

AR1918

TASMANIA

REPORT

OF THE

SECRETARY FOR MINES

FOR

YEAR ENDING DECEMBER 31

1918

Including Reports of the Inspectors of Mines, Government  
Geologists, Mount Cameron Water-Race  
Board, &c.



Tasmania:

JOHN VAIL, GOVERNMENT PRINTER, HOBART

1s. 6d.]

1919

B87592





# Report of the Secretary for Mines.

---

Mines Department,  
Hobart, 7th April, 1919.

SIR,

I HAVE the honour to submit my report on the Mines Department and the Mining Industry for the year ending 31st December, 1918.

## GENERAL REMARKS.

The aggregate value of minerals raised during the year was £1,750,574, being an increase of £166,284 on the value of the output for the previous year.

Although the quantity of tin ore raised was 381,134 tons less than the quantity raised during the previous year, the value, owing to the high market price, was £60,879 more.

The quantity and value of gold, silver-lead ore, blister copper, copper, and copper ore, coal, wolfram, and iron pyrites, shows a decrease in production, while there has been an increase of bismuth, osmiridium, scheelite, barytes, asbestos, and zinc.

The State has contributed its quota of wolfram and scheelite for the manufacture of munitions during the period of the war. The future permanency of these mines will be assured if the prices at present ruling are maintained.

Owing to so many miners enlisting during the period of the war, the mining industry was severely handicapped for want of good men, but it is anticipated that with the return of the soldiers from the front, the industry will be set upon a firm basis, and will again become a prosperous one.

## THE EFFECT OF THE WAR ON THE MINING INDUSTRY.

The outbreak of war caused a sudden and serious dislocation of markets. Some mines were compelled to suspend operations entirely, while others could only continue on a greatly restricted scale. To meet the difficult position which was thus created, the Government had to assist the industry financially, providing as much as £40,000 for advances in aid of mining during the time that the metal market was disorganised. The initiation of a large Portland cement industry in Southern Tasmania was undoubtedly prevented by the declaration of war a day or two before the proposition was to be floated; the same cause operated with respect to other projected enterprises.

The statistics of the Mines Department show a total increase in the value of minerals raised in 1918 over the pre-war output in 1913 of £334,874. This is due partly to an actual increase in ore-production and partly to enhanced prices incidental to war conditions. An increased output took place in copper, wolfram, scheelite, barytes, pyrites, bismuth, zinc, osmiridium, asbestos, ochre, and coal, while the production of silver-lead and tin ore fell off substantially. With the commencement of hostilities the output of nickel ore ceased, and the silver-lead and tin markets were abruptly closed. The high prices subsequently ruling had to suffer a considerable discount in consequence of the great increases in the returning charges. The price of tin has receded now to a little below its maximum in 1913. Tin-mining companies cannot be said to have directly suffered during the war, otherwise than from the exodus of men to the front, which left mineowners shorthanded for carrying on exploratory and developmental work. This was a feature of the situation which affected mines throughout the State. Another drawback has been the difficulty or impossibility of procuring requisite machinery for mining purposes. Tin-fossickers and alluvial parties have profited by the high prices, which have enabled them to turn their attention to previously worked and low-grade ground. The highest London price of tin in 1918 was £399 per ton; it is now £225. The market, however, is in an anomalous condition, and sales are difficult to effect.

Osmiridium mining has been greatly advantaged, supplies from Russia having been cut off. It is vaguely rumored that the mineral has found some application in

the manufacture of munitions of war, which has kept up the demand. The value of the output in Tasmania advanced from £12,016 in 1913 to £44,833 in 1918. The zinc output advanced from nil to a value of £152,880 and scheelite from nil to £39,252, pyrite from nil to £4667, and asbestos from nil to £5008. During the war manufacturers of asbestos roofing-slates on the mainland were unable to procure their fibre from Canada as usual, and had to fall back on the Tasmanian deposit, near Beaconsfield, for the time being. Wolfram producers have felt the benefit of Government prices for this munition mineral, but are looking forward with some apprehension to the immediate future.

Taking a broad view of the situation in general, certain thoughts suggest themselves.

It is beginning to be realised that if a thorough and effective scheme of repatriation is to be carried out, fresh industries must be started in our midst. Some of these are being commenced already; attempts are being made to establish others. Many of them being essentially founded on ore and metal winning, cannot but re-act on the mining industry generally, which needed just some such stimulus to infuse new vigor into the work of search and exploration.

The war has accentuated the industrial needs of the Commonwealth and Empire to a remarkable extent, and this has introduced new life into movements designed to foster the application of scientific methods to industry. It has given birth to efforts symbolised by councils of science and industry, mineral resources, bureaux, &c.

One of the consequences is that some of the best brains in the world are being focussed on problems pertaining to the metallurgical, mining, and chemical industries. This has resulted in a marked increase of attention to these departments of human effort. Information in respect of our mineral output and our undeveloped mineral fields is being increasingly solicited by the institutions referred to.

The war has led to a determination by the Commonwealth Government that Australia shall in future be free from the pre-war control of its metals by Germany or other foreign nations, and this resolve has crystallised into a settled Federal policy that the ores which we raise shall, whenever at all possible, be treated within our own Commonwealth boundaries. The way in which this policy has been given effect to has, it is feared, not been always and altogether free from objection; want of regard for

local needs has in some cases resulted in a restriction of output. The conclusion of the war and the impending realisation of British metal stocks are somewhat frightening producers here, and the effects are being watched with some anxiety. The indifferent demand for copper at present is allowing output to overtake sales, and the present selling prices are unprofitable. Some of the weaker companies in Australia will not be able to get through these troublous times, but it is gratifying to note that our own Mt. Lyell Company is in a strong position. Lead producers find themselves confronted by similar difficulties, and it is evident that for a time galena mines will suffer from a paralysed market. This will affect Tasmanian mines; already the North Mt. Farrell silver-lead mine has been compelled to close down its concentrating plant and cease production temporarily. Though the Commonwealth Government allows lead to be quoted at as much as £25 per ton, it is reported that this company finds it impossible to make absolute sales of its ore to the smelters at even £15 per ton. With Europe in a turmoil, and with enormous amounts of capital and numbers of workers deflected from normal industries, the metal market for a time is manifestly incapable of responding to our wishes. This period can, however, only be temporary.

The war period has seen the establishment of the iron and steel manufacturing industry on a large scale in New South Wales. In Queensland the State is erecting iron smelting works. In Tasmania the Commonwealth Government has obtained an option over the large deposit of iron at the Blythe River, while the holders of iron leases on the Dial Range are moving in the direction of improving their property. The Mines Department has lately had an official examination made of the iron ore resources of the Beaconsfield district.

The owners of tungsten properties in Tasmania have increased their output under the stimulus of good prices, and with a consciousness of a glow of patriotism in contributing to the badly needed supply of munition mineral. It may be mentioned, too, that some progress has been made in maturing plans for developing the enormous resources of the Read-Rosebery district.

The Hydro-Electric Department of the State has enabled the successful development of electrolytic zinc works at Risdon. This product is a war metal, and its output is contributing substantially to the prosperity of the State.

The way in which the European conflict has affected our mining industry may be illustrated by the fact that the war depended greatly for its progress upon mineral production. This could not fail to stimulate production. It is inevitable also that great efforts will now be made to develop our mineral wealth, and replace the monstrous loss caused by the waste of war. Wise statemanship will not neglect to foster and encourage the activities which seek to supply so essential an element in the life and prosperity of the nation. The uniform tendency of Tasmanian parliamentary policy has been to look upon mining with a benevolent eye, and to assist it where opportunity of doing so judiciously offered. The administrative department charged with its control, with its long experience and highly efficient organisation, has no other aim or desire than to see the industry firmly established in its rightful position as a permanent feeder of the primary requirements of the State.

#### STATE ARGENT FLAT MINE.

Operations at this mine ceased on the 12th May, 1917, and it remained closed down until the 12th December, 1918, when pumping operations were started to enable the plant and rails to be removed, as Parliament had not provided any money for the further development of the mine.

The whole of the plant has been dismantled, and will shortly be offered for sale.

The receipts during the year amounted to £130 9s. 5d., and the expenditure £297 2s. 3d.

The following is a statement of the total expenditure to date on this mine:—

	£	s.	d.
Expenditure previous to 1918 .....	43,401	10	8
Expenditure during 1918 .....	187	19	10
<b>Total expenditure to 31st December, 1918...</b>	<b>£43,589</b>	<b>10</b>	<b>6</b>
Value of ore sold by the State previous to 1918...	12,215	18	4
Ditto during 1918 (final payment, Lot 171)...	10	9	11
<b>Total value of ore sold by the State to 31st December, 1918 .....</b>	<b>£12,226</b>	<b>8</b>	<b>3</b>
Royalty paid by tributers previous to 1918 .....	2,157	13	8
Ditto during 1918 .....	70	19	2
<b>Total royalty paid by tributers to 31st December, 1918 .....</b>	<b>£2,228</b>	<b>12</b>	<b>10</b>

The value of the ore sold by the tributers during the year was £1185 18s. 6d., which was distributed as follows:—

	£	s.	d.
Repayment of advance made by State ...	252	3	3
And interest thereon .....	255	8	11
Royalty paid to State .....	70	19	2
Stores supplied .....	2	10	0
Paid to tributers .....	604	17	2
	<u>£1,185</u>	<u>18</u>	<u>6</u>

#### ADVANCES ON ORE.

During the month of January further advances, amounting to £473 18s. 2d., were paid to tributers, making the total amount advanced £4765 12s. 1d.

During the year the sum of £4735 4s. 5d. was repaid, leaving a balance of £30 7s. 8d. still outstanding.

The interest received amounted to £109 18s. 7d., which has been paid to the credit of "Interest on Public Accounts."

The expenses in connection with the administration of the vote amounted to £88 3s. 11d., so that the amount expended is more than compensated for by the interest received.

#### AID TO MINING.

The following is an account of the work carried out under the provisions of "The Aid to Mining Act, 1912," as furnished by the State Mining Engineer:—

Assistance to tributers at Zeehan was continued, and was also given to drive 590 feet, but a considerable amount of developmental work was carried out under the provisions of the Act without monetary assistance.

The pumping-plant at the No. 2 Argent Mine proved capable of dealing with the water to the No. 1 level. The output of ore was very satisfactory, and employment was found for about 40 men. It is intended to instal a more powerful pumping-plant, with a view to unwatering the mine to the lowest level. The developments at No. 1 level indicate that when the lower level is unwatered employment should be available for a large number of tributers.

A syndicate has been granted assistance to unwater No. 6 Argent Mine. A plant has been erected and pumping commenced. The flow of water is heavy, and con-

siderable difficulty has been encountered owing to wire rope, timber, and other objects having been dropped down the shaft.

The unwatering of this mine will drain a large area, and make available to tributers a number of lodes which are stated to be highly payable.

The attached statement of accounts is very satisfactory. The amount received from ore sales was £14,837 2s. 6d., which was disbursed as follows:—

	£	s.	d.
To tributers .....	11,158	11	8
Royalty paid to lessees .....	731	11	11
Royalty paid to State .....	1,544	4	0
Repayment of advances on ore and interest .....	1,402	14	11
Revenue from sale of machinery, stores, &c. ....	178	11	6

The total receipts were £1722 15s. 6d., and the total expenditure £1308 4s. 9d.

#### PROSPECTING.

A party of prospectors assisted to prospect at Cox's Bight and Port Davey, the result being that a company has been formed to work a tin deposit at Cox's Bight.

In addition to the above, the practice of cheap assays was continued for prospectors and tributers. Two hundred and ten mineral determinations, and 422 assays were made during the year.

	£	s.	d.
<b>RECEIPTS.</b>			
Royalty paid by tributers .....	1,544	4	0
Assay fees .....	28	11	0
Stores, <i>ex</i> Corinna store .....	1	19	6
Stores, <i>ex</i> Port Davey .....	3	15	0
Hire of pump (to Vincent) .....	6	0	0
Sale of engine, 10 h.p., petrol (Albury and party)	80	0	0
Sale of oil engine (to Hill and Dunn) .....	58	6	0
<b>Total Receipts .....</b>	<b>£1,722</b>	<b>15</b>	<b>0</b>

Amount received from sale of ore .....	£14,837	2	6
Which was distributed as follows:—	£	s.	d.
Royalty paid to State .....	1,544	4	0
Royalty paid to lessees .....	731	11	11
Paid to tributers .....	11,158	11	8
Repayment of advances and interest (£109 18s. 7d.), State .....	1,400	3	5
Storage paid to Railway Department .....	2	11	6
<b>Total .....</b>	<b>£14,837</b>	<b>2</b>	<b>6</b>

EXPENDITURE, 1918.		£	s.	d.
Salary	...	400	0	0
Wages	...	14	6	0
Office expenses	...	9	5	10
Assay goods	...	30	10	10
Assistance to prospectors (distance driven, 590 ft.)	...	238	15	0
Bulb, &c., for oil engine (Hill and Dunn)	...	18	6	0
Miscellaneous	...	3	1	9
Wages, Port Davey prospectors	...	90	0	0
No. 2 Argent pumping charges	...	503	19	4
		<hr/>		
		£1,308	4	9

## PUBLIC WORKS SUSPENSE ACCOUNT.

No. 6 Argent Prospecting Syndicate	...	£600	0	0
No. 2 ARGENT PROSPECTING SYNDICATE, YEAR ENDING 31/12/18.				
		£	s.	d.
Purchase and erection of plant	...	446	13	1
Repaid by royalty	...	195	5	8
Cost of running and maintaining pumping plant—				
Expenditure during the year—				
Power	... £503 14 4			
Other charges	... 0 5 0			
		<hr/>		
		503	19	4
Credit by rebate of royalty payments	...	483	6	2
		<hr/>		
		£20	13	2
		<hr/>		
Royalty paid in addition to above	...	£483	6	2

## APPENDICES.

Appended will be found the annual report of the Mt. Cameron Water-race Board.

Report of the Government Geologist.

Report of the Acting Assistant Government Geologist.

Report of the Government Assayer.

Report of the Chief Inspector of Mines.

Report of the Chief Inspector of Explosives

Reports of the Inspectors of Mines.

Mining Circulars by W. H. Twelvetrees :—

  Bauxite: A Source of Aluminium.

  The Search for Petroleum in Tasmania.

  Prospecting for Mercury in Tasmania.

  Diamonds in Tasmania.

A Review of the Osmiridium Industry of Tasmania, by Dr. Campbell Brown

## GOLD-MINING.

The following return shows the quantity and value of gold won during the year:—

	. Ozs.
Beaconsfield ... ..	2041·595
Lefroy ... ..	7·575
Lisle, Golconda ... ..	512·933
Mt. Claude ... ..	35·900
Mt. Cameron, Mt. Victoria, and Warrentinna	1034·970
Mathinna ... ..	898·150
North-West and West Coasts ... ..	6367·900
Total ... ..	<u>10,899·023</u>

Value, £44,724, equal to 10,528·930 oz. fine gold.

*Beaconsfield.*—The Tasmania Gold Mine Ltd.—Operations at the reduction works were confined to roasting, grinding, and filter press treatment of concentrates until 10th May, when these plants were closed down as the stock had become exhausted.

During the 4½ months of working, 6276 tons of concentrates were treated, which produced 2041 fine ozs. of gold, of the value of £8652. The total value of gold won from this mine is £3,607,807.

The company proceeded with the erection of a plant for treating the low-grade raw slimes in the dams, and this plant had only been in operation for a few days when the year closed.

On the mine, efforts have been concentrated on breaking up the machinery that is unsaleable as such, and realising assets generally.

*Lefroy.*—A local syndicate has been prospecting in the vicinity of the Volunteer Reef, but so far the prospects have not been encouraging.

*Golconda.*—The Golden Crest and Enterprise Mines suspended operations during the year. These were the only two mines operating in this district.

*Lisle.*—The Lisle Hydraulic Gold Mine treated 58,314 cubic yards of ground and obtained 560 ozs. of gold, 12 men being employed. On the western side of the main creek 61,514 cubic yards of ground were worked for a return of nearly 300 ozs. of gold, an average value of approximately 9d. per cubic yard. Messrs. Smith and Thompson have put in a prospecting tunnel on ground taken up by Major Dunn, the stone passed through showing traces of gold.

*Panama Creek.*—Messrs. Jack and Parsons have been prospecting on the banks of this creek, but no successful results have been obtained.

*Warrentinna.*—The Mara Gold Mining Co.—Work was carried out at the 136 feet and 200 feet levels. The Coronella Reef was followed southerly until faulted, this was driven through and cross-cut driven westerly and southerly. In the former the Ascot Reef was met with, and driven on for 40 feet. This reef is from 5 to 10 feet wide, with patches of good stone, but trial crushings proved the bulk to be low-grade, namely, from 7 dwts. per ton, the gold being worth approximately £3 per oz. In the south-east cross-cut the Coronella Reef was again met with, and when cut showed good quartz 7 inches wide, highly charged with mineral. This reef has since been driven on for 60 feet north and south, and has again been faulted. The reef channel is about 2 feet wide, with an average of 6 inches of quartz, some of which carries good values. A small amount of rising and stoping has been done on this reef where the stone continues about the same value. At the 136 feet level, operations have been confined to stoping on the Coronella Reef in a northerly direction, and the results from time to time have been very satisfactory. The yield of gold and silver has been good, but the high percentage of the latter metal reduces the value to barely £3 per oz. as it leaves the mine. The quantity of gold obtained was 857 ozs., the value, including concentrates and treatment of plates amounted to £2663 7s. 10d. The tailings have been stacked for future treatment when the quantity of quartz obtainable warrants the erection of a cyanide plant.

*Gladstone.*—The Gladstone Gold, Tin, and Wolfram Developing Co. has closed down for want of funds.

*Mathinna.*—At the New Golden Gate Mine Messrs. Moses and party sank two winzes 18 feet and 32 feet from the 500 feet level, and opened up small blocks of stone at the back of the level, and obtained 1006 ozs. of gold from 1278 tons of quartz, valued at £3597, 20 men being employed.

At the Forth River, Dial Range, and Sulphur Creek, near Stanley, prospecting for reef and alluvial gold has been carried on intermittently, but no discoveries of importance have been recorded.

*Mangana.*—A little interest in this old field has recently been revived, and it is probable that some of the old mines will be restarted in the near future.

*West Coast.*—The McDowell Prospecting Company's Gold Mine has been idle during the year.

Mr. John Ellison, registered gold buyer, Linda, purchased 18 dwts. of alluvial gold from one prospector, for which he paid £3 5s.

### SILVER-LEAD MINING.

The quantity of silver-lead ore produced was 7241·4 tons, valued at £127,176, being a decrease in quantity of 2334·380 tons, and a decrease in value of £24,946.

The principal producers were:—

	Tons.	Value. £
<i>Zeehan Mines.</i>		
Zeehan-Montana ... ..	126	2,432
Zeehan-Queen ... ..	502	6,264
Mt. Zeehan (Tas.) ... ..	777	17,799
Oonah ... ..	49·55	1,262
Nike ... ..	327·50	9,725
Dunn ... ..	181·50	2,095
<i>Mt. Farrell Mines.</i>		
North Mt. Farrell ... ..	2,144	26,516
<i>Magnet Mines.</i>		
Magnet ... ..	2,099	49,435
<i>Mt. Claude Mines.</i>		
Round Hill ... ..	516·40	6,846

*Zeehan District.*—The Mt. Zeehan (Tasmania) Mines Ltd.—The closing down of the State Argent Flat Mine caused the stoppage of all mining work on that part of the company's lease held by the State under agreement with the company. On that part of the lease resumed under "The Aid to Mining Act, 1912," the unwatering of the No. 2 shaft with State assistance enabled several parties to continue working on tribute on the Nos. 10, 11, 13, 15, and 16 lodes. Results have been moderately remunerative to the original tributers, but very little profit has accrued to the syndicate operating in the main workings. On the Britannia portion of the company's lease a fair amount of prospecting has been done, but on the whole, results have been disappointing. New work in progress is the unwatering of No. 6 shaft by a local syndicate working under tribute from the State on the Argent sections held under agreement with the company. The syndicate is being assisted by the State with capital, and by the company by use of a considerable amount of

plant. The volume of water to be dealt with makes these operations expensive and difficult. Assistance has also been rendered to several other parties of tributers by the company, by the use of machinery and mining plant, and the company's concentrator treats the second-class ore produced at a moderate charge, which under present conditions of prices of spare parts, and the limited tonnage to be dealt with, does not cover the cost of treatment.

Zeehan Queen Ltd.—The only work being done at present on this company's lease is by tributers on Taylor's Lode. Results from these operations have been good, but unfortunately nothing has been discovered that would warrant the company spending its capital in more comprehensive work.

The Dundas Cuni Mining Company Ltd.—This company's mines are still closed down owing to no market being available for the ore. Steps are being taken with a view to the disposal of the stock of ore on hand, but there is no possibility of the resumption of mining operations unless the embargo against the export of the crude ore, which is apparently the policy of the Federal Government, is withdrawn. It is difficult to see the wisdom of preventing the export of this ore which cannot be dealt with in Australia, especially considering the stage of the development of the mines. A considerably increased tonnage will have to be developed before the expenditure of capital in the erection of treatment works is justified, whereas, the withdrawal of the embargo against export would immediately employ men, and enable the mines to be developed to the stage when it might be more profitable to concentrate the ore by smelting.

The Oonah Company's sections have been worked by 4 parties of tributers, the average number of men employed being 10. About 80 feet of driving has been done. The operations of the tributers have not proved remunerative during the year.

The Nike Mining Company, No Liability.—This company put a rise through from the adit to the surface, a distance of 76 feet, to be used as the main shaft. The erecting of a pit-head was put in hand, and a 14 horsepower electric winch was installed. The main lode was driven on for a distance of 206 feet, and a cross-cut put in 64 feet long. The total quantity of ore won was 368 tons, containing 221 tons of lead, and 23,338 ozs. of silver, of a gross value of £40,681. The total number of men employed by the company was 23.

