 4 were tender and friable, so that it was found necessary to add 10 per cent. of a semi-ball clay to act as a bond to impart the necessary tenacity before burning.

The results obtained on burning were:—

Sample	No. 1.	No. 2.	No. 3.	No. 4.
Temperature ...	1,350° C.	1,450° C.	1,450° C.	1,450° C.
Linear shrinkage from air dry %	3·3	Not measured	Nil	Nil
Porosity (water absorbed) % ...	10·4	10·7	8·1	13·3

No. 1 showed distinct signs of fusion at 1,350deg. C.

Nos. 2 and 3 were plastic at 1,450deg. C., a considerable amount of slag derived from the biotite showing on the surfaces of the briquettes. No. 4 showed indications of extensive fritting at 1,450 deg. C.

The suitability of the sillimanite from this locality for the manufacture of refractories will depend to a large extent on the development of a satisfactory method for separating it from most of the associated quartz and mica.

Graphite.—A soft ferruginous rock with much graphite from Isseka assaying carbon 58.60 per cent., volatile 6.36 per cent., ash 35.04 per cent., yielded 21.3 per cent. of flake graphite containing 80 per cent. of carbon.

Dufrenite.—Masses of dark and bright green dufrenite (hydrous ferric phosphate) with granules of greenish brown glauconite embedded in a mixture of grey kaolin and quartz were received from Poison Hill, Gingin.

Scheelite (tungstate of lime) was present to the extent of about 3 per cent. in a cupriferous gold ore from 13 miles west of Kundip.

Alunite.—Alunite carrying K_2O 8.90 per cent.: Na_2O, 1.56 per cent, occurring as white nodules up to 1 inch in diameter in a reddish and spotted altered porphyrite, was received from Grant's Patch.

Alunite bearing material containing approximately 50 per cent. of alunite with 3.3 per cent. of "extractable" potash was examined from a lake east of Marvel Loch.

Riebeckite.—A blue schist from Duck Creek, a tributary of the Ashburton River, consisted almost wholly of massive riebeckite. The fibrous variety (crocidolite or blue asbestos) with tough and flexible fibres up to one inch in length was also recorded from this locality.

Mineral Analyses.—Complete mineral analyses were made of the following:—

(a) *Minerals.*—Almandine, Goyamin Pool; Anauxite, Ravensthorpe; Andesine, Bullsbrook; Andradite, Rothsay; Diopside, Davyhurst; Epidote, Callion, Swan View; Hypersthene, South Kumminin.

(b) *Rocks.*—Black chert, Kalgoorlie; Diorite, Harvey Weir; Fuchsite quartzite, Larkinville; Graphitic schist, Larkinville.

(c) *Ores.*—Gold ore, Reedy.

Investigatory.—Mr. J. N. A. Grace was engaged, as opportunity offered, on an investigation into the action of ammonia on sedimentary alunite. This work was designed so that the potassium and ammonium could be recovered from the solution as potassium ammonium sulphate and the aluminium from the insoluble residue. He obtained some very encouraging results which are now being incorporated in a paper.

Mr. H. P. Rowledge developed a new method for the determination of ferrous iron in refractory silicates. The results of his work, which form a valuable contribution to mineral chemistry, were published in the Journal of the Royal Society of Western Australia.

Mr. H. P. Rowledge has also been studying methods for the determination of fluorine in fluophosphates with a view to establishing the composition of mineral phosphates and their manufactured products. He has been paying special attention to the conditions for the quantitative precipitation of fluorine as a thorium salt and the possibility of adopting a gravimetric method.

SECTION III.—AGRICULTURE, WATER SUPPLY AND SEWERAGE.

(By A. J. Hoare, A.A.C.I.)

The number of samples entered for the year 1934 totalled 1,572. Although the actual number of samples received are lower than last year, the more detailed work required, more than compensates for this difference. The sources of the samples will be found on page 74.

Staff.—Considerable changes have taken place during the year. Mr. R. G. Lapsley, who was the senior chemist, resigned early in the year. Mr. B. D. Southern, A.A.C.I., was appointed to the position as from 1st July. Mr. G. E. M. Dean, A.A.C.I., joined the staff on the 2nd July. Mr. J. Pericles', A.A.C.I., transfer to the Foods and Drugs Section left a further vacancy which was filled by Miss H. T. Cole, B.Sc., A.A.C.I. The temporary position on the staff was filled by Mr. J. C. Cavanagh, B.Sc., early in December.