The Swansea Mining Company.—A shaft has been sunk to a depth of 47 feet. A crosscut from this level out west intersected No. 1 lode at 25 feet from the shaft. A drive was put in for a distance of 200 feet on the lode with fair results, the payable ore coming half-way up the drive, and averaging 18 inches of clean ore.

From No. 1 lode at the 47 feet level, the crosscut was continued to cut No. 2 lode, which was intersected at 30 feet from No. 1 lode, or a total distance of 55 feet from the shaft. This lode was driven on for a distance of 160 feet, the galena contents were good, averaging 1 foot of clean ore for the whole distance. From this drive and 200 feet of stoping the company obtained 210 tons of marketable ore, of an assay value of 70 per cent. lead, and 19 ozs. of silver, of an approximate value of £11 10s. per ton net.

The company has recently completed the sinking of the main shaft a further distance of 50 feet, which will give 70 feet of maiden ground to operate on.

*Mt. Read District.*—The Mt. Read and Rosebery Mines Limited.—No ore was exported or sold, but about 1800 tons of average grade zinc lead sulphide ore have been broken from various parts of the mine workings, to provide the required down-loading necessary to operate the haulage tramway. This has been added to the storage dump at Williamsford, where we have now some 6675 tons accumulated. The average number of men employed for the twelve months, including contractors and others, can be stated as being 40.

The mine workings have received a considerable amount of attention, and about £1700 was spent in maintenance and repair work. All the main galleries and crosscuts are now in first-rate condition, and the mine workings generally in a thoroughly efficient and safe order.

During the year all the open stopes in the main or "E" ore body have been close-filled, over £800 being spent in this direction; a small area remains to be mullocked up in the "B" workings, this is now being attended to, and should be finished in a few weeks.

A considerable quantity of developmental and exploratory work has been completed, the total cost of which was approximately £5000. Two new main levels, 75 and 150 feet below our previous main working level (No. 4), have been opened up by two adits 510 feet and 546 feet in length respectively—each of these adits penetrated our main "E" ore body at the anticipated distance, and

have opened up large bodies of high-grade ore; the work done has confirmed our previous diamond-drilling information, and transferred probable quantities into actual ore reserves. Three new mullock rises have been constructed from No. 4 level to the surface, and open cuts for the supply of suitable filling commenced—these rises will ultimately connect with our two new levels below.

The usual surface operations have been carried on, both the air-plant and the haulage tramway have been in operation as required, and both plants are in satisfactory working condition,

*Lyell District.*—Tasman and Crown Lyell Extended Mine.—In the early part of the year it was decided to put in two water-wheels to drive the concentrating mill. Mining and milling was resumed during the third quarter, but the water-wheels have not proved very successful. 518 tons of ore were crushed, and 49 tons of concentrate obtained, valued at £993 15s. 3d. Average number of men employed, 16.

*Mt. Farrell District.*—The North Mt. Farrell Mine.—During the year 13,919 tons of crude ore have been mined and dressed, resulting in the production of 2144 tons of marketable ore, containing 102,727 ozs. of silver, and 1089 tons of lead, of an estimated net cash value at the mine of £26,520.

The total production to date amounts to 40,921·5 tons of ore, containing 2,326,312 ozs. of silver, and 23,510 tons of lead, of a net value of £424,390.

For the first five months of the term, ore production was carried out on a much restricted scale owing to the inability to dispose of the full output of the mine; and during the latter part of the year scarcity of labour very adversely affected the output.

The bulk of the output was furnished by the stopes at the No. 3 shaft level. A fair tonnage was also drawn from the bottom, No. 4, level stopes, but so far these stopes have been operating in rather poor ground. The chief developmental work has comprised the further extension of the drives on the Nos. 2 and 3 lodes at the No. 4 level. Results of work done so far on the former at this level have been very disappointing. The main, No. 3 lode, however, has continued to open up fairly satisfactorily. At the close of the year the main ore body on this lode had just been reached at 350 feet north from the shaft. Prospects here are very promising, and it is con-

fidently expected that a large tonnage of high-grade ore will shortly be made available for extraction.

The new suction gaspower plant was put in commission early in the year. The slight troubles incidental to the starting up of plant of this nature were speedily overcome, and the plant has given very satisfactory service, the anticipated economy in fuel consumption being fully effected. Towards the end of the year a more powerful hoisting winch at the shaft and rock-drilling plant were installed, which are expected to effect further reduction in working costs.

The Mount Farrell Mining Company has been engaged in prospecting work in the quartz lode opened up in the eastern crosscut driven from their low-level drive at the No. 4 adit level, North Mount Farrell Mine. So far these operations have not been attended with any satisfactory results.

For reasons already mentioned the complement of men employed, 78, has been considerably below the average of past years. Apart from a little spasmodic prospecting, which has not been productive of any development of note, mining elsewhere is still dormant in this district.

*The North-Western Mining Division.*—The Magnet Silver Mining Company, No Liability.—Mining operations have been carried on at Nos. 10 and 12 levels, the bulk of the ore produced coming from No. 12 level. Owing to the shortage of good miners, the exploratory work has been confined to driving the south adit, south central drive at No. 10 level, and sinking the main shaft. The former has reached a point 1196 feet from the approach, and the lode should be met with any day, and as this drive is being driven to cut the lode 800 feet south of the main shaft, any good development will be of great importance to the mine and district. At No. 10 level the south central drive has been driven 85 feet—60 feet on payable ore—but the last 25 feet passed through one of the small slides which are frequently met with in the lode channel. The main shaft has been sunk to a depth of 109 feet below No. 12 level, and it is intended to keep on sinking until a depth of 220 feet has been attained. Plats will be cut at each 100 feet, leaving 20 feet below No. 14 level, so that sinking can be resumed at a future date. When the shaft has been sunk to No. 14 level, a vertical depth of 1000 feet from the outcrop will have been attained.

Hydro-Electric Plant.—An electric power plant, capable of generating 650 horsepower has been installed to supply current to one 155 B.H.P. winding motor, and two 75 B.H.P. motors, coupled to two stage centrifugal pumps, with a capacity of 12,500 gallons each per hour, which will be installed at No. 13 level. As soon as the plat is cut the water supply will be drawn from two earth dams, No. 1 having a capacity of 33,000,000 gallons, and No. 2 125,000,000 gallons. The latter is in course of construction and is nearly completed. The water is conveyed to the pipe-line through an open race.

Tons of ore treated ... .. .	10,455
Tons of metal obtained ... .. .	2,099
Metal contents—	
Silver (ozs.) ... .. .	136,166
Lead (tons) ... .. .	753
Gross value ... .. .	£49,436
Net value ... .. .	£31,942
Average number of men employed ... .. .	150

*Northern and Southern Division.*—The Round Hill Silver and Lead Mining Company, No Liability.—During the early half of the year under review the exploratory and developmental work was conducted on the anticline formation with only a limited amount of success, several small shoots of high-grade ore were discovered and stoped, but they were found to be erratic and unreliable, however, they contributed nearly sufficient ore to meet current mining expenses.

No. 1 or Main Tunnel.—This tunnel was continued to intersect and explore the quartz lode which showed a prominent outcrop on the surface. The lode when cut and opened out on proved to consist of quartz containing little or no galena ore, but gave a bulk assay for a width of 14 feet of 3 dwts. gold per ton.

No. 2 Tunnel.—A very considerable amount of exploratory and developmental work has been carried out at and above this tunnel, in all, 206 feet of driving, 34 feet of crosscutting, and 112 feet of rising. The work produced a fair quantity of payable ore, but the whole of the operations were carried out in the anticline or crushed formation, and upward to the conglomerate, which appears to cover the more productive stratum.

New Lode, No. 1 Tunnel.—A wing tunnel has been driven 6 feet from the main tunnel, following what appeared to be the indicator or productive stratum of the anticline formation. During the last 50 feet of driving,

the drive had passed out of the anticline or crushed formation, and the stratum had taken a more vertical and settled appearance. Early in September a crosscut was started from the end of this latter drive, and driven in a north-easterly direction, the crosscut having been driven 30 feet into a kindly lode formation, and where cut proved to be 12 feet wide, the lode matter carrying a fair percentage of galena ore, containing gold, silver, and lead values in payable quantities. Since cutting the lode, the main drive has been driven along its course for a distance of 51 feet north-westerly, and 57 feet south-easterly, or a total of 108 feet, with an average width of 12 feet. Bulk assay of the concentrates produced from the ore raised from this lode gave an average assay of 3 dwts. 10 grns. gold, 85 ozs. silver, and 42 per cent. lead per ton.

No. 2 Tunnel.—Since cutting the abovementioned lode at No. 1 tunnel, a crosscut has been driven north-easterly from the end of No. 2 tunnel. The track of the lode has been intersected, and a drive is now being driven along its strike. It is anticipated, however, that owing to the deep conglomerate cover, it will be necessary to drive a considerable distance yet before the lode rises to the level of this tunnel.

Developmental and Exploratory Work.—The following work has been carried out:—

Main drives	606 feet
Crosscuts	127 „
Rises	214 „

Concentrating Plant.—The ore from the mine being associated with a kindly quartz gangue, with an occasional mixture of heavy iron pyrites, is easily amenable to concentration, and no difficulty is being experienced in treating the ore at a minimum of loss. The plant treated 6314 tons of second-grade ore which produced 535 tons of concentrates, containing 264.2 tons lead, 20,685 ozs. silver, and 50.9 ozs. gold, of an approximate value of £7571.

The average number of men employed at the mine was 31.

## COPPER MINING.

The quantity of blister copper and copper ore produced was 6003.170 tons, valued at £776,106.

The Mt. Lyell Mining and Railway Company Limited.—  
The ores and metal-bearing fluxes treated by the company  
were as follow:—

Ore—	Tons (dry).
From the Company's Mt. Lyell Mine ...	137,487
Ditto, North Lyell Mine ... ..	70,826
Concentrates from the Company's Lyell Comstock and North Lyell Ores .....	7,057
Cement copper ditto ... ..	10
Purchased ore (from other mines) .....	1,396
<b>Total .....</b>	<b>216,770</b>

Blister copper produced, 5559 tons, containing:—Copper,  
5490 tons; silver, 314,058 ozs.; gold, 6367 ozs.; approxi-  
mate value, £793,010.

Average number of men employed:—

Mining Department—

At the Company's Mt. Lyell Mine ... ..	357
At the Company's North Lyell Mine ...	297
At the Company's Lyell Comstock Mine	44
At the Company's Crotty Leases... ..	20
At the King River Power Scheme ... ..	7
	<hr/>
	725

Reduction Works Department (including

Lake Margaret) ... .. 658

Railway Department—

Mt. Lyell Railway ... ..	145
North Lyell Railway ... ..	20
	<hr/>
	165

---

**1,548**

Dividends paid during year, £161,149 7s. 6d., equal to 2s.  
6d. per share.

Dividends paid from the inception of the Company to the  
31st December, 1918, £3,636,629.

Copper produced from the inception of the Company to the  
31st December, 1918, 158,569 tons fine.

Silver produced from the inception of the Company to the  
31st December, 1918, 12,382,608 ozs. fine.

Gold produced from the inception of the Company to the  
31st December, 1918, 361,163 ozs. fine.

Both open-cut and underground mining operations were  
in progress at this mine, but the latter are now of much  
greater importance than the former, and comprise the  
working of both the Mt. Lyell and South Lyell pyritic  
bodies.

Ore production was seriously restricted by the continued  
shortage of labour, but development work was carried  
out in accordance with the immediate requirements, and  
some exploration was done by the diamond-drill. This

latter was attended by very successful results, establishing the strong downward continuation of the South Lyell ore-body below the present lowest level of the mine (No. 9).

Recent developments point to the fact that the South Lyell ore-deposit is becoming an important factor in the supplies of pyrites, both for smelting purposes and acid-making purposes, thus supplementing the reserves still standing in the parent mine (Mount Lyell ore-deposit) to a very gratifying extent.

The new electrically-driven air compressors at this property proved to be very successful.

North Mount Lyell Mine.—As in the case of the Mt. Lyell Mine, ore production was seriously interfered with here by labor shortage, and development and exploratory work were consequently undertaken on a very largely diminished scale. The principal development work was the completion of the Crown Lyell shaft to the 1000 feet level, and putting it in full operation between that horizon and the surface as a travelling way, ore-hoisting being done in the main shaft.

The various ore-bodies have been worked systematically with satisfactory results, those in the northern end of the mine in process of being opened up at the ground floor developing favourably both as regards size and quality. Diamond-drilling undertaken in advance of the stoping-faces has proved that they will have further important extensions.

No work was done below the 1100 feet level, the 1200 feet level still remaining under water owing to the shortage of labour.

An appreciable tonnage of cement copper was won out of the waste water from the mine, as usual, by means of precipitation with scrap iron.

The celebrated electric hoist, as well as the electrically-driven air compressor at this mine, have continued to run without trouble.

Lyell Comstock Mine.—At this mine the extraction of ore, by open-cutting, proceeded throughout the year, but no underground work was undertaken. The steam tramway from the reduction works to the head of the Queen River Valley was extended right to the mine, establishing the through connection, replacing the horse-tram section at the mine end, and greatly facilitating transport.

The ore broken in this property has all been concentrated in the flotation plant.

Smelting.—The usual smelting operations were continued at the reduction works, but on a somewhat dim-

inished scale, owing to the paucity of mine labour, and the consequent shrinkage of the ore supply. It has only been possible to keep one, and occasionally two, furnaces in blast.

The old converter plant has been discarded, and the new converter plant was completely finished during the year (in August), and at once started. The converters are electrically actuated, and situated in a capacious hall, or housing in front of the blast furnaces, making it possible to transfer the matte by means of electric crane direct from the blast furnaces to the vessels thus simplifying and cheapening the operation. The electrically-driven copper-casting machine receives the molten product, and though a novelty has, like all the rest of the plant, proved a great success.

The silver and gold-bearing blister copper has, as heretofore, been sent to the Electrolytic Smelting and Refining Company for further treatment at Port Kembla, near Wollongong, N.S.W.

The oil flotation plant, which is situated close to the smelting-plant, has been in continuous operation on two shifts since April, and has, as remarked above, treated the output of the Lyell Comstock Mine. In addition to this a portion of the North Lye'l ore has also been successfully treated in this plant. The resulting product of concentrates is subjected to a preliminary sintering operation, which puts the concentrates in a compact shape so as to render them more suitable for the subsequent blast-furnace smelting. This latter operation has followed the well-known lines of former years, the Mount Lyell ore (which is basic), being utilised, both as fuel and flux for the North Lyell ore (which is silicious), and also simultaneously smelting the sintered concentrates.

The electrically-driven centrifugal blowers installed some years ago for the blast furnaces have continued to give every satisfaction. The ore supply for the converter vessels has been increased and intensified by the addition of a large electrically-driven centrifugal blower, and for high pressure work an electrically-driven special air compressor has been installed.

As heretofore, all the repair work has been done on the spot, including foundry work, &c. The smelter machine shops have been enlarged by the addition of a large high-class motor-driven lathe.

Hydro-Electric Power.—The Lake Margaret installation has proved adequate to all requirements but is now being enlarged by the addition of two more turbo genera-

tors in the generating station, which will bring the total number up to six generators, equivalent to about 8000 horsepower. Simultaneously, the dam at the lake outlet is being very considerably raised so as to increase the storage capacity of the lake to correspond with the enlargement of power supply. After some delay the third pressure-pipe was finally received from Great Britain on the spot, and its erection begun.

The company during the year practically concluded its local investigation of the facilities for the investigation of a hydro-electric plant in the King River, between Mounts Huxley and Jukes, and handed the data over to the Government Hydro-Electric Department.

Welfare Work.—The matter of increasing and improving housing accommodation for the company's employees at the mines has been actively continued, a large amount of building having been done during the year. In addition a further number of houses has been purchased, so that at the present time the company owns by far the greater portion of the housing accommodation at Gormanston, and some at Linda Valley. These houses are well-appointed and maintained, and are let to employees at a low rental. Some steps have also been taken to serve the social interest of employees by the establishment of institutions, run by the employees, though owned by the company, such as the Pastime Club at Linda Valley, the First Aid establishment (also to be used for social purposes), at Gormanston, and a fine Y.M.C.A. establishment at Queenstown, and other similar improvements are in contemplation, having a bearing on the social life, the reduction of the cost of living, &c.

A beginning has been made with the electric lighting, similar to Queenstown, of the Town of Gormanston by the company, in accordance with the provisions of "The Gormanston Municipal Lighting and Power Act, 1917."

The Mt. Lyell Blocks Copper Mining Company, No Liability.—Developmental and prospecting operations have been carried on during the year. The diamond-drill was at work for a considerable time, but failed to expose anything of much value. Some of the ground passed through was of a very favourable nature, but in various places where driven into, only revealed small and patchy bunches of ore, or ore of such a grade that it would not pay to break out and send to the smelters. At the 1300 feet level a winze was put down to 25 feet, but owing to the excess of barytes with the ore, it was too low to send to the smelters. On ore developed during 1917, some stoping

work was done, and various parcels were sent to the reduction works, totalling 1322 tons, of an average value of 4·68 ozs. silver, and 7·59 per cent. copper, the average number of men employed being 36. Stopping the adit was continued just below the 1200 feet level. The company has been considering the question of driving into the copper clay from the main shaft. It is estimated that there are between 60,000 and 70,000 tons of material in situ.

Mts. Jukes and Darwin.—Mt. Jukes Proprietary Mine.—The development of the ore body has been continued during the year with satisfactory results. It is understood that the Mt. Lyell Mining and Railway Company hold an option of purchase over this property. It is quite possible that with cheap power available it is likely to prove payable.

Adamthwaite Mine.—Two men were employed for just on nine months breaking copper clay from a shallow adit, and washing same. They obtained 5 tons, 17 cwts. 1 qr., and 6 lbs. of concentrates, and 1 ton 14 cwt. 0 qrs. 16 lbs. of cupriferous iron ore, which was sold to the Lyell Company.

*Balfour District.*—The Copper Reward Mine.—No. 2 dam has been raised to hold 20 feet of water. Both Nos. 1 and 2 dams have been used for tin mining. About 1½ miles of water-races have been cut and enlarged. A 10-head stamper battery has been brought to the mine, and is in course of erection, the piles are in position, boxes, horses, cam-shaft and stampers are erected, and the bed for the engine is being prepared. Several acres of scrub have been cut and burnt off in order to prepare the tin land for working.

#### TIN-MINING.

The quantity of tin ore raised was 2256·203 tons, valued at £488,798; an average value of £216 12s. 11½d. per ton.

The statistics for the year are:—

	Ore won, tons.	Value. £	Miners Employed.
Northern and Southern Division . . . . .	62·247	6,977	49
North-Eastern Division	952·441	216,129	450
Eastern Division . . . . .	335·075	69,846	258
North-Western Division	651·825	140,431	368
Western Division . . . . .	254·615	55,415	135
Total . . . . .	2,256·203	488,798	1,260

*North-Eastern Division.*—The output of tin ore was 952'441 tons, obtained as follows:—

	Tons.	Tons.
<i>Pioneer and Gladstone Districts.</i>		
Pioneer Tin Mine .....	263'50	
South Mt. Cameron .....	25'75	
Endurance .....	23'50	
Other claims .....	115'05	
		427'80
<i>Ringarooma, Derby, and Branchholm Districts.</i>		
Briseis Tin Mines .....	321	
Ditto Mutual .....	7'60	
Arba Tin Mine .....	89'45	
New Ruby Flat .....	9'90	
Other claims .....	68'141	
		496'091
<i>Moorina District.</i>		
Weld Tin Mine .....	15'70	
Other claims .....	9'70	
		25'40
<i>Straits Islands</i> .....		3'15
<b>Total</b> .....		<b>952'441</b>

*Eastern Division.*—The output of tin ore was 335'075 tons, obtained as follows:—

	Tons.	Tons.
<i>Weldborough, Lottah, and Blue Tier Mines.</i>		
Anchor Mine .....	6'375	
Other claims .....	44'570	
		50'945
<i>St. Helens Mines</i> .....		88'330
<i>Avoca Mines.</i>		
Royal George .....	111'60	
Story's Creek .....	52'60	
South Esk .....	5'40	
Others .....	26'20	
		195'80
<b>Total</b> .....		<b>335'075</b>

*North-Western Division.*—The output of tin ore was 651'825 tons, obtained as follows:—

	Tons.
Mt. Bischoff .....	458
Mt. Bischoff Extended .....	155'35
Weir's Bischoff Surprise .....	7'85
S. Bischoff .....	3'28
Waratah Alluvial .....	15'64
Mt. Balfour .....	11'705
	<b>651'825</b>

*Western Division.*—The output of tin ore was 254·615 tons, obtained as follows:—

	Tons.
Dreadnought-Boulder Mine ... ..	25·73
Renison Bell Mine ... ..	36·85
Central ... ..	27·525
Heemskirk ... ..	43·75
Stanley River ... ..	28·40
Mt. Lindsay ... ..	19·615
Others ... ..	72·745
Total ... ..	254·615

*Northern and Southern Division.*—S. and M. Syndicate.—An hydraulic-driven pumping-plant was installed during the year, and has worked satisfactorily. Milling was retarded during the early part of the year, owing to the shortage of water. One thousand five hundred and seventy-nine tons were treated for the first half, and 4825 tons for the second, making a total for year of 6404 tons. 59·25 tons tin ore were produced.

The steam-plant was in use for three months, and water-power plant for nine months. General operations were, apart from shortage of water, restricted by shortage of labour, and by reduction of working hours.

The Iris Syndicate produced 2·697 tons of tin ore, and 13 tons were obtained from Cox's Bight.

*North-Eastern Mining Division.*—Arba Tin Mine.—As the water-supply was poor during the early part of the year, all sluicing was stopped for 10½ weeks, from about the end of February to the middle of May. The dry weather broke on the 10th May, and sluicing was resumed on 13th May, and carried on continuously to 31st December.

The following is a statement of the work done, and cost of treatment for the past 12 months, with a summary of sluicing results to date:—

	Cubic yds.	Working cost.	Tin con- tents per		
			Tin won. Tons.	c. yd. Cwts.	lbs.
<b>Main Workings—</b>					
For year ended 31.12.18...	136,690	12·66d.	40	8	0·63
From 30.6.03 to 31.12.18...	3,013,502	6·22d.	1253	19	0·93
<b>Easement—</b>					
For year ended 31.12.18...	80,419	14·26d.	48	14	1·35
From 3.10.13 to 31.12.18...	460,407	9·22d.	243	0	1·19

The total quantity of tin recovered for 12 months was 89 tons 1 cwt., and the approximate value, £17,800.

The average number of men employed at the mine was 57.5, and the average number employed cutting and carting fuel, was 7.

Briseis Tin and General Mining Company.—

	Briseis Mine.	Mutual Hill Mine.
Average number of men . . . . .	84	9
Black tin won . . . . .	321 tons	7.6 tons
Equivalent metallic tin . . . . .	229.2 tons	5.1 tons
Value . . . . .	£73,241	£1647
Gold . . . . .	26.90 oz.	—
Value . . . . .	£102	—

The sluicing of tin-drifts at the Briseis Mine has gone on during the year as usual, and calls for little comment.

The chief productive faces in the so-called Kruska's Flat are now very close to the southern bank of the diverted Ringarooma River. The excavation is 100 feet below the river level.

A further diversion to the north-east of the northern end of the present river diversion is contemplated but poor progress has been made in the removal of drift and overburden on the northern side of the river owing to the reduced supply of water during the year.

The Pioneer Tin Mining Company Limited.—558,300 cubic yards of drift were sluiced at this mine for a yield of 257.13 tons of stream tin, the above yardage being below normal, owing to the uneven distribution of the rainfall, which only permitted of intermittent sluicing with both electric plants for a considerable part of the term.

At the company's South Pioneer leases, adjacent to the parent mine, 55,800 cubic yards of hard cemented drift were sluiced for a yield of 5 tons 18 cwt. of stream tin.

On the Argonaut Leases, at St. Helen's, 122,300 cubic yards of drift were sluiced, for a yield of 45 tons 2 cwt. of stream tin. The total yardage from all three mines being 736,400 cubic yards, for a yield of 308.13 tons of stream tin.

Since the commencement of operations in 1900, the Pioneer Company has sluiced 10,498,700 cubic yards of drift, for a yield of 7104.775 tons of stream tin. The average number of men employed during the year was 88—70 at Pioneer, and 18 at Argonaut. The high price of tin for some time past has made it possible to work a large area of ground that was formerly unpayable.

*South Mt. Cameron.*—The Endurance Tin Mining Proprietary commenced operations in January, and a large plant is now erected, comprising:—One 12-inch pump, one 12-inch nozzle-pump, and large condensing plant, erected on pontoon, three dams were built, one being a large return water-dam. A large amount of old and new ground has been sluiced since pumping operations commenced in June last, and 50 tons of tin ore, valued at £6000 have been obtained.

*Moorina.*—The Weld River and Echo Mines.—These mines are being worked conjointly, and 18 tons of tin ore, valued at £3608, were obtained during the year, 16 men being employed.

*Eastern Mining Division.*—The Anchor Tin Mine.—During the year the water-races from the Groom River and Crystal Creek were repaired, and an hydraulic elevator erected to work the alluvial ground lying between the battery buildings and the Groom River. The water-races from the Laffa and Ransom Rivers were also repaired, and a pipe-line and nozzle erected to work the ground above the quarry faces. From all sources, some  $6\frac{1}{2}$  tons of tin were won. On an average 8 men being employed. The season was an exceedingly dry one, and sluicing was not started until well into the second quarter of the year.

*Avoca District.*—The Royal George Tin Mine.—20,264 tons of stone were crushed for a yield of  $109\frac{1}{4}$  tons of tin oxide, valued at £21,421. Average number of men employed being 72. The lode at the No. 2 level was driven on for a distance of 463 feet. This lode is a pyritic one, with contents of average values. A rise was put through to the top level for ventilation purposes.

Foster's Freehold Tin Mine.—This mine is held on tribute from the owner of the private property. From 2 to 4 men are constantly employed in working the alluvial tin and lode matter. About 5 tons of tin ore were obtained, valued at £1120.

*Ben Lomond.*—The Dalrymple Tin Mining Company.—This company has erected a 5-head battery and oil engine. Stopping was confined to the shaft, and ore to the value of £1837 was recovered, giving a return of about 2 per cent. oxide. No dressing-plant has yet been erected, and probably a large percentage of tin ore is lost in treatment.

*Schouten Main.*—The Cygnet Tin Mining Company, No Liability, employing 6 men, obtained 1 ton of tin ore, valued at £192. Work stopped at the end of November, owing to the shortage of water.

*Western Mining Division.*—The Renison Bell Prospecting and Mining Company.—The mine was worked on a tribute basis, and mining operations were carried out on a large stanniferous ironstone out-crop on the extreme east portion of property adjoining the lease of the Central Tin Mine (T. W. Taylor), and the Montana syndicate's lease. The lode in most respects is similar to other ore-bodies previously worked on the mine. The average width of the ore-body was from 12 to 14 feet, and was mined entirely on the open-cut system, the depth of the faces being from 10 to 20 feet. Below that, free milling ore gives out to pyritic ore. 8757 tons of ore were mined and treated at the battery and concentrating plant, which yielded 43·93 tons of tin oxide, containing 28·17 tons of metallic tin, realising £8706 net. The oxide was sold to the Mt. Bischoff Mining Company. The average number of men employed was 24. Operations were restricted through a shortage of labour, but towards the end of the year conditions in this respect considerably improved. Another factor which greatly retarded productive operations was the shortage of water.

The Dreadnought-Boulder Tin Mines Amalgamated, No Liability.—Owing to the exceedingly dry weather during the first half of the year, the output was very low, and the company only treated 2077 tons of stone, or an average of 349 tons monthly, which was a disappointingly low result compared with previous returns. The output of oxide for the period was  $8\frac{1}{2}$  tons, and the cost per ton for the ore crushed and treated, reached the high figure of 13s. 6d., and the expenditure for the half-year was £2196. During the second half-year, the results showed an improvement, as 5225 tons of stone were crushed and treated, or an average of 871 tons monthly, at a cost of 10s. 5d. per ton for a recovery of  $18\frac{1}{2}$  tons of oxide, the working costs being about £3500. Operations were suspended prior to the holidays, and have not been resumed since, owing to the insufficient supply of water, but arrangements have been made for resuming work at an early date. Preparation has been made for opening up a new face to the south where it is reported that there is a good supply of crush-dirt available, estimated at from 10,000 to 12,000 tons. The company has expended over £72,000, and given employment to a large number of men, but up to the present the shareholders have not received any return for their outlay.

The Heemskirk Tin Syndicate sluiced 54,448 cubic yards of ground for  $44\frac{1}{4}$  tons of tin ore which, after treatment, yielded  $28\frac{1}{4}$  tons of tin, valued at £9297, an average of 18 men being employed. The rainfall at this mine for the year was 7631 points.

*North-Western Mining Division.*—The Mt. Bischoff Tin Mining Company.—The output of ore from the mine totalled 98,307 tons, of which 92,771 tons were delivered at the mills for crushing and concentrating, and 5536 tons being very low-grade, were rejected. 450 tons of concentrates were obtained, of an approximate value of £109,250. The average number of men employed was 235.

*Surface Workings.*—The winning of crush-dirt from the various faces and benches has been carried on systematically. The weather during the early part of the year was very dry, but throughout the latter portion the rainfall was excessive.

*Southern Slopes.*—The White Face, Brown Face, Gossan Benches, Happy Valley, and Don Section have been in operation.

*Northern Slopes.*—Benches Nos. 1 and 2, and the North Valley Flats and Terrace workings have been exploited as usual. No. 1 lode, north:—Two prospecting tunnels were driven on this lode, and the ore channel was found to be variable in width, fluctuating from a few inches to 6 feet, and the tin contents were equally inconstant, ranging from 0.1 per cent. to 35 per cent. Iron pyrites was freely mixed with the lode matter. No. 3 adit was recently commenced on the same lode, which at this point has a width of 42 inches, and assays 1.1 per cent. tin oxide. An electric traction has been installed on the North Valley Flats, connecting the benches on the terrace with the loading station at the head of the electric haulage. This plant is now in constant work on these flats, and greatly aids in the more efficient and economical handling of the product from the river faces and terraces.

The Milling and Concentrating Plant has been running uninterruptedly, and the grade of concentrates produced, and the ore recoveries have been maintained at the usual standard.

*Hydro-Electric Power Plant.*—All the machinery in connection with this plant has been in constant use.

*Aerial Ropeways.*—These have been working in the usual satisfactory manner.

Since the mine was discovered in 1870 it has produced 75,553 tons of metallic tin, valued at £5,149,916.

The Mount Bischoff Extended Tin Mining Company, No Liability.—Regular operations were carried out by an average of 98 men until the 16th February, when ore production ceased, and work in connection with the duplication of the milling-plant was put in hand by a much reduced number of men. The work of duplication consisted of the installation of another 10-head mill (1250 lbs.), ore-bin, and the necessary fine grinding and concentrating machinery, new crusher and storage station, two additional boilers, high-speed engine, air compressor, motors, &c., and new pump, and inverted siphon delivery, for increasing supply of milling-water, and the placing in underground of a complete rock-drilling system to facilitate larger crude ore production. In addition a new store and fitting shop was erected at the mill, the fitting shop being fitted with a motor-driven lathe and boring machine.

The mill engine now carries all the stamps, and primary concentrating machinery, the high speed engine driving the 50 horsepower generator, which is used to run the secondary concentrating machinery, crusher, roasting, and pumping-plants, together with other small motors, and the lighting of the plant. The addition of the new compressor, which is steam-driven, gives sufficient air available at 100 lbs. pressure to run constantly 10 drills in the mine. The air main to the main distribution center underground being a 4-inch pipe-line.

The work of alteration was sufficiently far advanced by the 11th of May to allow the original unit of 10 stamps to resume crushing, and as each new installation was completed it was put into commission, the trial run of the duplicated plant being very satisfactory.

Production has been held up during the latter end of the year by shortage of labour, and the shortage and high price of material, otherwise the mine has had a constant run on ore production since the 11th of May.

Development work underground consisted of 1539 feet, mostly on ore. A new level to No. 7 intermediate is now being opened up, and a second opening from the No. 9 level to the No. 6 level is in hand. The ore reserve continues to be kept at a satisfactory figure, the last estimation showing the ore in sight to be as under:—

Positive tons	38,600
Probable tons	27,400
Total tons	66,000

The average grade of the positive ore being 1 per cent. of tin.

Ore is being won from stopes spread from the No. 6 level to the surface, the average width stoped being  $15\frac{1}{2}$  inches.

In the firewood department the consumption was as under:—

Boiler department, 4356 tons (50 cubic feet).  
Roasting department, 961 tons.  
Total, 5317 tons

The year's output is as under:—

Tons of ore crushed, 12,902.  
Tons of pyritic concentrates roasted, 920.  
Tin oxide recovered, dry tons, 155.40.  
Average grade of oxide produced, 70.68 per cent. tin.  
Average recovery per ton of ore crushed, 0.851 per cent. tin.  
Value of output, £34,361 16s. 6d.  
Value per ton of ore crushed, £2 13s. 3.2d.  
Average number of men employed, 108.

#### COAL-MINING.

The total quantity of coal raised amounted to 60,163 tons, valued at £37,676.

The raisings at the different collieries were:—

Colliery.	Tons Raised.
Cornwall ... ..	26,900
Mt. Nicholas ... ..	29,403
Spreyton ... ..	421
York Plains... ..	301
Illamatha ... ..	932
Sandfly ... ..	997
Cardiff ... ..	158
Mt. Cygnet ... ..	136
Tasma ... ..	500
Pateena ... ..	560
Preolenna ... ..	25
Catamaran ... ..	30
	<hr/>
	60,163

The Mount Nicholas Coal Company Limited.—Mining operations have been carried on in the 6 feet seam in this company's leases uninterruptedly, and the working face has been advanced an approximate distance of  $3\frac{1}{2}$  chains, making a total distance of  $55\frac{1}{2}$  chains from the tunnel mouth. The seam still keeps at its usual thickness, and the quality of the coal is well maintained. The company has also driven the tunnel which goes into the 4 feet seam from the bank top a distance of 230 feet, making a total distance of 801 feet from the tunnel mouth. This seam

## CORRIGENDUM.

Page 35: in line 4 of paragraph headed "Osmiridium,"  
for increase in value of £399,735, read "£39,935."

is also keeping its usual thickness, and the quality of the coal is good.

The total output from the mine was 29,403 tons, of a value of £17,392, 81 men and boys being employed above and below ground.

The Cornwall Coal Company, No Liability.—This company raised 26,900 tons of coal, valued at £16,806, employing 72 men. Most of the coal produced was won from the lower seam, about 500 tons only having been won from the upper seam.

The Mt. Cygent Coal Mine.—Two men were employed for about three months, getting out about 160 tons of coal. There is very little demand for this coal in Hobart, and it is used locally for domestic purposes, and for apple-drying and coal storage.

The Sandfly Coal Mine.—About 977 tons of coal were raised during the year. There is no demand for this coal locally for domestic purposes, but a little is utilised for hop-drying and malting. Three men were employed for the greater part of the year.

Colebrook.—The Tasma Colliery.—Work was started on the 15th April, machinery, pit-head, and screens were erected, shaft unwatered and repaired, and on the 14th August operations were started underground. The work done to date has been most developmental, such as driving headings, air courses, &c., on both No. 2 and 3 coal seams.

Coal produced, 300 tons.

Value at pit, £240.

Average number of men employed, 10.

### OSMIRIDIUM.

The quantity of osmiridium obtained from the Savage River and Mt. Stewart was 1606·743 ozs., valued at £44,833, being an increase of 1284·664 ozs. on the previous year, and an increase in value of £399,735. Nearly the whole of the metal won during the year has been obtained from the alluvial diggings at Mt. Stewart. Many of the miners have done remarkably well, and the prices obtained for the metal reached their highest at £37 5s. per oz., but when the war ceased there was a rapid decline, and in December there were no buyers. The Agent-General was communicated with by cable, and informed that purchasing had ceased, and that the position was becoming serious, as nearly 400 men would be thrown out of employment, and was asked if there was any possibility of establishing a mar-

ket in London, and if so what prices were likely to be offered. A reply was received asking what weight was available now or over a period, and stating that he was endeavouring to secure a firm offer. The present price for good quality metal being from £10 to £12 per oz. The Agent-General communicated with the Director of the Imperial Institute, and received the following reply:—

“ It is stated that there is always a market in this country for osmiridium, but that the demand has been lessened by the introduction of substitutes, which are said to give very satisfactory results. It is impossible to indicate the quantity which could be absorbed, as this must depend upon the quality of the native material, as compared with the substitute, but it is considered that a demand could be secured if osmiridium of good quality could be delivered in the United Kingdom at an average price of from £10 to £12 per oz.”

Mr. W. Caudry has done a considerable amount of developmental work on his claim at the Bald Hills. This section was granted as a Reward Claim, being the first discovery of osmiridium in the matrix or serpentine rock. The lode in which the metal appears is well defined. Mr. Caudry has been working in a small way, and obtaining sufficient metal to enable him to put up a small crushing and washing plant. It is stated that the prospects are sufficiently encouraging to warrant the introduction of capital to develop the section on a much larger scale.

The Chief Inspector of Mines, who visited the field in November last, reported as follows:—

Caudry's Reward Section.—This section is situated at the head of McGinty's Creek, which flows into the Nineteen-mile Creek. The metal was traced up McGinty's Creek to a certain point, at which it ceased to exist. Mr. Caudry carried out a good deal of development work in this vicinity, and located what appears to be the source of the metal. He has open-cut for a distance of about 400 feet, and has exposed what appears to be a lode formation. A small plant has been erected on the property by an option-holder. The deposit was thoroughly sampled, but I regret that I was unable to obtain the results. There is no doubt that the metal exists in this lode, but whether in payable quantities or not can only be ascertained by sampling, which would take some time.

Nineteen-mile Creek.—This creek was worked some years ago for very good returns. A large number of men are employed working the ground, and there are some employed

at the head of the creek, which portion was not previously worked, owing to the venture proving unpayable.

Savage River.—No work was carried out here owing to the river bed being flooded. Work is confined to the dry seasons when the river is low.

Mt. Stewart.—This is the scene of the late discovery, and working parties are employed from the Castra River to the head of the creek. Where the creek joins the Castra River it spreads, making beaches and deeper ground. Further up the creek the ground becomes shallow and rougher, until at the upper end, the alluvial is extremely shallow, and the bottom consists of rock with deep crevices. A number of parties are doing remarkably well. On my visit the price of the metal was £36 7s. 6d. per ounce, which allows of very poor ground being worked at a reasonable profit.

#### BISMUTH.

The S. and M. Mine at Middlesex obtained from its tin ore 4·051 tons of bismuth, valued at £913, the Squib Mine obtained 25 tons, valued at £48, and the All Nations Company 343 tons, valued at £77.

#### WOLFRAM.

The output of wolfram ore was as follows:—

	Tons.	Value.
		£
Avoca Mines... ..	115·210	21,907
S. & M. Mine at Middlesex ...	30·660	3,680
Iris Mine ... ..	737	148
Squib ... ..	6·550	1,080
All Nations ... ..	2·205	424
Total ... ..	155·362	£27,239

#### SCHEELITE.

King Island Scheelite Company, No Liability.—Development has been curtailed by scarcity of suitable miners.

An adit has been started at beach level to act as drainage and also to exploit the lodes at this depth. The adit is now in 159 feet, and still in hard slate. No work has been done for some time for reasons stated above. Rises have been put up from north and west adits, as the glory-hole workings required new ore passes. Small prospecting shafts are being put down with a view to tracing continuation of

ore channels. A steam-shovel has been installed to remove overburden. Steam-shovel operations are gradually replacing the glory-hole system. The plant has been increased, and is now treating 750 tons per week, and additional plant has been installed to re-treat tailings, the recovery being increased to approximately 80 per cent.

During the year 21,088 tons were treated for 216 tons, 70 per cent. concentrates representing an approximate value of £39,253 16s. 6d. Working costs for the period were 11s. 10d. per ton.

Arrangements have been made with the Tasmanian Government for the construction of a jetty at the mine, and the work is to be put in hand at an early date. The company has subscribed £1000 for this work. Wooden tramways have been laid into the bush for the haulage of firewood.

#### ASBESTOS.

The Durabestos Company produced 2854 tons of asbestos, valued at £5008, 48 men being employed. A great deal of dead work has been done in searching for richer deposits of asbestos at the mine. The serpentine rock is poor, and the asbestos fibre very short and patchy, and it is doubtful if the mine would be working had it not been for the difficulty in importing asbestos during the war. The whole of the company's leases have recently been transferred to the Wunderlich Company Limited.

#### PYRITES.

The Kynance Prospecting Syndicate, No Liability, has been engaged raising 130 tons of pyrites, valued at £127, 3 men being employed. The company is at present opening up a lode which was cut 30 feet from the approach of the bottom of the 70 feet level, some 20 years ago. This has been driven on for a distance of 30 feet, and now shows 2 feet 6 inches of good pyrites. The pyritic lodes are apparently turning into zinc-lead ores as depth is obtained. The company is endeavouring to arrange with a zinc-lead reducing company for the disposal of its ore.

#### LIMESTONE.

The Broken Hill Proprietary Company employ about 70 men in quarrying limestone at its quarry at Melrose, near Devonport, for fluxing purposes at its works at Newcastle, N.S.W.

The Hydro-Electric Company has been obtaining limestone from its limestone leases near Ida Bay, for the purpose of making carbide at its works at Electrona, Snug River.

Signor A. G. D. Bernacchi has returned to Tasmania after an absence of many years, and has again taken up a large area of land on Maria Island for the purpose of manufacturing cement from the large limestone deposits, which exist on the island, and has furnished me with the following copy of a report made by Mr. S. R. Mitchell, Consulting Engineer to the Emu Cement Works of Melbourne:—

“ I beg to submit my report on the bulk test made on a parcel of Maria Island limestone. The test was carried out at the Emu Cement Works, Burnley, during October, 1918.

“ About 18 tons of the blue fossiliferous limestone, *without addition of other material*, was ground to the necessary fineness and ‘ burned ’ in a 65 feet rotary kiln clinker. This, on grinding, produced a very light-coloured cement. During the grinding of portion of the clinker a small amount of gypsum was added as a retarder.

*Chemical Analyses.*

Raw Meal Before Burning—		Cement with Gypsum Added—	
Per cent.		Per cent.	
Ca Co <sub>3</sub> ... ..	75.25	SiO <sub>2</sub> ... ..	24.7
SiO <sub>2</sub> ... ..	18.3	Al <sub>2</sub> O <sub>3</sub> ... ..	5.9
Al <sub>2</sub> O <sub>3</sub> Fe <sub>2</sub> O <sub>3</sub> ... ..	5.1	Fe <sub>2</sub> O <sub>3</sub> ... ..	4.9
		CaO ... ..	62.3
		MgO ... ..	1.4
		SO <sub>3</sub> ... ..	.3

*Works Tests on Cement.*

Cement with Gypsum Added—

Fineness, 14 per cent. on 180 mesh screen.  
 Time of Set : Initial, 23 minutes; final, 10 hours  
 Soundness : Moist air test, pats show air cracks.  
 Six hours' steam, pats sound.

Tensile Neat Cement—

Seven days : 600 lb. per square inch; 590 lbs. per square inch.

3 to 1 Sand and Cement—

Seven days : 130 lb. per square inch; 130 lb. per square inch.

Cement without Gypsum—

Fineness, 13.5 per cent. on 180 mesh screen.  
 Time of Set : Initial, 10 minutes; final, 2 hours.  
 Soundness : Moist air test, pats show air cracks.  
 Six hours' steam, pats left glass.