Soils.—Of the 633 soils received during the year, 66 finalised the nitrate survey of soils taken from an apple orchard at Argyle. This survey has been in progress for 12 months and a full report will be found in Vol. 11 (second series) of the Journal of Agriculture, W.A., page 173.

The Department of Agriculture submitted 302 samples; of these 129 were from three different districts; Herdsman's Lake (near Perth), Lake King area and flood plain soils of the Gascoyne River. These entailed a very complete examination and when the results are published by the Department of Agriculture, they will supply useful data as to the character of a further batch of the Western Australian soils. The balance of the samples were sent in principally for the determination of water soluble salts, sodium chloride and reaction; the figures being used to check the results found by the field survey parties.

The Forests Department submitted 288 soils in all, half of these being for nitrate determination and taken from the pine plantations at Myalup and Applecross.

The Myalup survey was completed during the year, but no definite conclusions could be drawn from the figures obtained. That from Applecross is still in progress. The soils officer of this Department sent in 129 samples for mechanical and chemical analyses, taken from the pine plantations at Mundaring, Pardelup, Harvey, Albany and also from the pine plantations at Green Hills, Tumut, New South Wales. In addition to the above 15 were taken at Tallanalla in connection with a land settlement scheme. Soils submitted privately numbered 43, the principal query being as to why they are infertile; this in most cases was caused by excessive quantities of water soluble salts, sodium chloride or acidity.

Fertilisers.—Of the 46 samples received, thirty-two official samples were submitted by the Inspector of Fertilisers, and nine of these did not comply with the regulations, being below the guarantee in one of the constituents. Four samples of stable manure to be used in conjunction with tobacco growing experiments at Manjimup were sent in by the Agricultural Department. The balance of the samples came from private sources; they were either accompanied by complaints as to quality or represented deposits thought to be of value as a fertiliser.

Fungicides and Insecticides.—Eight samples were submitted for analysis during the year. Six of these were received from private sources, the analysis being required before they could be registered under the Plant Diseases Act; the other two were a copper carbonate dusting powder, and an alleged cure for tobacco mould.

Fodders.—Very few natural or cultivated fodder plants were received for analysis. As information is often sought after in regard to the feeding value of fodder grasses, a collection of samples from different parts of the State, over a period of at least two years and at different stages of their growth, would supply very useful information. Only six samples were analysed during the year, four of these being annual and perennial veldt grass, taken at two different stages of growth; these were collected at South Perth by the Government Anaylst. The other two specimens were of a type of salt bush, growing in the Salmon Gums district, and were submitted by the Department of Agriculture.

Waters.—Of the 527 water samples received during the year, the Metropolitan Water Supply Department accounted for 144; these included hygienic analyses every quarter, of each of the different sources of supply to the metropolitan area; also every month a partial chemical analysis and determination of iron. These waters were found to be all of good potable quality. The Department of Works and Labour submitted 127 samples in all, taken from the Mundaring reservoir, Kalgoorlie reticulation, and country towns supplies; these also in the majority of cases were of good potable quality.

With the increased activity in gold mining, a good water supply is essential for boiler purposes. Taking English or American standards for boiler waters, very few if any of the inland West Australian waters would be accepted. Thirty-eight samples were submitted by gold mining companies during the year; these waters are usually high in chlorine, sodium, magnesium and nitrates; consequently being very corrosive and requiring special treatment, such as suspending zinc blocks in the boiler, and a more frequent blowing off of the concentrated solution and accumulated deposits. The majority of the balance of the samples received were for general stock and irrigation purposes.

Sewage.—The usual quarterly samples numbering 41 were received from the treatment works at Perth, Subiaco, and Fremantle. Six samples submitted by the Health Department come from country installations at Bridgetown, Kalgoorlie, and Wooroloo; judging from the figures obtained treatment might be improved.

Ash of Pines.—Following on the study of soils from the Forests Department's pine plantations, it was decided to start an investigation into the composition of the ash from well grown and stunted pines, to see if any lead can be given as to why some trees grow well in a certain district and others either die or remain stunted. This work was started at the latter end of 1934; the needles, bark and wood of good and poor trees are being treated separately.