Tensile Neat—

Seven days : 610; 580.

3 to 1 Sand and Cement—

Seven days : 230; 230.

These tests were made on fresh cement, and are not yet complete. When matured the cement should give much better results.

These figures prove that the cement is of the correct chemical composition, and that a perfect cement can be manufactured from material of this class. Once a plant is properly working any defects in the cement, both chemically and physical, can be corrected, provided there is suitable raw material.

During my visits to Maria Island in April last, I carefully examined the deposits, both from a geologist's and cement chemists point of view. I am thoroughly satisfied that you have unlimited quantities of suitable raw material for cement manufacture. Some of the beds may contain an excess of silica, but with the large deposits of crinoid limestone on the property this should be easily corrected. Samples of crinoid stone contain up to 95 per cent.  $\text{CaCO}_3$ . The clay sent over is also highly suitable showing up to 43 per cent.  $\text{Al}_2\text{O}_3$ .

It will be very necessary to open up the property systematically, both for sampling and for future quarrying. I would suggest a contour survey being made, followed by a geological examination. In this way the various beds can be plotted and co-related, and then opened up to the best advantage. This is very important for the future working of the plant."

#### OCHRE.

There are many deposits of ochre, of various colours, in different parts of the State, and during the last two or three years, the attention of those persons interested in the manufacture of paint has been drawn to some of the deposits, and many experiments have been made, with the result that a paint factory has been established at Launceston, and a company has been formed in Hobart for the manufacturing of paint from some of the extensive deposits in the south.

The Serpentine Paint Company has taken up leases near Ilfracombe, and is obtaining various coloured pigments, and making the paints in Launceston. The company also has a large area of land at Mowbray, from which some excellent ochre is obtained. The paints compare very favourably with the imported product, and time is required to prove whether they are equal to the imported article.

## BARYTES (Barium of Sulphate).

The Colonial Barium Company Proprietary Limited Mine.—This mine is situated at Howard's Plains. 21 tons of ore were broken out and sent away to Melbourne. The mine has been closed down for the greater part of the year.

## ZINC.

The Electrolytic Zinc Company Proprietary of Australasia Limited, Risdon.—This company has treated 20,979 tons of calcines from Broken Hill, and produced 3822 tons of slab zinc, of an approximate value of £152,880. The average number of men employed on treatment only was 81, and the average number of men employed on the works, 375.

## OUTPUT.

Return showing the Quantity and Value of Mineral Products for the State of Tasmania during the Year ending 31st December, 1918.

Mineral.	Quantity.	Value.
		£
Gold*..... ozs.	10,528·930	44,724
Silver-lead Ore..... tons	7241·400	127,176
Blister Copper †..... "	5559	772,162
Copper and Copper Ore..... "	444·170	3944
Tin Ore..... "	2256·203	488,798
Coal..... "	60,163	37,676
Wolfram..... "	155·362	27,239
Bismuth..... "	4·608	1038
Osmiridium..... ozs.	1606·743	44,833
Scheelite..... tons	216	39,252
Barytes..... "	217	977
Iron Pyrites..... "	5105·600	4667
Asbestos..... "	2854	5008
Zinc..... "	3822	152,880
Ochre..... "	100	200
Total.....	...	£1,750,574

\* Fine gold, including gold contained in blister copper.

† Value of gold deducted.

## DEPARTMENTAL CIRCULARS.

The Government Geologist (Mr. W. H. Twelvetrees), has, at my request, furnished for the guidance of prospectors, circulars containing information on the following subjects:—

- No. 1—Bauxite: A source of aluminium.
- No. 2—The search for petroleum in Tasmania.
- No. 3—Prospecting for mercury in Tasmania.
- No. 4—Diamonds in Tasmania.

These circulars have been published in the press, as issued, and printed copies, in pamphlet form, have been widely disseminated throughout the State. So far no discoveries of importance have resulted, but numerous specimens of clay, shale, and minerals, have been forwarded to the Government Assayer for determination from time to time, and prospectors and miners have expressed pleasure at the action of the Department, and the interest taken to assist them in their efforts to discover new minerals, &c. Copies of the circulars are appended for future record.

## GEOLOGICAL SURVEY BRANCH.

A report by the Government Geologist on the work done by this branch of the Department is appended. The Assistant Government Geologist (Mr. Loftus Hills, M.Sc.), is still absent at the front, where he has done good work in connection with the Mining Corps. The pressing work of this branch necessitated the engagement of Mr. Alexander McIntosh Reid, whose reports have been published during the year, and have proved of value to the Department and the mining public.

## INSPECTORS OF MINES.

The report of the Chief Inspector of Mines is appended. Mr. James Harrison, Inspector of Mines at Zeehan, has reached the retiring age, and will sever his connection with the Department on the 31st May next. I desire to record my very high appreciation of the manner in which Mr. Harrison has performed his duty during the 37 years he has been connected with the Department most of which has been spent on the West Coast. His retirement is a loss to the Department, and his services cannot be easily replaced.

## REVENUE.

The revenue for the year amounted to £17,833 14s. 8d., being an increase of £3146 7s. 7d. on the previous year. The sum of £3152 4s. 2d. deposited as survey fees with applications for leases is not included in the above.

## MINING MANAGERS' EXAMINATIONS.

No candidates presented themselves for examination during the year.

## DEPARTMENTAL STAFF.

The only change in the departmental staff during the year, was the appointment of Miss B. W. Simms, clerk and typiste, on the 1st April, 1918, *vice* Miss L. R. Edmunds, resigned.

## CONCLUSION.

In conclusion, I desire to thank the officers of the Department, and the officers of the Mining Branch of the Department of Lands and Surveys for their loyalty, and the willing assistance they have afforded me through a very strenuous year. Now that the war is over, I hope we shall have a more prosperous time, as things once more become normal.

I have the honour to be,

Sir,

Your most obedient Servant,

W. H. WALLACE,

Secretary for Mines.

The Honourable the Minister for Mines.

## No. 1.

*RETURN showing the Quantity and Value of Gold won from 1880 to 1918 inclusive.*

Year.	Quantity.	Value.
	ozs.	£
1880 to 1903 inclusive .....	1,265,836·95	4,905,706
1904 .....	65,921	280,015
1905 .....	73,540·5	312,380
1906 .....	60,023·4	254,963
1907 .....	65,354·25	277,607
1908 .....	57,085·1	242,482
1909 .....	44,777·366	190,201
1910 .....	37,048·053	157,370
1911 .....	31,100·873	132,108
1912 .....	37,973·252	161,300
1913 .....	33,400·457	141,876
1914 .....	26,243·453	111,475
1915 .....	18,547·338	78,784
1916 .....	15,790·096	67,072
1917 .....	14,496·464	61,577
1918 .....	10,528·930	44,724
	1,857,667·482	7,419,640

## No. 2.

*RETURN showing the Quantity and Value of Silver-Lead Ore produced from 1888 to 1918 inclusive.*

Year.	Quantity.	Value.
	Tons.	£
1888 to 1903 inclusive .....	300,977·5	2,571,771
1904 .....	51,138	203,702
1905 .....	75,270·5	246,888
1906 .....	87,117·75	462,443
1907 .....	89,762·5	572,560
1908 .....	63,116·9	322,007
1909 .....	80,378·35	298,880
1910 .....	51,226·91	247,576
1911 .....	61,501·195	253,361
1912 .....	90,123·868	309,098
1913 .....	83,289·268	319,997
1914 .....	11,565·54	96,225
1915 .....	10,382·95	91,689
1916 .....	11,229·410	153,796
1917 .....	9575·780	152,122
1918 .....	7241·400	127,176
	1,083,897·821	6,429,291

## No. 3.

*RETURN showing the Quantity and Value of Blister Copper produced from 1896 to 1918 inclusive.*

Year.	Quantity.	Value.
	Tons.	£
1896 to 1903 inclusive .....	52,154	4,186,805
1904 .....	8371	*582,540
1905 .....	8610	*704,287
1906 .....	8708	*862,444
1907 .....	8247	*832,691
1908 .....	8833	*603,069
1909 .....	8638	*586,419
1910 .....	8193	*553,822
1911 .....	6022	*385,797
1912 .....	5136	*430,965
1913 .....	4569	*364,732
1914 .....	7509	*477,361
1915 .....	7901	*709,167
1916 .....	6305	*884,689
1917 .....	5845	*841,583
1918 .....	5559	*772,162
	160,600	13,778,527

\* Value of Gold contents deducted.

## No. 4.

*RETURN showing Quantity and Value of Copper Matte exported during the Years 1902, 1903, and 1904 to 1918 inclusive.*

Year.	Quantity.	Value.
	Tons.	£
1902 .....	2500	50,112
1903 .....	3727	83,624
1904-1918 .....	—	—
	6227	133,736

## No. 5.

*RETURN showing the Quantity and Value of Copper Ore produced from 1896 to 1918 inclusive.*

Year.	Quantity.	Value.
	Tons.	£
1896 to 1903 inclusive .....	23,736·5	298,292
1904 .....	104	1640
1905 .....	1150·75	52,939
1906 .....	2234·5	72,480
1907 .....	788·25	36,975
1908 .....	1185	6588
1909 .....	1587·8	21,619
1910 .....	671·27	13,150
1911 .....	2286	22,852
1912 .....	1391·6	9479
1913 .....	1966·8	10,932
1914 .....	3287·75	18,680
1915 .....	66	367
1916 .....	96·84	1765
1917 .....	771·40	6171
1918 .....	444·170	3944
	41,768·63	577,873

## No. 6.

*RETURN showing the Quantity and Value of Tin exported from Tasmania from 1880 to 1904 (compiled from Customs Returns only), and Tin Ore produced during the Years 1905 to 1918 inclusive.*

Year.	Quantity.	Value.
	Tons.	£
1880 to 1904 inclusive .....	76,708·4	7,167,564
1905 .....	3891·5	362,670
1906 .....	4472·75	557,266
1907 .....	4342·75	501,681
1908 .....	4520·8	421,580
1909 .....	4511·2	418,165
1910 .....	3701·01	399,393
1911 .....	3953·05	513,500
1912 .....	3713·825	543,103
1913 .....	4010·41	531,983
1914 .....	2572·713	259,300
1915 .....	2599·234	292,306
1916 .....	2854·636	350,852
1917 .....	2637·337	427,917
1918 .....	2256·203	488,798
	126,845·818	13,236,078

## No. 7.

*RETURN showing the Quantity and Value of Iron Ore produced from 1897 to 1918 inclusive.*

Year.	Quantity.	Value.
	Tons.	£
1897 to 1903 inclusive .....	20,442	16,276
1904 .....	6840	2975
1905 .....	6300	2600
1906 .....	2600	1100
1907 .....	3000	1150
1908 .....	3600	1600
1909-1918 .....	—	—
	42,762	25,701

## No. 8.

*RETURN showing the Quantity and Value of Wolfram produced from 1899 to 1918 inclusive.*

Year.	Quantity.	Value.
	Tons.	£
1899 to 1903 inclusive .....	57·25	2157
1904 .....	15·5	1147
1905 .....	32·25	2371
1906 .....	19·75	1465
1907 .....	40·75	4411
1908 .....	4·5	338
1909 .....	28·35	2494
1910 .....	67·35	7280
1911 .....	69·96	7769
1912 .....	66·49	6601
1913 .....	68·07	7040
1914 .....	46·873	4327
1915 .....	94·685	11,115
1916 .....	106·265	16,910
1917 .....	172·190	28,714
1918 .....	155·362	27,239
	1045·595	131,378

## No. 9.

*RETURN showing the Quantity and Value of Coal raised from 1880 to 1918 inclusive.*

Year.	Quantity.	Value.
	Tons.	£
1880 to 1903 inclusive .....	767,261	659,010
1904 .....	61,109	51,942
1905 .....	51,993	44,194
1906 .....	52,895·75	44,962
1907 .....	58,891	50,057
1908 .....	61,067·75	51,907
1909 .....	66,161·75	56,237
1910 .....	82,445	48,609*
1911 .....	57,067	26,214*
1912 .....	53,560	24,568*
1913 .....	55,043	25,367*
1914 .....	60,794	27,853*
1915 .....	64,536·25	30,418*
1916 .....	55,575	27,736*
1917 .....	63,412	38,673*
1918 .....	60,163	37,676
	1,671,983	1,245,423

\* Value at pit's mouth.

## No. 10.

*RETURN showing the Quantity and Value of Osmiridium produced during the Years 1910 to 1918 inclusive.*

Year.	Quantity.	Value.
	Ozs.	£
1910 .....	120	530
1911 .....	271·88	1188
1912 .....	778·77	5742
1913 .....	1261·65	12,016
1914 .....	1018·83	10,076
1915 .....	247·048	1581
1916 .....	222·150	1899
1917 .....	332·079	4898
1918 .....	1606·743	44,833
	5859·150	83,463

## No. 11.

*RETURN showing the Quantity and Value of Barytes produced during the Years 1916 to 1918 inclusive.*

Year.	Quantity.	Value.
	Tons.	£
1916 .....	83	359
1917 .....	52	234
1918 .....	217	977
	352	1570

## No. 12.

*RETURN showing the Quantity and Value of Bismuth produced from 1904 to 1918 inclusive.*

Year.	Quantity.	Value.
	Tons.	£
1904 .....	·3	15
1905 .....	3·5	800
1906 .....	·3	24
1907 .....	·175	27
1908 .....	3·75	462
1909 .....	2·9	980
1910 .....	10·70	4249
1911 .....	14·395	5758
1912 .....	7·59	2646
1913 .....	5·08	1627
1914 .....	5·619	1666
1915 .....	5·5	1203
1916 .....	3·51	1059
1917 .....	4·212	895
1918 .....	4·608	1038
	72·189	22,449

## No. 13.

*RETURN showing the Quantity and Value of Asbestos produced from 1899 to 1918 inclusive.*

Year.	Quantity.	Value.
	Tons.	£
1899 .....	200	363
1900 .....	128	113
1901 .....	46·5	45
1902-1915.....	—	—
1916 .....	15	30
1917 .....	271	271
1918 .....	2854	5008
	3514·5	5830

## No. 14.

*RETURN showing the Quantity and Value of Shale produced during the Years 1910 to 1918 inclusive.*

Year.	Quantity.	Value.
	Tons.	£
1910 .....	364	214
1911 .....	500	250
1912 .....	—	—
1913 .....	130	130
1914 .....	75	75
1915 .....	—	—
1916 .....	1286	1286
1917 .....	—	—
1918 .....	—	—
	2355	1955

## No. 15.

*RETURN showing the Quantity and Value of Iron Pyrites produced during the Years 1915 to 1918 inclusive.*

Year.	Quantity.	Value.
	Tons.	£
1915 .....	12,835·59	8945
1916 .....	14,005·084	13,597
1917 .....	7,685·549	7137
1918 .....	5,105·600	4667
	39,631·823	34,346

## No. 16.

*RETURN showing the Quantity and Value of Zinc produced during the Years 1917 and 1918.*

Year.	Quantity.	Value.
	Tons.	£
1917 .....	48	1968
1918 .....	3822	152,880
	3870	154,848

## No. 17.

*RETURN showing the Quantity and Value of Scheelite produced during the Years 1917 and 1918.*

Year.	Quantity.	Value.
	Tons.	£
1917 .....	69	12,130
1918 .....	216	39,252
	285	51,382

## No. 18.

*RETURN showing the Quantity and Value of Ochre produced during the Year 1918.*

Year.	Quantity.	Value.
	Tons. 100	£ 200
1918 .....		

## No. 19.

*RETURN showing Quantity and Value of Minerals and Metals raised in Tasmania from 1880 to 1918 inclusive.*

Mineral or Metal.	Quantity.	Value.
		£
Gold .....	1,857,667·482 ozs.	7,419,640
Silver-lead Ore.....	1,083,897·821 tons	6,429,291
Blister Copper.....	160,600 "	13,778,527
Copper Matte .....	6227 "	133,736
Copper and Copper Ore...	41,768·630 "	577,873
Tin Ore.....	126,845·818 "	13,236,078
Iron Ore .....	42,762 "	25,701
Coal .....	1,671,983 "	1,245,423
Wolfram .....	1045·595 "	131,378
Bismuth .....	72·139 "	22,449
Asbestos .....	3514·500 "	5830
Shale .....	2355 "	1955
Iron Pyrites.....	39,631·823 "	34,346
Osmiridium ... ..	5859·150 ozs.	83,463
Barytes.....	352 tons	1570
Scheelite .....	285 "	51,382
Zinc .....	3870 "	154,848
Ochre .....	100 "	200
Unenumerated prior to 1894...	...	31,988
Total .....	...	£43,365,678

## No. 20.

*RETURN showing the Amounts paid in Dividends by Mining Companies during the Year ending 31st December, 1918.*

Mines.	Dividends.
	£
Copper .....	209,495
Gold .....	...
Tin .....	119,426
Silver .....	...
Coal.....	4313
Scheelite .....	10,000
Total .....	£343,234

## No. 21.

*RETURN showing the Average Number of Persons engaged in Mining during the Years 1880 to 1918 inclusive.*

Year.	Number.	Year.	Number.
1880.....	1653	1900.....	7023
1881.....	3156	1901.....	6923
1882.....	4098	1902.....	5934
1883.....	3818	1903.....	6017
1884.....	2972	1904.....	6194
1885.....	2783	1905.....	6581
1886.....	2681	1906.....	7005
1887.....	3961	1907.....	7516
1888.....	2989	1908.....	6466
1889.....	3141	1909.....	6054
1890.....	2868	1910.....	5770
1891.....	3219	1911.....	5247
1892.....	3295	1912.....	5566
1893.....	3403	1913.....	6107
1894.....	3433	1914.....	4741
1895.....	4062	1915.....	3908
1896.....	4350	1916.....	3864
1897.....	4510	1917.....	4050
1898.....	6052	1918.....	4278
1899.....	6622		

## No. 22.

*RETURN showing the Mining Companies registered during the Year ending 31st December, 1918.*

Number of Companies.	Capital.
6	£73,200

In addition to the above, five Agents for Foreign Companies and three Syndicates, under Part V.a of the Mining Companies Act, were registered.

## No. 23.

*RETURN showing the Average Number of Miners employed during the Year ending 31st December, 1918.*

Division.	Number.
Northern and Southern .....	341
North-Eastern .....	533
Eastern .....	535
North-Western.....	681
Western.....	2188
	4278

## No. 24.

*RETURN showing the Total Amount of Rents, Fees, &c., received by the Mines Department during the Year ending 31st December, 1918.*

Head of Revenue.	Amount.
	£ s. d.
Rent of Auriferous and Mineral Land.....	16,367 8 3
Fees, ditto ditto .....	1466 6 6
Survey Fees .....	3152 4 2
Total .....	£20,985 18 11

## No. 25.

*RETURN showing the Total Area of Land and Number of Sluiceheads of Water applied for during the Year ending 31st December, 1918.*

Mineral.	Number.	Sluiceheads.	Area.
			Acres.
Arsenic .....	3	...	160
Asbestos .....	1	...	10
Barytes .....	3	...	30
Bismuth .....	...	...	...
Chrysotile .....	...	...	...
Clay .....	4	...	28
Coal .....	19	...	3642
Copper .....	9	...	550
Gold .....	53	...	1088
Guano .....	...	...	...
Iron .....	7	...	299
Limestone .....	5	...	685
Minerals .....	56	...	2785
Molybdenite .....	2	...	120
Oxide .....	2	...	15
Osmiridium .....	2	...	20
Phosphate of Lime .....	1	...	7
Pyrites .....	2	...	20
Silver-lead Ore.....	7	...	279
Slate .....	4	...	154
Scheelite.....	4	...	170
Tin.....	338	...	5380
Wolfram .....	4	...	86
Machinery Sites .....	10	...	30
Mining Easements .....	27	...	263
Dredging Claims .....	16	...	252
Water Rights and Dam Sites .....	137	570	212
	716	570	16,285

## No. 26.

*RETURN showing the Total Number and Area of Leases issued during the Year ending 31st December, 1918.*

Mineral.	No. of Leases.	No. of Sluicheads.	Area.
			Acres.
Asbestos .....	...	...	...
Barytes .....	3	...	30
Bismuth .....	...	...	...
Coal .....	6	...	1000
Copper .....	8	...	474
Clay .....	2	...	11
Gold .....	18	...	294
Guano .....	...	...	...
Iron .....	...	...	...
Limestone .....	...	...	...
Machinery Sites .....	...	...	...
Minerals .....	34	...	1327
Manganese .....	...	...	...
Nickel .....	...	...	...
Osmiridium .....	1	...	23
Silica .....	1	...	20
Slate .....	4	...	717
Scheelite .....	1	...	10
Silver-lead .....	5	...	224
Tin .....	106	...	1598
Wolfram .....	...	...	...
Dredging Claims .....	2	...	25
Water-rights .....	8	8	8
Mining Easements .....	4	...	12
	203	8	5773

## No. 27.

*RETURN showing the Total Number of Leases in force on  
31st December, 1918.*

Mineral.	No. of Leases.	No. of Sluicheads.	Area. Acres.
Asbestos.....	3	...	140
Bismuth.....	1	...	70
Barytes.....	6	...	270
Coal.....	35	...	7919
Copper.....	30	...	1278
Clay.....	3	...	21
Chrysotile.....	3	...	160
Dredging Claims.....	23	...	323
Gold.....	43	...	657
Iron.....	3	...	138
Limestone.....	4	...	605
Mining Easements.....	111	...	594
Machinery Sites.....	37	...	165
Minerals.....	171	...	13,150
Molybdenite.....	...	...	...
Manganese.....	1	...	63
Nickel.....	2	...	121
Osmiridium.....	2	...	63
Phosphate Rock.....	...	...	...
Silica.....	1	...	20
Slate.....	4	...	717
Scheelite.....	2	...	85
Shale.....	1	...	1488
Silver-lead.....	26	...	2404
Tin.....	523	...	13,426
Water-rights.....	494	1865	2121
Wolfram.....	19	...	602
	1548	1865	46,600

## No. 28.

*RETURN showing the Annual Value of Mineral Products for the State of Tasmania from 1880 to 1918 inclusive.*

Year.	Value.	Year.	Value.
	£		£
1880.....	554,031	1902.....	1,378,406
1881.....	602,723	1903.....	1,354,044
1882.....	556,306	1904.....	1,379,204
1883.....	560,873	1905.....	1,729,129
1884.....	468,302	1906.....	2,257,147
1885.....	518,885	1907.....	2,277,159
1886.....	489,966	1908.....	1,650,027
1887.....	593,256	1909.....	1,574,995
1888.....	616,733	1910.....	1,432,193
1889.....	504,718	1911.....	1,349,497
1890.....	444,210	1912.....	1,493,502
1891.....	528,388	1913.....	1,415,700
1892.....	526,909	1914.....	1,007,038
1893.....	627,909	1915.....	1,225,575
1894.....	732,764	1916.....	1,521,050
1895.....	575,692	1917.....	1,584,290
1896.....	662,058	1918.....	1,750,574
1897.....	1,006,140	Unenumerated	
1898.....	1,071,084	prior to 1894	31,988
1899.....	1,660,622		
1900.....	1,888,695		
1901.....	1,763,896		
			£43,365,678

No. 29.

RETURN showing the Number and Area of Leases held under "The Mining Act," in force on 31st December, 1911 to 1918 inclusive.

Nature of Lease.	In force on 31st Dec., 1911.		In force on 31st Dec., 1912.		In force on 31st Dec., 1913.		In force on 31st Dec., 1914.		In force on 31st Dec., 1915.		In force on 31st Dec., 1916.		In force on 31st Dec., 1917.		In force on 31st Dec., 1918.	
	No.	Area.														
For Minerals, Silver, Tin, &c.	1025	Acres. 41,311	960	Acres. 36,157	926	Acres. 36,271	1129	Acres. 37,785	907	Acres. 36,437	872	Acres. 34,458	876	Acres. 36,203	796	Acres. 32,011
For Coal, Slate, Shale, &c.	58	13,049	37	8854	23	5660	26	6405	45	11,522	52	13,742	50	13,138	44	10,729
For Gold	73	1220	73	1344	54	988	95	2130	94	2026	85	1692	91	1761	43	657
Dredging Claims	42	647	42	489	30	329	36	403	29	351	30	437	30	401	23	323
Mining Easements	99	606	133	606	105	603	110	611	102	553	106	641	105	628	111	594
Machinery Sites	37	145	39	149	36	153	43	180	40	183	37	190	38	175	37	165
Water-rights Mineral and Gold	502	1060 & 1845 sluice-heads	550	1640 & 2043 sluice-heads	546	1909 & 2034 sluice-heads	605	2449 & 2160 sluice-heads	568	1988 & 2135 sluice-heads	572	2302 & 2061 sluice-heads	557	2085 & 2035 sluice-heads	494	2121 & 1865 sluice-heads

## No. 30.

*COMPARATIVE Statement of Revenue from Mines, being Rents, Fees, &c. (exclusive of Survey Fees) paid to the Treasury for the Years ending 30th June, from 1882 to 1903, and for Six months ending 31st December, 1903, and for the Years ending 31st December, 1904, to 1918 inclusive.*

Year.	Amount.			Year.	Amount.		
	£	s.	d.		£	s.	d.
1882.....	23,077	1	9	1901.....	21,569	5	2
1883.....	15,439	14	5	1902.....	19,471	0	1
1884.....	6981	11	10	1903.....	17,776	14	3
1885.....	11,070	5	7	1903, 1 July to 31 Dec. ....	14,758	17	1
1886.....	12,523	10	4	1904, Jan. to Dec. ....	16,631	8	2
1887.....	14,611	11	5	1905.....	20,208	17	0
1888.....	23,502	8	4	1906.....	24,136	12	5
1889.....	17,254	9	0	1907.....	24,794	7	7
1890.....	26,955	4	9	1908.....	20,311	3	0
1891.....	37,829	16	5	1909.....	22,804	1	5
1892.....	17,568	18	4	1910.....	22,221	18	0
1893.....	16,971	9	2	1911.....	20,556	15	10
1894.....	16,732	7	7	1912.....	17,639	19	11
1895.....	15,323	1	9	1913.....	19,410	17	8
1896.....	20,901	13	2	1914.....	14,087	0	6
1897.....	25,631	0	3	1915.....	17,679	3	6
1898.....	33,661	13	9	1916.....	14,678	19	10
1899.....	24,606	10	5	1917.....	14,669	7	2
1900.....	28,380	11	10	1918.....	17,833	14	9

The above Statement does not include Stamp Duties upon Transfer of Leases and Registration of Companies, nor the Tax payable upon Dividends, from which sources large sums are derived.

REPORT OF THE MOUNT CAMERON WATER-  
RACE BOARD FOR THE YEAR ENDING  
31st DECEMBER, 1918.

Gladstone, 10th February, 1919.

SIR,

WE have the honour to submit the report of the Board for the year ending 31st December, 1918.

*Race.*—The race is in good condition from intake to outlet. The embankments are standing well, and no breaks of consequence have occurred. A small expenditure was incurred in cleaning-out branch races and cutting the scrub along the banks thereof.

The hand-railing and cross-bearers at the fluming over Old Chum Creek has been repaired and is now in good order.

*Syphons.*—These pipes are standing well, and whenever signs of rust occur, they are carefully cleaned and painted.

*General.*—Two wooden flumings on an abandoned race, constructed by the Purdue Tin Mining Company, which belonged to the Government, were, with the authority of the Minister for Mines, handed over to the Board for future use. They have been removed and stacked on the Board's premises. The boards are in good condition, and some have already been used for repairing flumings and a bridge over a creek near the manager's residence.

*Revenue.*—The revenue for the year amounted to £1701 3s. 6d., being an increase of £168 18s. 6d. on the previous year.

*Rainfall.*—The registered rainfall for the year was as follows:—Main intake, 33 inches 65 points; Little Mussel Roe intake, 33 inches 49 points.

*Expenditure.*—The expenditure amounted to £791 0s. 6d., being an increase of £15 11s. 2d. on the previous year.

The statistics for the year are as follow:—

Average per week of claims supplied, 10.

Greatest number supplied in any one week, 17.

Total number of heads supplied—Under fixed or cash scale, 269½; under royalty or credit scale, 2385½. Total 2655.

Tin ore raised for the year—Under fixed scale, 11 tons 10 cwt. 2 qr.; under royalty scale, 25 tons 9 cwt. 3 qr. 3 lb. Total, 37 tons 0 cwt. 1 qr. 3 lb.

Average number of men employed per week, 22.

<i>Receipts.</i> —Total receipts for the year:—		£	s.	d.
Water sold under fixed scale .....		306	5	0
Water sold under royalty scale .....		1,378	11	0
Miscellaneous .....		16	7	6
		<u>£1,701</u>	<u>3</u>	<u>6</u>

<i>Expenditure.</i> —		£	s.	d.
Salaries and wages .....		684	0	6
Printing and stationery .....		3	3	11
Telephones .....		1	18	5
Insurance .....		6	3	0
Travelling expenses .....		17	7	8
Race repairs .....		14	18	0
Fluming repairs .....		2	0	0
Stores, tools, &c. ....		14	6	6
Removal of boards from Pyke's Creek		38	7	6
Purchase of pumps, &c. ....		8	15	0
		<u>£791</u>	<u>0</u>	<u>6</u>

Paid to Public Debts Sinking Fund  
for the year ending 30th June, 1918  
(including moiety of rents of mineral  
land served by the race, £5  
12s. 6d.) ..... £1,060 11 4

We have the honour to be,

Sir,

Your obedient servants,

W. H. WALLACE, Chairman.

CECIL RYAN,  
CHAS. BARNES,  
J. O. HUDSON,  
E. L. HALL,  
JOHN SIMPSON, } Members.

The Hon. the Minister for Mines.

## GEOLOGICAL SURVEY OF TASMANIA.

## REPORT OF THE GOVERNMENT GEOLOGIST.

Geological Survey Office,  
Launceston, 2nd April, 1919.

SIR,

I BEG to submit my report for the year ending 31st December, 1918, and to append annual reports by Mr. A. McIntosh Reid, Acting Assistant Government Geologist, and Mr. W. D. Reid, Government Assayer.

The following publications have been issued during the year:—

- (1) Bulletin No. 26: The Tinfield of North Dundas, by Hartwell Conder, M.A., A.R.S.M., 31st January, 1918.
- (2) Bulletin No. 27: The Bangor Mineral District, by W. H. Twelvetrees, 28th March, 1918.
- (3) Mines Department Circular, No. 4: Diamonds in Tasmania," by W. H. Twelvetrees, 21st August, 1918.

In addition to the above, Bulletin No. 28 (The North Pie-man and Huskisson and Sterling Valley Mining Fields, by A. McIntosh Reid) was sent in to the printer on the 12th June. Mr. Reid also reported departmentally on the lodes of the Golden Crest Mine, Golconda.

*North Dundas and X River Tinfields.*

Bulletin No. 26 was prepared by Mr. Conder in the previous year, and published in 1918. It should be read in connection with Bulletins Nos. 6 and 12, 1909 and 1911, by L. Keith Ward, but these being now out of print and not readily obtainable the information contained in them has been brought up to date. The body of information presented in the present bulletin should be of interest and use to those who are in any way associated with the work on this field.

*Diamonds in Tasmania.*

A circular on this subject was prepared in order to record what is known with reference to the discoveries which have been made, and to supply information which may be useful to persons sluicing sands in likely districts. Some 16 or 18 small diamonds have been found in Tasmania from time to time, mostly while sluicing for gold in the Donaldson District. These were generally about one-eighth carat stones, one reaching one-third of a carat. The yellow apices form a distinctive character of the gems from this province.

Since the publication of the circular, my attention has been drawn to the Royal Society's Proceedings for October, 1874, in which Mr. S. H. Wintle is reported to have sent for exhibi-

tion a collection of gem stones from the stanniferous drift of the Golden Fleece Rivulet, consisting (according to the exhibitor) of diamonds, oriental rubies, sapphires, zircons, and spinel.

The district is a very unlikely one for the occurrence of diamonds, being essentially a tin-bearing granite area. The probability is that the alleged diamonds were topaz. In the early days stones of topaz were frequently suspected to be diamonds, and sometimes called by that name; *e.g.*, the Killiecrankie diamonds of Flinders Island, which are transparent brilliant topaz. It does not appear that it would be profitable to devote much time to a special search for diamonds, but if men who are sluicing for gold or osmiridium in our diamond province know what to look for, discoveries may be made now and then.

#### *Magnet District.*

In June, during a visit which I paid to Magnet, I had an opportunity of examining the geological and structural features of the lode at the mine there, on which I reported to the Department.

The observations made of the remarkable lode occurrence at the Magnet are applicable to other mines on the same line. The lode is in the hanging-wall portion of a broad dyke of eruptive rock which seems to be about 400 feet wide. This rock is the ultra-basic variety known to petrologists as websterite-porphry. The dyke bears about 20 degrees east of north and underlies to the north-west. The lode consists of a series of parallel bands of galena, alternating with bands of carbonate of iron and dolomite; the dolomite is frequently highly ferriferous. The whole forms a lode-belt which sometimes attains a width of over 100 feet. In the footwall portion of this belt there will be up to 30 feet of ore-ground; in the central portion about 10 feet; and on the hangingwall about 5 feet. The average width of the lode taken out is from 40 to 45 feet of varying quality. There are therefore, as a rule, three parallel drives on each level.

The economic mineral of the lode is essentially galena, with which is associated a subordinate proportion of zinc blende. The silver and gold contents in the upper part of the lode were abnormally high, the gold averaging 2 dwt. per ton, and the silver 4 oz. per unit of lead. Primary ores of argentiferous lead and antimony were decomposed, and formed new combinations—chromate, sulphate, and carbonate of lead, native silver, and jamesonite. The result was the formation of a zone of enrichment which descended to a considerable depth, but which at the deeper levels gives place to a zone of leaner primary ores, with which an increasing proportion of zinc blende is associated.

In the upper zone a whole series of lead and antimony minerals is present. Besides those mentioned above, the following varieties exist:—Pyromorphite (chlorophosphate of lead), mimetite (chlorarsenate of lead), vanadinite (chlorvanadate of lead) endlicheite (arsenical chlorvanadate of lead), massicot (yellow oxide of lead), minium (red oxide of lead), bindheimite (oxide of lead and antimony), Stibnite (sulphide of antimony). Then we have also the oxides of iron and manganese forming the gossan ores, which were worked down to an appreciable depth.

The gangue minerals of the lode are carbonate of iron, dolomite (carbonate of lime and magnesia), and calcite (carbonate of lime). Quartz is absent.

The lode-channel is not to be regarded as having been an open gaping fissure ready to receive in one act the lode-minerals as we see them to-day, but rather as having widened slowly by the breaking down and removal of successive bands of soluble rock, which were replaced, *pari passu*, by bands of mineral. Thus the original channel, which was perhaps not an inch wide, gradually acquired a width of 50 to 100 feet. The dissolution of the magnesian dyke-rock furnished magnesian solutions, which consolidated as dolomite. A good deal of the latter mineral was deposited at the same time as the lode bands, and a good deal of it went on forming after the deposition of ore ceased. In the latter case it formed a sort of hangingwall to the ore-veins, and some indications suggest that it even encroached on the lode itself and replaced the ore. In fact, over a considerable extent of the lode it fills the channel to the exclusion of the ore. Sometimes the lode-channel, several yards in width, is completely filled with massive white dolomite. Occurrences in which disjointed fragments of banded ore are seen scattered throughout the dolomite matrix show that the latter was a filling subsequent to the formation of the ore. It frequently happens that the ore ceases suddenly, and dolomite occupies the vein-channel. Exactly why this takes place is not understood. Either the dolomite has replaced ore, or the solutions were depleted of their ore contents and continued precipitating their magnesian contents. The subject requires further study.

The metalliferous portion of the lode is, as a rule, between the greenish dolomitised rock on the footwall and the white dolomite on the hangingwall. Although dolomitisation is more pronounced close to the lode, it exists in an incipient stage through the dyke, so that absolutely fresh dyke-rock is difficult to find. Although too much dolomite may be looked upon as unfavourable for ore, the presence of this mineral is undoubtedly an indication of the ore solutions, so that in prospecting all along this line of country, if we meet with dolomite we may be confident that we are in a lode-channel or alongside it.

There are numerous slides and slips in the lode-channels, and the ore often disappears after passing these, but they are probably mere gliding planes against which ore has formed. It would be useless to try to pick up suspected faulted parts of the lode beyond these slides, many of which already existed before the ore was formed. It may be that the slides generally represent differential movements in the original rock, due to its hydration and consequent increase in volume. Similar gliding planes and partings are abundant in serpentine masses, which are closely allied in constitution to the present rock.

The upper levels in the mine are now inaccessible, and the foregoing observations were carried on in the lower workings, down to a depth of about 800 vertical feet below the outcrop.

The same conditions are continued into the North Magnet Mine. The low south drive in that mine has its end in massive white dolomite, which either fills the genuine lode-channel or has formed on the hangingwall of the latter.

It is apparent that the features of this long lode-line are of exceptional interest geologically, and as it is not likely that

the Magnet and North Magnet Mines are the only seats of ore-concentration, the geological study of the whole belt would probably have important results.

#### *Overseas Reports.*

In accordance with a request received from the Department of Scientific and Industrial Research, London, I prepared a report during the year on the sources and production of iron and other metalliferous ores used in the iron and steel industry. The subjects were the deposits in this State of iron ore, molybdenite and wolfram, and scheelite.

In response to confidential communications from the Secretary of State for the Colonies, I also reported on our munitions' minerals. The agents of our mines producing these minerals were urged to take all possible measures to accelerate the production. With a view of stimulating prospecting and encouraging the continuance of work on some of the smaller properties, Mr. A. McIntosh Reid, Acting Assistant Geologist, was charged with a visit to the wolfram field of the Moina district, and he completed his report on the same in September.

The usual reports on the progress of Science and Industry in the State have been sent to the British Science Guild.

#### *Hydro-Electric Department.*

During the year a report was drawn up for the Hydro-Electric Department on ore-deposits and raw materials likely to be of use as the basis of electro-metallurgical industries in connection with the State installation. The report dealt with the subjects of iron ore, tungsten, quartz for quartz glass manufacture, manufacture of graphite, of carborundum, &c.

#### *Deposits of Iron Ore.*

The question of the production of iron and steel in the Australian States having assumed an acute phase, it has been considered desirable to collect all available information relating to Tasmanian deposits and publish it in a bulletin, so as to render it accessible to inquirers. With this in view, I visited in November and December the occurrences at Penguin, the Dial Range, the Blythe, and Natone; and it was decided that this should be followed by an examination of the iron ore-deposits of the Beaconsfield, Anderson's Creek, and Sugar Loaf Districts. The information available respecting the iron lodes at Comstock and Temma will also be included in the report, which will thus furnish a useful description of our principal deposits of this mineral.

*Dial Range.*—The Dial Range ore-deposits are situated high up on the western flank of the range about 6 miles from the sea-coast at Penguin. They consist of red hæmatite, and appear to be a replacement of the bedded conglomerate rock. They extend north and south through two 80-acre sections, showing outcrops at intervals. The surface of the ore-body has not been sufficiently exposed to admit of its width being accurately measured, but a good deal of it seems to be 3 or 4 chains wide, and on the northern lease its width may be as much as 500 feet. Owing to the ore-body being the result of replace-

ment, which has taken place to a variable extent throughout the belt, some of it showing only a partial substitution, the grade is irregular. However, some of the outcrops show good ore, and in working the deposits favourable places in the belt would have to be selected. Samples of ore containing 66 to 69 per cent. iron, with 0.5 to 1.6 per cent. silica, and traces only of phosphorus and sulphur, can be obtained; while, on the other hand, promiscuous samples will yield from 50 to 63 per cent. iron and from 9 to 23 per cent. of silica, with from 0.03 to 0.09 per cent. sulphur, and from 0.02 to 0.15 per cent. phosphorus. Ore with an excess of silica would require washing. A certain amount of improvement could be effected, without washing, by the use of picking belts. Sixty per cent ore is good grade, and if the Dial Range ore can be raised to a grade anywhere in the neighbourhood of that, a little extra cost in preparation will be remunerative. The present owners are endeavouring to get the enterprise started.

The way in which the iron industry will be initiated on the Coast is at present so uncertain that it is difficult to say how these deposits will be exploited. Only a very rough idea can be formed of their possibilities, but they might very well prove capable of producing a few hundred thousand tons of pig iron, and as probably not more than 20,000 or 30,000 tons of metal would constitute the annual output on the scale that the property is likely to be worked, the raw material would obviously last a good many years.

The deposits can either be worked as an independent enterprise or as an adjunct to the Blythe mines, if the latter are started. If the option over the latter is exercised by the Commonwealth Government, it would, from a business point of view, be desirable for the Federal authorities to acquire control of the Dial ore, so as to avoid having two separate industries within a few miles of each other. In that case the ore would probably be transported to the Penguin, and then railed to the mouth of the Blythe.

If, on the other hand, it is decided to make a beginning in a modest way, the smelter would most likely be near Penguin. This would permit of the Penguin Creek deposits being tapped and contributing moderate quantities of high-grade ore to the general output.

The whole subject of starting work is bound up with the questions of competing works, fuel, and power, as well as the class of product aimed at; consequently, the future of these properties will inevitably be governed and regulated by the result of expert investigation of these conditions. The decision as to what class of iron will be specialised in will influence the scale of operations. Work will probably be restricted to the manufacture of some special lines of iron and steel, for which a market can be secured without having to meet any ruinous competition.

With the State hydro-electric enterprise ready to cater for consumers on the North-West Coast, it is in the interests of the State that its electric current should be used wherever practicable. Electric power is being applied to iron ore smelting in other parts of the world, and could also be used here, both for iron and steel manufacture. Hitherto the bulk of the iron in Sweden has been produced in small blast furnaces, using

charcoal as fuel, but these are now being supplemented or replaced by electric smelting furnaces, also of small capacity, say up to 30 tons of pig iron daily.

Descriptions of electric smelting processes suggest generally that they are not universally applicable, but that they may be adopted with advantage where the conditions are favourable; that is to say, where cheap hydro-electric power is available and fuel and flux can be had at low figures. Electric steel-furnaces are in operation all over the world.

With proper selection and concentration, these Dial Range and Penguin ores, smelted electrically, should yield high-class iron and steel, commanding superior prices in the market. Quality, not quantity, should be the aim in establishing this industry.

*Blythe River Iron Lode.*—A visit was paid to this occurrence, confirming the impressions of its character and value which I formed on my examination of it in 1900 and 1901. Those impressions were supported by Mr. J. H. Darby, who reported generally that the quality of the ore is excellent, and rarely surpassed by any in Europe or America, and stated without hesitation that the average sample which he treated was capable of producing, with good coke and limestone, very superior hæmatite pig-iron suitable for the manufacture of high-class steel. He also stated that his general impression was that the quantity of ore is sufficient to supply iron and steel works capable of making 3000 tons of finished steel per week for many years to come.

No exhaustive examination of the deposit has been made since Mr. Darby's visit, and if such is now contemplated by the Federal Government, which has an option over the property, some preliminary work should be done in order to facilitate expert inspection.

*Natone Iron Lode.*—This outcrop, perhaps better known as Rutherford's lode, is 2 miles south-west of the most southerly exposure of the Blythe River lode. It marks the general continuation of the Blythe ore-belt, and shows some excellent ore at intervals through the lease for over a  $\frac{1}{4}$ -mile. As the solid outcrops are marked by hard knobs of ore only here and there, it is likely that the lode is of unequal value at different points. The comparatively limited dimensions of the occurrence would probably militate against its development as a self-contained smelting centre, but it may have a future in connection with developments at the Blythe; or, less probably, with operations at the Dial Range and Penguin. The owners of the Blythe leases would admittedly have plenty of ore available from their own lode without acquiring additional properties, but nevertheless, it may be good policy to control neighbouring deposits.