Barley.—Twenty-one samples of barley were received from the Department of Agriculture, of which 16 were grown at Merredin and Wongan Hills State Farms. The protein, starch and fibre in these were required principally to fix their value for malting purposes.

Brans and Pollards.—Fifty-six samples were registered during the year, of these 44 were bran samples for moisture determination. The balance were official bran and pollard samples collected under the Feeding Stuffs Act. With the exception of three, these all failed in some respect to comply with the standards set down under the Act.

Flour.—The total number of flours received during the year was 85, of these 71 came through the Agricultural Department, the majority of them being obtained from the grinding of wheats grown at the various State farms. The balance of the samples comprised: three for export to China; two from the Tender Board; two from a commercial mill and seven for the Government Analyst.

Wheat.—Of the 128 wheats received, seven were sent in by a commercial firm for moisture determination. The balance came from the Department of Agriculture and comprised: 5 for moisture; 5 f.a.q. samples; 22 from the State farms for milling and analysis of the flour obtained; 26 for protein and Pelshenke figure, these also came from the State farms; 63 in connection with the Royal Agricultural Society competitions. Due to a change in the methods of judging wheats, suggested by the Agricultural Department and endorsed by the Council of the Royal Agricultural Society, the milling of Show wheats and analysis of the flour has been abandoned; the protein and Pelshenke figures being substituted in their place. The judging was carried out by officers of the Agricultural Department in conjunction with a miller from a commercial flour mill.

The figures obtained for the f.a.q. wheats are as follows:—

Lab. No.	2210	2211	2212	3555 2nd Sample
Mark and Origin	33/4	33/4	33/4	33/4
Condition	Victoria Bleached, sprouted slightly smut tipped	New South Wales. Sound thin grain	South Australia. Sound shrivelled	Western Australia. Sound even size
Grain Analysis :				
Moisture, %	12·48	12·38	11·33	11·35
Bushel weight, lbs.—Found	60	60	61¼	61½
do. do. Declared	60	59	60	61½
Weight of 1,000 grains, grams	37·48	36·50	35·08	37·57
Milling Analysis :				
Flour, %	72·9	71·5	70·8	72·9
Bran, %	18·7	17·7	18·1	18·2
Pollard, %	8·4	10·8	11·1	8·9
Wheat Meal Analysis :				
Protein (N x 5·83), %	11·42	11·48	11·47	10·38
Pelshenke Test—Time factor (minutes)	36	66	40	40
do. do. Specific protein quality	3·2	5·9	3·6	3·9
Ash, %	1·52	1·60	1·58	1·35
Flour Analysis :				
Lab. No.	3556	3557	3558	3559
Moisture, %	12·70	13·35	13·34	13·25
Protein (N x 5·7), %	9·33	9·44	9·77	9·15
Ash, %	·59	·61	·62	·61
Gluten, Wet, %	26·99	25·90	27·43	25·89
do. Dry, %	8·76	8·93	9·10	8·51
Strength, water absorption %	53·9	55·7	55·9	54·0
Maltose figure, Kent Jones, %	2·36	1·52	1·90	2·09
Buller value, Pelshenke	1·20	1·30	1·30	1·30
Flour Colour :				
Pekar A	5	5	5	5
do. B	4·5	4·5	4·5	4·5
do. C	4·5	4·5	4·5	4·5
Petrol figure, Kent Jones	7·6	8·0	9·0	9·6

The wheat protein, flour strength and Pelshenke quality figures are reported on a standard moisture basis, viz., 10 per cent. for wheat and 12 per cent. for flour.

With the increased activity in gold mining, a good water supply is essential for boiler purposes. Taking English or American standards for boiler waters, very few if any of the inland West Australian waters would be accepted. Thirty-eight samples were submitted by gold mining companies during the year; these waters are usually high in chlorine, sodium, magnesium and nitrates; consequently being very corrosive and requiring special treatment, such as suspending zinc blocks in the boiler, and a more frequent blowing off of the concentrated solution and accumulated deposits. The majority of the balance of the samples received were for general stock and irrigation purposes.