#### *Alkali Commission.*

The members of the Federal Alkali Commission met me in December at Burnie to obtain information respecting possible deposits of salt in Tasmania, and as a result Mr. A. M. Reid proceeded to the Midlands to examine the saline lagoons of the Macquarie Basin. He reported on these to the Department, and refers to his examination in his annual report herewith.

The result of an analysis of a piece of "rock salt" from the Pelham District has been communicated to me by Mr. Grimwade, of Melbourne, as follows:—

	Per cent.
Sodium chloride .....	74·7
Sodium sulphate .....	2·1
Magnesium sulphate .....	11·0
Moisture at 100° C. ....	9·2
Insoluble .....	3·1
	100·1

The mode of occurrence and quantities available have not been ascertained.

#### *Encyclopædia of Australia.*

Messrs. Angus and Robertson are arranging to bring out an Encyclopædia of Australia, and approached the Department in order to obtain an article on the mineral resources and mining industries of Tasmania. I prepared this contribution, embracing for each mineral its output, mining history, geographical distribution, composition, and geological occurrence; and a note on our mining legislation, edited by yourself. An accompanying map, prepared in this office by Mr. A. M. Reid, showed the distribution of the various minerals throughout the State.

#### *The French Mission.*

On the visit of General Pau and this Mission to Launceston an opportunity was taken of supplying copies of your annual reports, and a complete set of the publications of the Geological Survey, together with geological and mineral maps of Tasmania, for study and reference on the return of the members to France. These were appreciatively acknowledged by the General.

#### *British Trade Commissioner.*

In October Mr. MacGregor, the British Trade Commissioner, visited Tasmania, and informed me of his desire to obtain information respecting the mining industry. I attended by request a meeting of the Launceston Chamber of Commerce to hear what he had to tell us concerning the encouragement of trade between Great Britain and the Dominions. I accompanied him to the Victoria Museum, and showed him the very full collections of the Geological Survey, illustrating the mineral occurrences and products of the State.

#### *Museum.*

Work at the Museum has, owing to our shortness of staff, been restricted to the barest necessities. The collections have, however, steadily grown, and the public attendance has been greater than ever. Now that they are more widely known, prospectors consult them more frequently, and they are also visited a good deal by scholars from the various schools. The display serves as a valuable instrument of education, and it is the aim of the Survey to enhance its usefulness in this direc-

tion by all possible means. One of our staff will soon return from the theatre of war, and it is hoped that thereafter it may be found possible to devote more time to this work than has been practicable during the last few years. In the additions to the present building (which are indispensable if the cause of national education is not to suffer) I would strongly urge that room be provided for students to examine and handle working specimens of minerals and ores. For this purpose working collections could be formed and made available for students who wish to acquire familiarity with the physical characters of minerals. This arrangement would prove a useful adjunct to the new technical school organisation.

The following remarks are extracted from the Annual Report of the Curator (Mr. H. H. Scott) to the Mayor of Launceston:—

“The need for a separate geological gallery becomes more and more pressing as time goes on, both as regards the geological collection itself, and for the serial advancement of, more strictly speaking, the natural history collections. Case room is also a problem in this department, and frequently most useful specimens have to be withdrawn to make room for more pressing claims of the moment; needless to say, this is unsatisfactory. During the year Mr. W. H. Twelvetrees and his able assistant, Mr. Reid, have exhibited quite a number of new specimens to illustrate the fields of investigation covered by the work of the Geological Survey, and this practical illustration of the mineral wealth of the island has been much appreciated by miners and the visiting public generally.”

We have to thank various donors of specimens who have been kind enough to enrich our collections during the year. Thanks are also due, as usual, to Mr. F. Chapman, Palaeontologist to the National Museum, Melbourne, for his kindness in determining fossils.

In consequence of the recent assumption by the Government of the control of technical education, the necessity for increased accommodation for students has forced itself on the attention of the Education Department, and it is not surprising that the capacity of the present Technical School buildings in Launceston is showing itself too limited for the students enrolling under the new system. More than one scheme for remedying the deficiency has been suggested, but the most practical and advantageous one provides for the evacuation of the present building and the erection of a new one more adapted to present-day needs in the Royal Park, between the Victoria Museum and the river. The Municipal Council appears to be prepared to cede this ground to the Government in exchange for the existing Technical School. The latter building would form a highly desirable annex to the museum, and would provide the additional accommodation which is so urgently needed. Two other departments of the State would benefit by this plan. The Mines Department would share in the increased room available for mineral collections, and a fuller display could be made of the mineral products and resources of the island. A suggestion of the utmost value has been made to me lately by Mr. Hartwell Conder, namely, that the Geological Survey should exhibit its maps in a series of cases, each map to be surrounded by typical specimens of ores and rocks met with in the area to which the map refers. This is an admirable idea, and such a

display would have a distinct educational value. However, with our existing crowded cases it is impossible to carry it out. At present everything is deplorably cramped and confined. Hidden away in a shed we have a large rock collection, comprising series of specimens from every part of the island, besides a collection of typical foreign rocks, but owing to want of space very few rocks are being exhibited. As a rule, too, our cases are filled with too many specimens to allow room for the explanatory, informative descriptions which lend such a value to properly displayed collections. With more space a much more useful and effective display could be made.

It is therefore greatly to be desired that when the Educational Department is making its arrangements for a new technical school building, the advantages of transferring the present building to the museum should not be lost sight of.

The other State Department which would benefit by the proposal would be in the Public Works, as the present Mines Department room in the Public Works Store on the Market Green could then be surrendered. This room at present receives the bulk field collections of the Geological Survey, which are stored there for reference and future use. They would be more conveniently stored in the new annex to the museum.

The above brings me to speak of the museum department generally. The present arrangement by which the Launceston Council gives us room for our cases of exhibits and undertakes their care is an excellent one, but this care extends only to the outside of the cases; the inside cleaning of them, the arrangement and labelling of specimens, and keeping the latter fresh and up to date, have to be attended to by the Geological Survey, whose officers are not always available at the proper time. Specimens, too, which are received from donors have to be set aside properly when they cannot be exhibited at the time, and where they can be found when wanted. Owing to want of space at the museum the store-shed there is hopelessly filled with confused and inaccessible material, which requires to be sorted and packed. The material in the Market Green Store also needs going through, but at present, owing to insufficient protection, the open boxes get covered with layers of ash and dirt from the adjoining foundry, making it next to impossible to carry on any work on these collections. The arrangement alluded to above in connection with the Technical School will furnish a remedy for this, but if that scheme does not materialise the store-room will have to be roofed in and lighted with skylights or something else devised.

It is also evident that in the near future the appointment of a curator for the collections will have to be considered. Owing to pressure of engagements and want of time, officers have not been able to attend to the necessary details with reference to storage of their field collections, and with changes of staff a good deal of the value of these is sometimes lost, besides which, practically no time has been available for giving technical information to visitors to the exhibits, so that the State is not extracting the fullest value from same. Our geological staff is very limited; it is working at high pressure, and very shortly some assistance in the direction suggested will be found to be indispensable. The proposed curator could also act as librarian to the Survey. The library continues to grow, and needs continual attention. The preparation of a subject index

would be a long and continuous piece of work, but would be of immense value to the staff in the preparation of reports, and would save much time now occupied in searching the literature for references and information.

#### *Laboratory.*

From the Government Assayer's report of the year's operations, you will see that the past twelve months has been a busy period. The work is increasing, as is illustrated by the fact that 2750 mineral assays and determinations have been made, compared with 2254 in 1917, and 1694 in 1916.

The Assayer, in his report, calls attention to the necessity for the appointment of a laboratory assistant, as the demands of the work necessitate continual evening overtime, which is a state of things not capable of being prolonged indefinitely.

The calorific value of coals is frequently asked for by those sending samples for assay, and the Assayer emphasises the desirability of adding this apparatus to the laboratory equipment. When I joined the State Industrial Science Committee in 1917, I suggested that the Committee recommend the expenditure of £90 for this purpose, but nothing came of the suggestion.

Mr. Reid has presented to the Department a complete acetylene gas generating plant for the laboratory, valued at £40. This has been received with due acknowledgments to the donor for his generosity. The plant is in good order, and is almost new, and can be connected up very easily at any time when required. It is called the Eclipse acetylene gas generator, and is made by J. Simons, Adelaide.

#### *Mine Plans.*

The plans of underground workings of mines, furnished by mineowners in compliance with the "Mines and Works Regulation Act," are kept at this office, and are in charge of the assayer and draftsman, who examines them on behalf of the Inspection of Mines branch.

#### *Library.*

The library continues to grow, though during the war its expansion has been at a slower rate than previously. The short time during which the book vote is available (practically only six months) makes it impossible to procure books from England in time. Some arrangement by which the sum voted by Parliament would be prevented from lapsing is very desirable. One hundred and fifty useful publications for our library shelves were received from the Hon. the Premier's office. The Survey has to acknowledge with thanks the receipt of books presented by Mr. Louis Simson, of Launceston.

Thanks are due to the proprietors of the following papers, which they have kindly provided for our files:—Launceston "Examiner," "Daily Telegraph," "The World," "Queensland Government Mining Journal," "Chemical, Engineering, and Mining Review," and others.

Exchange publications received totalled 483 (125 interstate and New Zealand, and 358 British and foreign).

*Office and General.*

The correspondence and mail matter amounted during the year to 2288 items (875 inwards and 1413 outwards).

Mr. Loftus Hills, M.Sc., is still on the Headquarters Staff in France, but may be expected to return to his position with us some time this year. Mr. A. McIntosh Reid, Acting Assistant Government Geologist, has discharged the duties of his position to my entire satisfaction. My thanks are due to him for his assistance, and to Miss Middleton, clerk in charge, for her efficient work in the office.

*Programme of Work for 1919.*

In formulating a programme for the current year, we may assume that Mr. Loftus Hills will have returned and be able to take part in the work of the second half of the year. Exactly how much work can be accomplished this year cannot be determined beforehand, but the following items are awaiting attention:—

- (1) Preparation of bulletin by Mr. A. M. Reid on the Mt. Pelion group of mines.
- (2) Preparation of bulletin by the Government Geologist on the iron ore deposits of Tasmania.
- (3) Preparation of bulletin (Part III.) on the metallurgy of the zinc-lead sulphide deposits of the Read-Rosebery district by Mr. Loftus Hills (on his return).
- (4) It is suggested that examinations be made of the Mt. Lyell and Mt. Bischoff mining fields. These have not been officially reported on, and it is considered advisable that these gaps in our work should be filled in. The Mt. Lyell field was assigned to Mr. Loftus Hills as an end subject in the series of his West Coast Range bulletins. It is proposed that Mr. A. M. Reid undertake the examination of the Mt. Bischoff tin district.
- (5) Two contemplated publications remain over for the present in consequence of the pressure of work, namely, a new edition of the *Outlines of the Geology of Tasmania*, and a handbook of the minerals of the Geological Survey collections in the Victoria Museum.

I have, &c.,

W. H. TWELVETREES, Government Geologist.

The Secretary for Mines, Hobart.

REPORT OF THE ACTING ASSISTANT GOVERNMENT GEOLOGIST.

Geological Survey Office,  
Launceston, 27th March, 1919.

SIR,

I HAVE the honour to submit my report for the year ending 31st December, 1918.

The field work carried out during the year under review consisted of—

- (1) The completion of the geological examination of the North Pieman and Huskisson and the Sterling Valley mining fields.
- (2) An examination of the lodes of the Golden Crest Mine, Golconda.
- (3) The geological examination of the Moina, Mt. Claude, and Lorinna mining fields.
- (4) An examination of the saline deposits in the Macquarie Basin, County of Somerset.

During the same period the following reports have been prepared:—

- (1) Report on the Golden Crest Mine, Golconda.
- (2) Geological Survey Bulletin No. 28, "The North Pieman and Huskisson and the Sterling Valley Mining Fields" (12th June).
- (3) Preliminary reports on the Moina, Mt. Claude, and Lorinna mining fields.
- (4) Report on the saline deposits in the Macquarie Basin.

In addition to these works, a locality map showing the mineral occurrence of economic importance was prepared for the French Mission. Copies of this map were made for the use of the Geological Survey, and a similar map on a smaller scale was prepared for inclusion in the Australian Encyclopædia, to accompany an article on the mineral deposits of the State to appear in that publication.

During the year a considerable amount of time has been taken up with office work. A large number of letters have been written in answer to inquiries relating to subjects concerning the development and exploitation of mineral deposits. Attention has been paid also to the mineral section of the Victoria Museum.

The following notes, of general nature only, relate to the investigations conducted at the several localities mentioned. Notes on the North Pieman and Huskisson and Sterling Valley districts appeared in the annual report of 1917, and therefore will not be included here.

*The Golden Crest Mine, Golconda.*

The lode, which is contained in hornblende granitite near the contact with sandstone, consists of gold-bearing quartz with the accessory sulphides arsenopyrite, chalcopyrite, pyrite, and a

little bismuthinite. The greater portion of the gold is contained in the metallic sulphides, and of these arsenopyrite is the most important "carrier." The values in this lode are very unevenly distributed, and the average content is not high, although bunches of very rich ore have been found. The average grade of the ore in No. 1 tunnel is  $4\frac{1}{2}$  dwts. gold and 12 dwts. silver per ton, of a gross value of 21s. 6d. per ton. In the stopes above the main tunnel level the average gross value of the ore is 62s. per ton. The critical worth, below which mining the ore at a profit cannot be counted on under prevailing conditions, has been put at 50s. per ton. In arriving at this figure allowance has been made for the inclusion of 25 per cent. by weight of wall-rock, which will act as a diluent, reducing the average grade of ore by this amount. It is at once apparent from the foregoing statement that the value of the ore in the No. 1 workings is too low to pay for extraction and treatment under existing working conditions, but the ore in the intermediate workings should be operated at a profit. There is only a very small quantity of ore above the main level available for treatment, and a commencement has been made to sink a winze on the richer copper-bearing material for the purpose of augmenting the reserves.

#### *Moina, Mt. Claude, and Lorinna Mining Fields.*

The original purpose of the expedition to these fields was to make an examination of the tin, tungsten, bismuth, and molybdenum deposits, and to report upon those unprospected areas which were considered likely to prove profitable sources of the ores of these metals; but, in compliance with the request of mine-owners and others interested in these districts, the scope of the investigation was extended to include metallic mineral deposits other than those enumerated.

All the mines and mining prospects in operation and most of those temporarily abandoned were visited, and a very careful examination was made of the geological features of the districts. Investigations have been made to ascertain whether the amount of molybdenum present justifies the establishment of a customs concentrating plant for bismuth, tungsten, and molybdenum ores, with the addition of a special unit for the complete separation of the latter mineral.

Mining in these districts is in a particularly flourishing condition. This is due principally to the great demand for metals and consequent high prices occasioned by the war. None of the mines is very large, and the aggregate output is not great, but all those that have reached the producing stage are being exploited profitably. The S. and M. is still the premier mine of the Moina area, and is a regular producer of tungsten, tin, and bismuth ores. Work at the All Nations is confined to the shallow-level tunnels, but it is contemplated by the management to make provision for its more extensive development by the sinking of a main shaft and making that the centre of operations. Reasonable expenditure in this connection is certainly warranted by the results already obtained. The Squib Mine has joined the list of regular producers, and although operated on a very small scale, a profit is being made. The latest discovery of importance in this area is that of Lawson and Riley's show, which has a very promising appearance, and may develop into one of the leading mines. The Princess and

Pearce's (Sayer's) properties are now held under option by a Melbourne syndicate, who are carrying out preliminary exploratory works in preparation for more extensive developments later on. On the east side of the Forth River a number of prospective mines have come into prominence during the past year. The most important of these are the Falls, Morgan's, Hidden Treasure, Premier, and Thomas and Rees' shows, all of which are now receiving attention.

Only four silver-lead mines are in operation, and of these the Round Hill alone is producing on a large scale. The new discovery in the south-eastern end of the main workings is developing remarkably well, and promises to place the enterprise on a profitable basis.

The outlook for the districts as a whole is one full of promise. Although the first discoveries date back to 1878, many of the important developments have been made recently, and there are many unexplored areas worthy of the attention of prospectors.

#### *Saline Deposits in the Macquarie Basin.*

The saline deposits of the Macquarie Basin have lately received attention through the widespread interest taken in the search for available sources of soda and potash. A further incentive has been given locally since inquiries have recently been made by representatives of English manufacturers who purpose erecting works in Australia at places where the deposits are of sufficient extent and value, and where the conditions for operation are suitable.

Macquarie Basin is a broad, flat depression, 700 to 750 feet above sea-level, lying between the Eastern and Western Tiers, which rise 2000 to 3000 feet higher. It is an extensive basin, from 5 to 10 miles in width, and about 30 miles in length. Within this area large numbers of salt-water lagoons occur, the most important of which are found on Salt-pan Plains, in the vicinity of Tunbridge. The salt-pans and Grimes lagoon of Mona Vale and Ballochmyle estates occur in a more or less straight line bearing a little east of north, and appear to occupy the bed of a pre-existing stream. The depth of the pans ranges from 6 to 12 feet, but even in the rainy season they seldom contain more than 3 feet of water, and in mid-summer they are quite dry.

It has been found that the lower soft strata of the lagoon beds are chiefly muds containing soluble salts. These muds rest on marl or limestone, and are reported as containing gypsum. The chief component of the salts is sodium chloride or common salt. This soluble salt assumes the solid and liquid conditions in the pans alternately with the dry and wet seasons of the year. The concentration and the localisation of the salt in the lagoons is of considerable advantage to pastoralists, as the saline constituents are drawn from the soil, which is thereby rendered sweet and suitable for ordinary vegetation.

It is considered that the most important agent in the formation of these depressions is that of chemical solution. In every instance where examination has been possible, marl or limestone has been found occupying the bottoms of the salt-pans or lagoons and underlying the Mesozoic sandstone. Limestone is one of the most easily soluble rocks. The ultimate source of the salt is the Mesozoic sandstone beds, from which, even at the

present time, considerable quantities are being drawn by springs and creeks.

The volume and area of these lakes have not been accurately determined. The smallest of the five lakes or pans on Mona Vale estate is estimated at 40 acres, and the largest, Grimes Lagoon, is put at 450 acres. Scattered over this large river basin are numbers of pans and lagoons, large and small, and all are more or less filled with brine.

The dissolved mineral salts have not yet been carefully studied. An analysis of the brine by Mr. H. J. Colbourn, Agricultural Chemist, showed the following content:—

1765 grains of sodium chloride per gallon.

133 grains of potassium chloride per gallon.

This result shows only the relative proportion of potassium to sodium. The magnesium and calcium contents were not determined.

In conclusion, it is safe to say that commercially valuable concentrations of salt do not occur in the lagoons and salt-pans generally. The richest deposits contain only an insignificant quantity and possess only a local value. The salts still retained in the soils are so intermixed with the alluvium that they could not be profitably recovered; and, again, such deposits are unlikely to retain any considerable amount of salt in the soluble form. Only in the bottoms of the salt-pans, the waters of which have been dried up, are saline deposits free from admixture with mud to be found. In effect, the deposits are not of sufficient extent to prove of value for the purpose of chemical manufacture, in which economical production on a large scale is essential.

I have, &c.,

A. McINTOSH REID,

Acting Assistant Government Geologist.

The Secretary for Mines, Hobart.

REPORT OF THE GOVERNMENT ASSAYER AND  
DRAFTSMAN.

Geological Survey Laboratory,  
Launceston, 26th March, 1919.

SIR,

I BEG to submit this my annual report for the year ending 31st December, 1918.

During the year the work consisted largely of making metallurgical tests and analyses of minerals, rocks, and ores. The total number of assays and qualitative tests made for the public and the Department was 2750, being an increase of 22 per cent. on those carried out during the previous year.

Assays have been made for: Gold, silver, tin, lead, zinc, copper, bismuth, tungstic acid, molybdenum, barium sulphate, iron, manganese, sulphur, nickel, cobalt, osmiridium, platinum, radium, chromium, antimony, arsenic, titanium, phosphorus, silica, vanadium, sodium, potassium, magnesium, calcium, mercury, fluorine, and aluminium.

Complete analyses have been made of rocks, ores, clays, coals, and alloys. Distillation tests of shale, &c., have been carried out.

Assistance has been rendered prospectors and others by demonstrating the best methods of cleaning samples of osmiridium, and thus enabling them to obtain the highest market prices. In addition, the work of this branch of the Department has proved of great benefit to prospectors in aiding them to develop newly discovered deposits, and it has been largely instrumental in bringing many known prospects to the productive stage.

In consequence of the greatly increased price of certain materials formerly imported in the manufactured condition, inquiries have been made, and from the other States also, for the raw products—principally red and yellow ochres, graphite, barytes, arsenical pyrites, manganese oxides, and pure white clays.

Mine-owners and others have sent samples of coals to be tested for their calorific value. The laboratory equipment does not include a bomb calorimeter, and therefore proximate tests only can be made. An instrument of this kind is urgently required, and provision should be made for the purchase of a Berthelot-Mahler calorimeter—the most suitable instrument for such work.

Owing to the large number of inquiries concerning industrial and technical subjects, it has been necessary to carry out a great deal of the laboratory work after office hours. The work of this branch of the Department has grown so rapidly, and has reached such a stage of development, that the services of an assistant are required for laboratory work alone.

A considerable amount of time has been spent in checking the field notes and calculations and plans and sections of the underground workings of the mines in the State. Geological plans have been prepared for the printer.

The number of letters, &c., in and out totalled 1240.

I have, &c.,

W. D. REID, Government Assayer.

The Secretary for Mines, Hobart.

## REPORT OF THE CHIEF INSPECTOR OF MINES.

Chief Inspector of Mines' Office,  
Hobart, Tasmania, 15th April, 1919.