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The figures obtained for the f.a.q. wheats are as follows:—

Lab. No.	2210	2211	2212	3555 2nd Sample
Mark and Origin	33/4 Victoria	33/4 New South Wales.	33/4 South Australia.	33/4 Western Australia.
Condition	Bleached, sprouted slightly smut tipped	Sound thin grain	Sound shrivelled	Sound even size
Grain Analysis :				
Moisture, %	12·48	12·38	11·33	11·35
Bushel weight, lbs.—Found	60	60	61¼	61½
do. do. Declared	60	59	60	61½
Weight of 1,000 grains, grams	37·48	36·50	35·08	37·57
Milling Analysis :				
Flour, %	72·9	71·5	70·8	72·9
Bran, %	18·7	17·7	18·1	18·2
Pollard, %	8·4	10·8	11·1	8·9
Wheat Meal Analysis :				
Protein (N x 5·83), %	11·42	11·48	11·47	10·38
Pelshenke Test—Time factor (minutes) ...	36	66	40	40
do. do. Specific protein quality ...	3·2	5·9	3·6	3·9
Ash, %	1·52	1·60	1·58	1·35
Flour Analysis :				
Lab. No.	3556	3557	3558	3559
Moisture, %	12·70	13·35	13·34	13·25
Protein (N x 5·7), %	9·33	9·44	9·77	9·15
Ash, %	·59	·61	·62	·61
Gluten, Wet, %	26·99	25·90	27·43	25·89
do. Dry, %	8·76	8·93	9·10	8·51
Strength, water absorption %	53·9	55·7	55·9	54·0
Maltose figure, Kent Jones, %	2·36	1·52	1·90	2·09
Buller value, Pelshenke	1·20	1·30	1·30	1·30
Flour Colour :				
Pekar A	5	5	5	5
do. B	4·5	4·5	4·5	4·5
do. C	4·5	4·5	4·5	4·5
Petrol figure, Kent Jones	7·6	8·0	9·0	9·6

The wheat protein, flour strength and Pelshenke quality figures are reported on a standard moisture basis, viz., 10 per cent. for wheat and 12 per cent. for flour.

DIVISION VIII.

Report of the Chief Inspector of Explosives for the Year 1934.

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 1934.

The continued activity in gold mining has again resulted in a large increase in the quantity of explosives imported into this State during the year. Table No. I. shows the quantities of the various explosives imported, and Table No. II., giving the importations for the past five years, shows a steady and marked increase in the importations. It will be seen that the amount has practically trebled during the period. Eleven shipments arrived during the year, each shipment being sampled and submitted to tests for stability and also sensitiveness. In no case was it found necessary to detain any of the explosives, as the tests obtained were all satisfactory. The results obtained for the velocity of detonation of explosives imported into this State must be considered very satisfactory indeed, as in no case did the velocity fall below 1,700 metres per second. Explosives with this rate of detonation, when used in mines, should do efficient work and the products of combustion will be such that they will not materially affect the health of the men working underground where proper ventilation is provided and reasonable care is taken by the men after firing a face.

TABLE No. I.

Importation of Explosives into Western Australia during 1934.

Explosive.	Quantity in lbs.
Gelignite	1,411,900
Gelatine Dynamite	1,432,650
Blasting Gelatine	143,700
Permitted Explosives	75,350
Powder, Blasting and Pellet ...	146,250
	3,209,850
Detonators, No.	2,644,000
Fuse, Yards	4,322,000

TABLE No. II.

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

Explosive.	1930.	1931.	1932.	1933.	1934.
	lbs.	lbs.	lbs.	lbs.	lbs.
Gelignite	413,500	565,500	1,067,250	1,125,700	1,411,900
Gelatine Dynamite	447,000	575,250	617,200	797,950	1,432,650
Blasting Gelatine	220,000	145,150	336,600	314,350	143,700
Permitted Explosives	61,000	20,000	38,050	149,750	75,350
Powder, Blasting and Pellett	150,000	90,725	136,875	127,500	146,250
Totals	1,291,500	1,396,625	2,194,975	2,415,250	3,209,850
Detonators, No.	1,075,000	1,805,000	2,370,000	3,310,000	2,644,000
Fuse, Yards	...	1,987,200	2,880,000	3,770,400	4,322,000

The distribution of explosives in the different classes of industry was as follows:—

TABLE No. III.

Distribution and Consumption of Explosives for years 1933 *and* 1934.