SIR,

I HAVE the honour to submit my annual report on the inspection of mines for the year 1918.

The work has been carried out with the usual staff. Inspector Harrison will retire during the present year, having reached the retiring age. Applications have been called for his successor. Inspector Harrison has been in the service for 36 years, and proved himself a very capable officer, both to the Department and to the public. I feel sure that his retirement will be received with much regret.

*Accidents.*—Appended is the usual diagram, also statistical tables in connection with accidents. The total number of accidents for the year was 50, being the same as for the previous year. There were 5 fatal accidents, being 3 in excess of the number for last year. Forty-five persons were seriously injured, the injuries being such as to necessitate the persons being absent from their usual occupations for more than 14 days. The number of men employed was 4279. The average killed per thousand men employed was 1.168 and injured 10.516.

1. The fatal accidents occurred as follows:—A miner was employed working out the top portion of a pillar from the bottom of an open-cut. The pillar was also being mined at a lower level, and these workings evidently caused a cave in the filling, where the man was employed, to run. The man was rescued with apparently little injury, but death was caused by a blood clot. In connection with the accident one of the underground officials and several men displayed great heroism in the rescue work.

2. A miner was employed in an open-cut after dark and work had ceased in the face, raking ore into the pass. A fall of ground occurred, breaking the grid over the pass, allowing the man to fall down the pass.

3. Three miners were employed throwing timber down a pass to a lower stope. One of them descended, by holding a rope, to clear the timber. After doing so he was climbing up, and lost his hold of the rope, and falling, caused a fracture of the skull.

A regulation was made making it compulsory for persons ascending or descending a pass to be securely fastened to a rope and an attendant to be provided.

4. A man employed at the smelters was pushing a full slag pot which collided with an empty one. The handle of the pot struck him in the abdomen, causing rupture.

5. A Chinaman working alone on a holding to which he had no claim, and unknown to the officers of the Department, was struck by a stone. He was not found until a week after the occurrence. The depositions taken at the coronial inquiry

showed that two persons had warned the deceased that he was working under unsafe conditions.

Of the 46 serious accidents 13 sustained injuries causing fractures, loss of fingers and limbs, or loss of sight. The remainder were not of a serious nature, but necessitated absence from work for more than 14 days.

*Prosecutions.*—Action was taken against 11 persons for non-compliance with the provisions of the Act. In eight cases convictions were obtained, two cases were dismissed, and in the other the summons could not be served owing to the man leaving the State. The majority of the cases were for not using water while rock-drilling. One case was for using abusive language on a mine, and one for failing to protect the entrance to workings where shots were ignited. The prosecutions being for breaches which have occurred on one group of mines only, leads one to the conclusion that something is lacking in the administration. It is not that ample provision is not made in regard to apparatus and equipment to comply with the Act, but in educating and insisting on the employees using effectively the provisions which are made to safeguard their health and safety. It is to be regretted that there is a tendency not to co-operate in obtaining the maximum safety. It is a practice which has long passed. The present-day theory is that safety is economy. It is recognised that with the greatest precautions in mines it is impossible to foresee sufficiently to totally eliminate all accidents, but when it is found that the same dangers occur year after year one can only assume that the systems adopted are not all that can be desired in regard to safety. In mines to-day the value of an underground foreman or shift boss is recognised, not alone by his ability to obtain ore, but also by his capacity for safe working. It is to be hoped, both for the reputation of the industry and for economy, where this practice exists that steps will be taken by those in authority to have it removed.

I desire to tender my thanks to the officers administering the Act for their hearty loyalty and co-operation.

I have, &c.,

J. O. HUDSON, Chief Inspector of Mines.

W. H. WALLACE, Esq.,

Secretary for Mines, Hobart.

*COMPARATIVE Table of Statistics of Accidents in and about the Mines of Tasmania from 1st July, 1892, to 31st December, 1918.*

Period.	Number of Miners employed.	Number of Accidents.	Number of Persons.		Total Killed and Injured.	Average per 1000 Killed and Injured.	Average per 1000.	
			Killed.	Injured.			Killed.	Injured.
1 July, 1892, to 30 June 1893	3295	28	4	25	29	8·8001	1·214	7·586
" 1893 " 1894	3403	25	7	20	27	7·934	2·057	5·877
" 1894 " 1895	3789	26	4	24	28	7·390	1·058	6·332
" 1895 " 1896	4160	22	7	16	23	5·529	1·682	3·847
" 1896 " 1897	4303	36	7	31	38	8·831	1·627	7·204
" 1897 " 1898	5530	36	13	33	46	8·318	2·351	5·967
" 1898 " 1899	6180	35	9	34	43	6·957	1·456	5·501
" 1899 " 1900	6834	1£	7	16	23	3·365	1·024	2·341
" 1900 " 1901	7017	29	8	23	31	4·417	1·140	3·278
" 1901 " 1902	6438	38	7	35	42	6·524	1·088	5·437
" 1902 " 1903	6484	44	6	43	49	7·557	0·925	6·632
" 1903, to 31 Dec., 1903	5604	27	8	20	28	4·977	1·428	3·569
1 Jan., 1904 " 1904	6192	73	9	65	74	11·951	1·454	10·497
" 1905 " 1905	6586	34	7	30	37	5·618	1·063	4·555
" 1906 " 1906	7004	65	4	61	65	9·280	0·571	8·709
" 1907 " 1907	7516	68	6	64	70	9·314	0·798	8·515
" 1908 " 1908	6464	60	6	58	64	9·900	0·928	8·972
" 1909 " 1909	6054	54	6	49	55	9·085	0·991	8·093
" 1910 " 1910	5770	63	8	57	65	11·265	1·386	9·878
" 1911 " 1911	5247	80	4	77	81	15·437	0·762	14·675
" 1912 " 1912	5566	60	53	53	106	13·044	9·522	9·522
" 1913 " 1913	6106	64	6	60	66	10·809	0·982	9·826
" 1914 " 1914	4741	69	9	62	71	14·977	1·896	13·081
" 1915 " 1915	3908	71	6	67	73	18·679	1·535	17·144
" 1916 " 1916	3864	53	2	51	53	13·716	0·517	13·198
" 1917 " 1917	4050	50	2	48	50	12·345	0·493	11·852
" 1918 " 1918	4279	50	5	45	£0	11·684	1·168	10·516

*ANALYSIS of Statistics for Western Division.*

Division.	Average Number of Men Employed.	Number of Accidents.	Number of Persons		Total Number Killed & Injured.	Average per 1000 Killed and Injured.	Average per 1000	
			Killed.	Injured.			Killed.	Injured.
Mt. Lyell .....	1605	29	3	26	29	18.068	1.869	16.199
Zeehan, &c. ....	584	2	—	2	2	1.168	—	1.168

*TABLE showing Rate per Thousand Killed and Injured in different Divisions for the Year ending December, 1918.*

82

Division.	Average Number of Men Employed.	Number of Accidents.	Number of Persons		Total Number Killed & Injured.	Average per 1000 Killed and Injured.	Average per 1000	
			Killed.	Injured.			Killed.	Injured.
Northern and Southern .....	341	3	1	2	3	8.797	2.932	5.865
North-Eastern ... ..	533	7	—	7	7	13.112	—	13.112
Eastern .....	535	9	1	8	9	16.822	1.869	14.953
North-Western .....	681	—	—	—	—	—	—	—
Western .....	2189	31	3	28	31	14.161	1.370	12.791

TABLE showing the Number of Persons Killed and Injured in and about the Mines of Tasmania during the Year 1918.

PLACE OR CAUSE OF ACCIDENT.	INSPECTION DISTRICTS.													
	Northern and Southern Division.		North-Eastern Division.		Eastern Division.		North-Western Division.		Western Division.				TOTAL.	
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Zeehan and Districts.		Lyell District.			
Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	
UNDERGROUND—														
Falls of ground .....	1	...	...	...	...	1	...	...	...	...	...	7	1	7
Shaft Accidents—														
Falling down passes and shafts .....	...	...	...	...	...	...	...	...	...	1	1	...	1	1
Total .....	1	...	...	...	...	1	...	...	...	1	1	7	2	8
Miscellaneous (underground).														
Haulage .....	...	...	...	2	...	1	...	...	...	...	...	...	...	3
Trams, &c. ....	...	...	...	...	...	...	...	...	...	...	...	2	...	2
Sundry accidents .....	...	...	...	4	...	2	...	...	...	1	1	4	1	11
Explosives .....	...	...	...	...	...	...	...	...	...	...	...	1	...	1
Total .....	...	...	...	6	...	3	...	...	...	1	1	7	1	17
Total Underground ....	1	...	...	6	...	4	...	...	...	2	2	14	2	26

Table showing Number of Persons Killed and Injured, &c.—continued.

PLACE OR CAUSE OF ACCIDENT.	INSPECTION DISTRICTS.													
	Northern and Southern Division.		North-Eastern Division.		Eastern Division.		North-Western Division.		Western Division.				TOTAL.	
									Zeehan and Districts.		Lyell District.			
	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	Killed.	Injured.
ON SURFACE—														
Smelting-works .....	...	...	...	...	...	...	...	...	...	1	3	1	3	
Machinery .....	...	...	...	...	...	...	...	...	...	...	3	...	3	
Tramways .....	...	...	...	...	...	1	...	...	...	...	2	...	3	
Falls of persons .....	...	...	...	...	...	...	...	...	...	...	1	...	1	
Explosives .....	...	...	...	...	...	1	...	...	...	...	...	...	1	
Miscellaneous.....	...	2	...	1	...	2	...	...	...	...	3	...	8	
Sluicing .....	...	...	...	...	1	...	...	...	...	...	...	1	...	
	...	2	...	1	1	4	...	...	...	...	1	12	2	19
Gross Total .....	1	2	...	7	1	8	...	...	...	2	3	26	5	45

## REPORTS OF INSPECTORS OF MINES.

MR. INSPECTOR CURTAIN (Launceston) reports:—

*Accidents.*—While the majority of those tabulated were of a minor character, and the sufferers have been able to return to work, the list unfortunately includes two fatal accidents, which happened under somewhat similar circumstances, the victims in each instance being alone, and their deaths were attributed to falls of earth in surface or open-cut faces, and should have been avoided. In the case at the Scheelite Mine, King Island, the company compensated the deceased's widow. Explosive accidents were numerous, as in addition to those enumerated other instances of youths and children becoming possessed of detonators, with the inevitable result, have come under notice. The injuries inflicted were chiefly caused by striking or picking the cap. To obviate this, schools should be provided with a dummy exhibit, and its propensities explained on similar lines to those used when a teacher illustrates the dangerous qualities of a most venomous reptile.

*Ventilation.*—In all metal mines this has been reasonably satisfactory, while connections have been made and airways kept open in the principal collieries in order to improve and keep the current in circulation.

*Equipment.*—Changing-houses are provided in the principal metalliferous mines, but no collieries comply with this stipulation of the Act. The various managements assert that as their employees have made no demand for such requisites, they evidently do not appreciate or require them. Latrines are provided, and usually kept clean and disinfected. In all mines using rock-drills, water jets are provided, and if the men do not avail themselves of their use the fault must necessarily lie with themselves, as no man need, or is expected to, work a machine in a dusty atmosphere.

*Dust and Fumes.*—Apart from the mines, other industrial enterprises have come into existence where the presence of these pernicious elements are much in evidence, and attention has been drawn to the necessity for their abatement. In connection therewith the respective managements have signified their willingness and intention to grapple with these evils and nuisances, but the means to obtain this much desired end, without stopping the industry, is so controversial that, apart from baffling or producing over-head draughts, no scheme has yet been devised or thought out.

*Ropes and Cages.*—These have been periodically overhauled and tested, and their condition satisfactorily recorded.

*Explosives Magazines and Inflammable Oil Depots.*—Throughout this extensive district these have received regular attention, and on the whole their condition has been found satisfactory.

*LIST of Accidents in Inspector Curtain's District for the Year 1918.*

Fatal, 2 ; non-fatal, 17 ; total, 19.

Date.	Name of Mine.	Locality.	Cause of Accident.	Name of Sufferer.	Married or Single, and Age.	Nature of Injuries.	Killed.	Injured.	Particulars.
1918. Jan. 23	All Nations Wolfram	Moina	Blow from hammer	William Dunn	Married, 49 years	Fractured fore- finger	—	1	Whilst working alone, commonly called "gymping," struck his left hand with the hammer he was using
Feb. 4	Mt. Nicholas Mine	Mt. Nicholas	Splinter caught in hand	Henry Stone	Married, 50 years	Splinter in palm of right hand	—	1	While timbering his place up before knocking off, splinter got into palm of right hand
Feb. 22	Mutual Hill Tin Mine	Derby	Fall of rock	Henry Kelly	Married, 61 years	Scalp wound & con- tused left shoulder	—	1	Whilst working in the face, a stone slipped off and fell on him
Mar. 27	Arba Tin Mine	Branx- holm	Water-pipe broke	Andrew Henry Wickins	Married, 49 years	Laceration to face and mouth	—	1	Whilst uncoupling a water-pipe it broke, and he fell some 15 feet, and cut his face and mouth

Apr. 11	Mt. Nicholas Coal Mine	Mt. Nicholas	Jammed between coal-skips	John Llewellyn	Single, 17 years	Right hand jammed	—	1	Whilst assisting to bring a couple of skips to the air furnace, got his fingers jammed between them
Apr. 20	Private Mine	Lottah	Fall of rock	Kew Ling King (a Chinese)	—	Crushed fatally	1	—	Working alone on his own property, when a rock fell from the face, and pinned him, causing his death
Apr. 29	Matural Hill Tin Mine	Derby	Ditto	Frank Klimeck	Married, 32 years	Bruised toe	—	1	Whilst barring down, a piece of rock fell on his left foot, temporarily incapacitating him
May 8	Briseis Tin Mine	Ditto	Grindstone operated by motive-power	James Thomas Maddren	Married, 59 years	Bruised fingers	—	1	Was grinding sharpening-tools, and getting his clothes caught in the spindle of the stone, sustained the injuries whilst freeing himself
May 23	King Island Scheelite Mine	King Is., Grassy	Fall of surface earth	Patrick Thos. Fox	Married, 51 years	Skull fractured and other bodily injuries	1	—	Whilst temporarily working alone in the open cut during night shift, was evidently overcome by a fall of earth, which broke the "grids," and carried him into an ore pass over which he was working, and produced such injuries that life was extinct when the body was recovered some time later
June 11	Briseis Tin Mine	Derby	Dismantling of a tram-line	Michael O'Meara	Widower 50 years	Cut finger	—	1	Whilst assisting to remove a tram-line, cut his finger, which necessitated his knocking off for a fortnight

*LIST of Accidents in Inspector Curtain's District—continued.*

Date.	Name of Mine.	Locality.	Cause of Accident.	Name of Sufferer.	Married or Single and Age.	Nature of Injuries.	Killed.	Injured.	Remarks.
1918. June 15	Mt. Nicholas Coal Mine	Mt. Nicholas	Stepped or fell on tram-rail	Frank McGiveron	Single, 19 years	Crushed fingers	—	1	McGiveron, a pony driver, whilst bringing a rake of trucks on to the "flat," slipped and fell; the trucks passed over his right hand and crushed his fingers
June 21	Durabestos Asbestos Mine	Near Beaconsfield	Spawl from striking hammer	William Dobbie	Married, 51 years	Left eye-ball cut	—	1	This was occasioned by a "splinter" flying and striking Dobbie in an eye that was previously affected, necessitating its removal
July 7	Mt. Nicholas Coal Mine	Mt. Nicholas	Fall of coal	William Targett	Married, 47 years	Cut forehead	—	1	Whilst the injured man was taking a rest, a quantity of coal "worked" or bulged out of the face, and dislodging a prop it fell on him
Aug. 2	Storey's Ck. Tin Mine	Ben Lomond	Fall with staging	Charles Sydney Leeshton	Married, 42 years	Twisted or strained knee and internal pains	—	1	Whilst beating a hole, the lath used as a staging gave way, and the man, falling somewhat heavily with it, sustained the injuries described

Aug. 30	Mt. Nicholas Coal Mine	Mt. Nicholas	Sprag-stick broke	Thomas Parker	Married, 35 years	Jammed forearm	—	1	Whilst assisting to "sprag" a full truck of coal down an incline grade, lost control of it through the sprag breaking, with the foregoing result
Oct. 1	Private	St. Helens	Explosion	Maurice Hartnett	Married, 45 years	Thumb and two fingers blown off	—	1	Whilst inserting the fuse into a damaged detonator, it exploded
Oct. 8	Private	Gladstone	Premature explosion	George Hy. Horton	—	Peppered about face & arms	—	1	Horton reports, "tha while working alone on his own property, and during the act of spitting a short 12-inch fuse, the charge exploded"
Nov. 13	New Golden Gate Mine	Mathinna	Spawl or splinter from hammer	Percy Mullins	Married, 26 years	Ball of eye cut and injured	—	1	Mullins, in the usual course of his work, feeding the battery, had to break or spawl stones, and was injured whilst doing so
Dec. 21	Briseis Tin Mine	Derby	Slipped off short ladder	James Mulvell	Widower 53 years	Hip dislocated	—	1	Had finished his shift, and was about to leave the mine, when ascending a ladder he fell, and sustained the injury stated

MR. INSPECTOR HARRISON (Zeehan) reports :—

*Accidents.*—In submitting my annual report for 1918, I am pleased to be able to state that my accident list is the lowest for many years—only two in number, neither being of a dangerous character.

*Safety Appliances.*—Ropes and cages attended to and kept in good working condition.

*Magazines and Oil Stores.*—There are 22 of the former and seven inflammable oil stores. I have not found it necessary to make any complaints; they are kept clean and in good order.

*Ore Output, Zeehan.*—The output of ore from the Zeehan field has been very well maintained by numerous tributers. During the year the Nike Mine installed an electric plant, which is giving satisfaction. The No. 2 Argent Syndicate is keeping up a fair output of ore. When No. 2 level is unwatered we can confidently look for a considerable increase in the output. I regret to state that No. 1 Argent Syndicate had to close down temporarily, as the water in the mine proved to be too much for present appliances.

*North Heemekirk.*—The Heemskirk Tin Syndicate has had a very successful run, with every prospect of improvement during present year.

*Stanley River.*—A regular output of tin ore has been maintained.

*Mt. Lindsay.*—Good results have been obtained. The company is now getting ready to instal pumping and winding machinery, portions of which are delivered along the track. This work is both slow and costly, as it has to be dragged many miles over a bush track on sledges.

*Renison Bell District.*—The Dreadnought-Boulder, Central, and Renison Bell tin mines are all running and keeping their dressing-mills going.

*Rosebery.*—The only mine at work is the Tasmanian Copper Mine, where the manager is opening up more ground and awaiting instructions.

*Mt. Reid.*—The Hercules Mine, where new ground is being constantly opened up, is the only mine working in the district at present.

*Mt. Farrell.*—The North Farrell Mine: This mine has had a powerful suction gas-engine erected, which drives the dressing-mill and an air-compressor which provides air to drive the hoisting engine and rock-drills. The manager estimates that this new plant is effecting a saving of over £1000 a year in fuel.

*Chester Mine.*—During the year a large dressing-mill has been erected. Unfortunately, shortly after starting an accident to the machinery took place, and the mine had to close down pending repairs. The manager expects to make a fresh start early in the present year.

*Waratah District.*—The Mt. Bischoff Tin Mining Company is keeping a large number of stamps employed. Fresh faces are being opened up down the North Valley.

**Bischoff Extended Mine:** During the year the company has erected another 10 head of stamps and installed rock-drills. The mine is looking well.

The South Bischoff Tin Mine closed down, pending reconstruction.

**Magnet.**—Magnet Silver Mine: The new electric plant and compressing plant has had a trial run, which proved very satisfactory. The dam is expected to be ready for use in March. Main shaft has been put down another 100 feet below No. 12 level, and chamber cut. A contract was then let for another 100 feet, on which good progress is being made. When this work is completed and crosscuts driven to the lode, the mine will be in a position to keep up a heavy output of ore.

**Whyte River and Heazlewood.**—Mining is very quiet in these districts.

The heavy slump in the price of osmiridium caused a number of miners to cease work, pending an understanding being arrived at. The assistance offered by the Mines Department is giving general satisfaction. The miners do not hesitate to say that they have been in the hands of buyers far too long.

In conclusion, I wish to state that there is an unlimited quantity of low-grade ore in this district suitable for smelting purposes, but until there is some definite action taken in this direction we cannot look for any considerable output.

*LIST of Accidents in Inspector Harrison's District for the Year 1918.*

Fatal, 0 ; non-fatal, 2 ; total, 2.

Date.	Name of Mine.	Locality.	Cause of Accident.	Name of Sufferer.	Married or Single, and Age.	Nature of Injuries.	Killed.	Injured.	Particulars.
1918. Feb. 26	No. 2 Argent	Zeehan	Stay gave way	John McQuirk	Single, 17 years	Lacerated ankle	—	1	The stay on which McQuirk was standing collapsed, causing laceration of ankle ; also small bone in ankle broken
Sept. 29	Mt. Read and Rosebery Mine	Rosebery	Fell down a rise	Earnest Thompson	Single, 35 years	Back injured	—	1	While getting round the pent-house, 49 feet from opening, slipped and fell down the ore compartment, a distance of about 35 feet, causing injuries to back

MR. INSPECTOR VAUDEAU (Queenstown) reports:—

The tabulated list attached contains an account of 29 accidents, being one more than for the previous year, but those for this year are of a more serious nature. All the accidents occurred at the mines and works of the Mt. Lyell M. and R. Company Limited. As will be seen by looking at the list, three men died as the result of injuries received. At the time of the accidents neither the first nor the last was thought to be of a serious nature. However, both men subsequently died, as a result of injuries received. The second case was one in which a miner lost his life by falling down a mullock pass in the Mt. Lyell Mine. It was madness for a man to go, or to be allowed to go, down this pass as this man did—on a greasy rope. Since this accident Regulation 14 was strongly recommended, and has now been brought into force.