	1933.		1934.	
	Lbs. used.	Percentage of total.	Lbs. used.	Percentage of total.
Gold Mining	2,140,050	90·4	2,503,500	91·1
Agricultural and Land Clearing	23,600	1·0	23,550	0·9
Government Departments, including Railways, Public Works, and Water Supplies ...	108,150	5·0	105,200	3·9
Quarrying	61,300	2·5	78,950	2·9
Coal Mining	35,600	1·1	37,950	1·2

It is regrettable that during the year there have been a number of accidents in connection with the use of explosives, a number of which have been attributed to fast burning or running fuses. Although it was considered that it was impossible to get a running fuse, this question caused such concern to the Hon. the Minister and officers of the department, that arrangements were made for a visit to the factory for the purpose of investigating thoroughly every phase of the process of manufacture with a view to determining whether it was possible for fuse, as manufactured to-day, being made which would tend to burn fast or run. After careful observation and the most minute examination of every part of the process of manufacture, and an examination of the ingredients used in the building up of the fuse, the opinion already formed, that fuses were not made to burn unduly fast, was supported to the point which left no doubt that the accidents reported in the mines were not due to running fuses. Unfortunately, up to the present, it has not been possible to convince all users of explosives of this fact.

In Table No. IV. are given particulars of licenses issued for the storage, etc., of explosives under the provisions of the Act:—

TABLE No. IV.

Licenses issued during 1934.

Magazines on Government Reserves	46
Magazines used by Government Departments ..	22
Magazines on private property	41
Store Licenses:—	
Mode (a)	101
Mode (b)	1
Fireworks only	220
Importation licenses	2

The increased quantities of explosives imported and distributed over such a wide area as Western Australia naturally means a great amount of inspection and travelling. In order to enable this to be done efficiently, without increasing the staff, the Hon. the Minister approved of the use of a motor car for the purpose of travelling. This has proved satisfactory, and the inspection work throughout the State is enabled to be done efficiently, and reasonable safeguards taken in connection with the transport and storage of explosives which would be quite impossible if the old method of travelling by railway was in force, as so much of my time is necessarily taken up with the examination and testing of explosives at headquarters. As a result of inspections made, it is satisfactory to note that it was not necessary to institute proceedings against any persons for serious breaches of the Act or Regulations, although a number of warnings were given to licensees in connection with minor breaches.

It was found necessary to destroy the following explosives, as they were considered unfit for consumption, or dangerous to store:—

TABLE No. V.

Destruction of Explosives during 1934.

Date.	Place.	Kind and Quantity.	Remarks.
15–2–34	Manjimup	425 Detonators	Damaged by water.
30–7–34	Kalgoorlie	40 lbs. Nitro Compounds	Chemical deterioration.
31–7–34	do.	50 Detonators	Damaged by moisture.
8–6–34	Wickepin	5 lbs. Gelignite	Chemical deterioration.
1–10–34	Carnamah	5 lbs. Gelignite	Damaged by moisture.
2–10–34	Mullewa	50 lbs. Gelignite	Chemical deterioration.

In Table No. VI. will be found numbers and particulars of tests of explosives made with a view to determining their chemical purity and stability:—

TABLE No. VI.

Tests and Analyses made during 1934.

Heat tests	1,304
Fuse tests	551
Complete analyses	5
Fireworks tests	98
Velocity of detonation	105
A.D.C. tests	15
Tests of detonators	150
Miscellaneous	23

Transport of Explosives.—With the ever changing methods of transport involving the use of petrol driven vehicles and the elimination of horses, it has been found necessary to give very close consideration to the question of transport to mines and other centres removed from the railways. In very many cases it is impossible to obtain horse-drawn vehicles to transport explosives, and therefore approval has been given for their carriage on trailers attached to motor trucks by means of a quickly releasable pin. Another phase of transport that is presenting certain difficulties is that of carriage of explosives by sea to the North-West ports of the State. The increased activity in mining in the North-West is demanding the use of fairly large quantities of explosives, and as there are no boats carrying cargo only trading on the coast, it has become somewhat difficult to transport the requirements by methods which have been adopted in the past. This question will require serious consideration in the near future.

Applications have been received for the placing on the authorised list of four new explosives, but their authorisation is still in abeyance pending investigation and observations of their physical properties.

J. W. KIRTON,
Chief Inspector of Explosives.

21st February, 1935.

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