In reference to the first case given in the list, the man was thought to be only slightly injured, and was allowed to walk to his home. When the doctor saw him some hours afterwards he ordered him to be removed to the hospital to be operated upon, but it was too late.

In the third case the deceased was putting ore into an ore-pass, when the floor of the stope on which he was working caved in, and he fell with the mullock. The accident was due to the removal of a portion of a cross-pillar on the level below, between the stope where he was shovelling and the one next to it. The removal of this pillar had been strongly condemned by me for various reasons, but on visiting this stope some days previously the mullock filling on the side of the pillar looked reasonably safe. When seen after the accident the mullock was very wet; this no doubt was accountable for the subsidence. With the first rush the man was buried to his armpits. With great risk to himself one of the level bosses went down on a rope to try to get him out; this he soon found to be impossible, so he asked for timbers to cover the man over to protect him from the mullock which was rolling down the sides on to him. Timbers were passed to him, and he, with two miners, soon had a pent-house over him. Some hours elapsed before the injured man was got out, he having been pinned by one foot for most of the time. The men worked like Trojans to release him, and deserve great credit, especially the shift-boss and the men who first went to his assistance. After the man was taken to the casualty ward the doctor examined him, and reported that he was suffering from shock and slight bruises, but it was not thought that his injuries would prove fatal.

Two miners had the misfortune to bore into an old miss or cut-out hole in the North Lyell Mine. Full particulars are given in the list. Another miner, while pouring metal into the mould, which he had made himself, was severely burnt in the eye. These three men each lost one eye, and there is only a remote chance of one of them having any sight in the other eye. Several of the mishaps were purely accidental, but others could easily have been prevented with reasonable precautions.

*Health of Miners.*—The medical testimonials obtained from the two doctors stationed here are given below. Dr. Love joined up for active service, so I am not able to give his report up to the time of his departure in May last. Dr. J. A. Hamilton reports:—"I had only two cases of incipient miners'

phthisis, both of which left the mine, and I have had no opportunity of following the cases. This is about an average of the cases treated by me yearly, as the miners usually live at Gormanston, and do not come under my treatment, so there has been no increase or decrease so far as my practice is concerned." Dr. J. G. Walker reports:—"For the first four months of last year I was in Queenstown, while in the latter eight months I was in Gormanston."

*Chest Complaints.*—There were three deaths during the year from pneumokoniosis, terminating in pulmonary tuberculosis. One of these was an old Lyell worker, who worked in this district for nearly twenty years, so that his condition was entirely due to working in the local mines. The other two cases were men who had worked at other mines in the last ten years, and the work in this district cannot be put down as having entirely caused their condition. One of these men had an attack of influenza two months ago, and developed an acute pulmonary tuberculosis as a complication. He was suffering from fibrosis of the lung before the influenza. I have seen two cases of pneumonia in workmen; one of these was a complication of influenza. Six cases of pleurisy were seen in workmen. Asthma is not common, and no cases could be put down as due to the men's work. Many workmen suffered from influenza in October and November, several having severe attacks. Tenosynovitis, usually of the forearm, was seen in five cases. Most of these cases were new men who had started on work to which they were not accustomed. I gave one man a certificate for a pension who was suffering from fibrosis of the lung and was past work. He left this district." It is to be regretted that there are still men who have not realised the seriousness in working under dry and dusty conditions. Considering that I was not getting the assistance I should have obtained from several of the officials of the Mt. Lyell M. and R. Company's mines, I went to the General Manager, and he promised me his assistance, and he had the following notice posted about the mines:—

"The Mt. Lyell M. and R. Company Ltd. Notice to all persons employed underground: Although the number of accidents is small, I wish to call attention to the desirability of reducing them. Each individual is the natural guardian of his own safety, but it is also his duty to have regard to the personal well-being of his mates whilst at work. The following cautions pertaining to the more important sources of injury should be especially borne in mind:—

1. Do not work underneath ground before finding out if it is sound.
2. Do not leave passes uncovered.
3. Do not handle and use explosives carelessly.
4. Do not fail to lay the dust.

"The danger emanating from the last source is none the less serious because it happens to be less obvious. Every effort should be made to prevent and allay dust from boring, shooting, and shovelling. The water provided for this purpose should be regularly and conscientiously used. If there is no water to hand, or if the water connections are out of order, this should at once be reported to the person in charge, and other work which does not make dust shall be undertaken till the repairs are effected. Too much stress cannot be laid on the wisdom

and advantage of taking proper precautions against every risk, and the best results can only be achieved with your hearty personal co-operation.

“ROBERT STICHT, General Manager.

“Queenstown, July 1, 1918.”

Several men have been charged and fined for failing to use water to allay the dust. I believe most of the men are realising the seriousness of the dust question, and I feel it is only a question of time and perseverance when they will do all in their power to allay it. One does not expect to ever get anything like perfect conditions underground, but there is no reason why we should not have the best results possible. At different times the company has been requested in the mine record book to comply with General Rule 12, which reads as follows:—“In the event of any nuisance whatsoever being caused by dust or fumes mingling with the air in any portion of the workings of a mine in which miners are working to such an extent as in the opinion of the inspector to be detrimental to the health of such miners, it shall be the duty of the manager to remove such nuisance by spraying or other effective means,” but they have thought fit to ignore it on several occasions.

*Equipment and Safety Appliances.*—Taken on the whole, these are in a reasonably satisfactory condition on all the mines. At the Mt. Lyell Company's Reduction Works a few places which I did not consider reasonably safe were brought under the notice of the machinery inspector, with the request that he would attend to them.

*Magazines and Oil Stores.*—All licensed and registered premises are in a satisfactory condition.

*Explosives.*—The usual complaints regarding the weakness of the nitro-compounds (50 per cent.) still continue, and owing to the data brought forward by A. E. Mann, Esq., Chief Inspector of Explosives, and T. N. Kirton, Esq., Inspector of Explosives of Western Australia, in their report on “Investigations into the Development of Inertness in Industrial Explosives of the Nitro-Compound Class,” it might be as well to have the material used in Tasmania subjected to similar tests.

*Fuse and Detonators.*—Two faulty pieces of fuse were reported, but on testing other coils from the same bundles I could find no defect; otherwise all was satisfactory.

*Change-houses.*—Apart from two complaints these have been kept clean and satisfactorily.

*Casualty Wards.*—These are kept in a satisfactory condition.

*General.*—The various mines and works in the district have been thoroughly inspected and kept in close touch with during the year.

*LIST of Accidents in Inspector Vaudeau's District for Year 1918.*

Date of Accident.	Name of Mine.	Locality.	Cause of Accident.	Name of Sufferer.	Married or Single, and Age.	Killed	Injured.	Particulars.
1918. Jan. 8	Mt. Lyell Mine	Gormans-ton	Falling tree	J. Guiedo	Married, 30 years	—	1	Had been barring down, and was cleaning up, when some mixed ore and schist came away from hanging wall, and rolled on his arm
Jan. 19	ditto	ditto	Finger jammed between truck and chute	G. Ludby	Single, 16 years	—	1	Finger jammed whilst trucking, necessitating amputation to the first joint
Mar. 5	ditto	ditto	Struck by piece of falling mullock	J. Phillips	Single, 28 years	—	1	Whilst mullocking, a piece of stone bounced off the slide and hit him on the ribs, causing two to be broken
Mar. 15	Lyell Smelters	ditto	Hot metal splashing	O. Roberts	Married, 53 years	—	1	Was injured by hot metal splashing on his back causing severe burns
Mar. 18	Mt. Lyell Mine	ditto	Struck in eye by piece of stone	P. Lawson	Single, 50 years	—	1	Was hit in the eye by a piece of stone, which flew off a rock another man was spawling
Mar. 20	North Lyell Mine	North Lyell	Struck by piece of stone	A. Darcey	Married, 50 years	—	1	While poking chute, a piece of ore rolled out and caught him on the fingers. The injury was neglected and blood-poisoning set in

Mar. 30	Mt. Lyell Mine	Queens- town	Two slag pots col- liding	John Garrett	Married, 60 years	1	—	He was drawing a slag pot, which collided with an empty one, the cross-bar striking him on the stomach causing a severe rupture, which proved fatal
Apr. 10	ditto	ditto	Falling log from an ore-pass	G. Jolly	Married, 50 years	—	1	While lacing off an ore-pass, a log-fell off the top striking him on the head and left shoulder
Apr. 13	ditto	ditto	Affected roof came away	J. Smith	Single, 28 years	—	1	While erecting timber, some affected roof came away and struck him on the hand
Apr. 13	ditto	ditto	ditto	D. Jones	Married, 45 years	—	1	Same accident as preceding one
Apr. 15	ditto	Gormans- ton	Fell down a pass	Saml. Turner	Single, 45 years	1	—	He was ascending after loosening block in a timber-pass, when he slipped and fell. The injuries sustained were a fractured skull and lacerated wound on the head, which proved fatal
Apr. 29	ditto	ditto	Truck in motion	L. Fry	Single, 15 years	—	1	While attempting to get on moving haulage trucks he slipped and was dragged about 80 yards, sustaining a broken arm and leg
May 8	ditto	Queens- town	Hand caught in plant	J. Daley	Single, 25 years	—	1	Two fingers severed through blades catching on a bar with which he was cleaning a mixer
June 21	North Lyell Mine	N. Lyell	Boring into an old charge	John Burton	Married, 52 years	—	1	While boring an old charge it exploded, causing injuries to both hands, wrists, and eye. The latter had to be removed
June 21	ditto	ditto	ditto	R. Webb	Married, 54 years	—	1	Same accident as above, injuring both hands, and chest, and eye. It was necessary to remove one eye

LIST of Accidents in Inspector Vaudau's District—continued.

Date of Accident.	Name of Mine.	Locality.	Cause of Accident.	Name of Sufferer.	Married or Single, and Age.	Killed.	Injured	Particulars.
1918. June 25	Mt. Lyell Mine	Queens- town	Finger caught in revolving chain	J. Blague	Married, 61 years	—	1	Two fingers were torn off by a revolving chain of a railway tricycle which he was repairing
July 10	ditto	ditto	Slipped in hot matte	J. McGhee	Married, 48 years	—	1	Slipped, and in trying to save himself, put his leg into a paddock of hot matte, burning his ankle
Aug. 5	ditto	ditto	Slipped on a stone	T. Baker	Married, 59 years	—	1	Bruised his ribs through slipping on a greasy log while helping to put up a bulk log
Aug. 5	ditto	ditto	Slipped off truck	A. Murray	Widower, 36 years	—	1	Slipped off a truck, his leg getting caught underneath
Aug. 15	ditto	ditto	Mullock fil- ling caved away	Jas. Brandum	Married, 50 years	1	—	While putting ore into an ore-pass the mullock filling caved away, taking him with it, and pinning him by the leg for some hours. Six days' later he died from the effects of the fall
Aug. 17	ditto	ditto	Jarred arm	S. Good	Single, 35 years	—	1	Ruptured blood vessel in his arm while spawling a piece of rock
Aug. 19	ditto	ditto	Fall of ground	A. Dagleish	Married, 21 years	—	1	While working in a northerly drive some defective ground came away and fell on him, causing bruises to muscles and groin

Aug. 26	ditto	Gormans- ton	Ore rolled down rill	H. Boyd	Single, 46 years	—	1	While putting ore into an ore-pass a piece rolled down the rill, catching him on the foot, crushing the big toe and fracturing the bone
Sept. 6	ditto	Queens- town	Fall off gir- der	J. Cummings	Married, 43 years	—	1	The tackle rope broke when he was lifting an air pipe into position. Overbalancing, he fell to the ground 15 feet below, sustaining sprained ankle and bruises
Oct. 1	ditto	ditto	Ore rolled down rill	H. Jolly	Single, 33 years	—	1	Was engaged putting ore into pass when a piece rolled down the rill on to his foot, jamming it badly
Oct. 17	ditto	ditto	Limestone jammed thumb	P. Rogers	Single, 20 years	—	1	While spawling and shovelling lime- stone, a piece evidently rolled over his thumb, jamming it badly
Oct. 25	North Lyell Mine	N. Lyell	Fall of ground	W. Wilken	Married, 31 years	—	1	While adjusting timber a further fall of ground took place, fracturing his left leg
Dec. 5	Mt. Lyell Mine	Queens- town	Slag shot out from por	J. O'Brien	Married, 57 years	—	1	While breaking through crust in pot of slag with a bar, some of the metal splashed his hand and back
Dec. 19	ditto	ditto	Metal flew into his face	C. Manfield	Single, 19 years	—	1	Was engaged casting flanges, and whilst stooping, some metal splashed into his face through a joint in the box, causing the loss of one eye

## REPORT OF THE CHIEF INSPECTOR OF EXPLOSIVES.

Chief Inspector of Magazines and Explosives,  
Hobart, Tasmania, 15th April, 1919.

SIR,

I HAVE the honour to submit my annual report in connection with "The Explosives and Inflammable Oils Acts" for the year 1918.

The publication of explosives imported into the State was discontinued during the war, but will now be resumed.

Name.	Quantity. lbs.
Gelignite .....	277,000
Gelatine dynamite .....	10,000
Ammon ligdyn .....	16,500
Monobel.....	27,700
Blasting powder .....	20,450
Sporting powder .....	8,375
Detonators .....	340,000

The quality of the explosives was generally satisfactory. A shipment of powder was damaged by water, and it was found necessary to destroy a portion of the consignment. Accidents from explosives were few, there being only four causing injury to five persons.

Great carelessness is often displayed in the handling and storing of explosives, *e.g.*, one accident occurred through a boy becoming possessed of a detonator which had fallen to the floor from the ceiling of one of the rooms in which a former occupant had stored some detonators. The boy was in the act of striking it with a stick when the mother tried to prevent him from doing so. The detonator exploded and injured the mother's left hand. It was afterwards found that a previous occupant of the house had stored detonators in the ceiling, and that one had fallen on the floor.

The provisions of the Acts have been reasonably complied with, and it was not found necessary to prosecute in any case. Where infringements occurred it was found that they were due to ignorance.

<i>Revenue.</i>	£	s.	d.
Magazine rents .....	172	18	0
Licences to store .....	26	0	0
Magazine licences.....	85	0	0
Permits to import .....	26	0	0
Permits to sell .....	36	0	0
Permits to convey.....	7	5	0
Registered premises .....	24	10	0
Total .....	£377	0	0

I have, &c.,

J. O. HUDSON, Chief Inspector of Explosives.

W. H. WALLACE, Esq., Secretary for Mines, Hobart.

## MINING CIRCULARS.

By W. H. TWELVETREES, Government Geologist.

## BAUXITE: A SOURCE OF ALUMINIUM.

*Aluminium.*

The bright and light metal known as aluminium has in recent years been subject to an increasing demand in the markets of the world. It is familiar to householders in the form of kitchen utensils. It is now extensively used in the bodies and engines of motor-cars, aeroplanes, and in the construction of electric long-distance transmission-lines. It has been employed in making rifle and shell cartridges, though its use for this purpose is said to have fallen off, and its dust is being used in the manufacture of certain explosives. It has a high metallurgical value in welding iron, and it forms part of important alloys with zinc, copper, nickel, and tin; some of these alloys are greatly esteemed in the manufacture of machinery.

The world's production of the metal is estimated to be nearly 90,000 tons annually. Its market price in the United States, which produces more than half the total output, in 1915 was 1s. 4d. per lb., but by the end of the year this had risen to 2s. 6d. per lb., and at present is still higher. The price of bauxite ore at the American mines has for several years been about 20s. per ton.

*Utilisation of Bauxite in the Production of Aluminium.*

Aluminium does not occur as a native metal, but exists in the earth's crust in combination with oxygen, potash, soda, fluorine, phosphorus, beryllium, silica, and sulphur, some of which combinations form aluminium ores. Turquoise and chrysoberyl are gems; corundum is an abrasive. Bauxite and cryolite are ores from which aluminium may be reduced. Of these, bauxite, a hydrated oxide of aluminium, is now the most important source of the metal. It is first purified by calcining, and then treated with carbon in an electric furnace, when crystallised alumina is produced. This is charged into the electric aluminium reduction furnace, in the bottom of which the melted aluminium collects. It is stated that 6 tons of bauxite are used to make 1 ton of aluminium.<sup>(1)</sup>

The metallurgy of aluminium dictates the elimination from the bauxite of metals which would contaminate the product. These are got rid of, as indicated above, in the first treatment stages, and then the difficultly-reducible aluminium is separated from its oxide in the electric furnace. Consequently cheap hydro-electric current is a most important desideratum. This is now obtainable in Tasmania by means of the Government

(<sup>1</sup>) Mineral Industry during 1912: Vol. XXI., p. 92.

hydro-electric installation. How important a factor cheap electric current is in the production of aluminium may be judged from the fact that bauxite ores were, previous to the war, exported from Europe to Canada, to be treated at the extensive works at Shawenegan Falls, Quebec. Bauxite melts at a temperature of 1820° C. (+ 3308° F.).

Cryolite, a fluoride of sodium and aluminium, is also used in the manufacture of aluminium. It is not known to occur in Tasmania; and the only recorded occurrence of the mineral in commercial quantities is in Greenland.

The production of aluminium is the chief use to which bauxite is put, but there are other applications. It is employed for the manufacture of alum and other aluminium salts, and for refractory furnace bricks. At Niagara Falls, in America, calcined bauxite is smelted in the electric furnace and converted into "alundum," or artificial corundum, which is used for crucibles and other refractory laboratory articles, and as an abrasive for polishing metals.

*Bauxite: Its Composition and Physical Characters.*

The exact composition of the ore is indefinite, being determined by the proportions of the impurities present; but the mineral itself is a combination of alumina (oxide of aluminium) and water, the alumina forming 74 per cent. and water 26 per cent. of the total (= 39 per cent. aluminium). The principal impurities are iron oxide and silica and oxide of titanium. Published analyses of good grades of bauxite ore are as follows:—<sup>(2)</sup>

	From Baux.	From Ireland.	From Georgia.	From Alabama.	From Arkansas.	From Georgia.
Alumina .. .. .	57.60	61.89	59.22	61.00	62.05	62.46
Ferric Oxide .. .. .	25.30	1.96	3.16	2.20	1.66	.81
Silica .. .. .	2.80	6.01	3.30	2.10	2.00	4.72
Lime Carbonate .. .. .	.40	..	..	..	..	..
Titanic Acid .. .. .	3.10	..	3.62	..	..	.23
Water .. .. .	10.80	27.82	28.80	31.58	30.31	31.03
Moisture .. .. .	..	..	1.90	3.12	3.50	..

Ores with 40 per cent. of alumina and upward are mined.

The contrast between this composition and that of ordinary clay and kaolin is easily realised when it is borne in mind that clays contain from 40 to 70 per cent. silica, and only from 10 to 40 per cent. alumina.

In appearance bauxite is decidedly clay-like or earthy-looking, generally with light-yellow, brown, or red colours. Sometimes its texture is compact, kaolinic or even flinty, but often, and characteristically, oolitic or pisolitic; that is to say, with a structure showing concretionary concentric grains or spherules ranging from the size of a pea to that of a nut. Occasion-

<sup>(2)</sup> Economic Geology: H. Ries, p 517.

ally, when formed by the decomposition of syenite in place, it has a granitic texture.

Briefly, bauxite may be regarded as a disintegration product consisting of hydroxide of aluminium, and accompanied mostly by a little silica and sesquioxide of iron. For its correct identification an analysis is necessary. Prospectors and others desirous of information respecting their samples are invited to apply to the Government Assayer, Geological Survey Laboratory, Launceston. A determinative assay will be made, if wished, for the sum of one shilling.

*Bauxite: How it Occurs; Countries in which it is Found.*

Bauxite owes its name to its occurrence in the district of Les Baux in Southern France, where it was first discovered. It exists there in limestone. In central France and the north of Ireland it is associated with basaltic rocks. In the Georgia-Alabama belt in the United States it is in pockets or lenses in residual clay derived from underlying dolomite. In Arkansas, beds of bauxite rest on and pass down into kaolinised nepheline syenite, and finally into the unaltered syenite. Where the mineral has been derived from igneous rocks, the decomposition of the latter supplied the aluminium silicate, which later was replaced by the oxide. It has been assumed widely that alkaline or acidic solutions have altered rocks and clays to deposits of bauxite, but the data on which the assumption is based are uncertain. It seems possible that ordinary weathering or lateritic processes in tropical or subtropical climates have in most cases been responsible for the alteration of the original rock by the abstraction of the lime and alkalies and the formation of bauxite. The bauxitic laterites or ferruginous clays of India, which cover large areas of basaltic rock, are considered to have originated in this way.

The occurrence of bauxite in cold temperate climates is exceptional.

*The Most Likely Localities for its Discovery in Tasmania: Suggestions to Prospectors.*

The prospector will, of course, remember that he is not searching for a metallic mineral, but for one which assumes the guise of an ochreous or clay-like substance. Its modes of occurrence, as mentioned under the preceding heading, must be borne in mind. First, its association with igneous rocks must be followed up. If present, it will be found overlying these and filling the surface hollows and passing gradually into the fresh rock below. Then, again, it may occur as beds overlying the surface of limestone or forming pockets in the decomposed portions of the latter. Here it is obviously the result of weathering, but where it forms masses in the rock thermal or chemical action has been postulated.

In any case prospectors would do well to examine carefully the superficial covering of clay associated with limestone country. The limestone which offers the best chances in Tasmania is that of Silurian age, as it is not very siliceous; the Permian-Carboniferous limestones and calcareous mudstones contain more silica. Limestones which may be examined are those in the Chudleigh and Mole Creek districts, Railton, Gunn's Plains,

Lorinna, Moina, Zeehan, Beaconsfield, Winkleigh, Ida Bay, Blythe River, and Gordon River. Notice should be taken as to whether the surface clay is the result of the weathering of the limestone or has been transported from a distance.

Beds of clay in the large Tertiary basins of the island may be here and there bauxitic; *e.g.*, those of the Longford plain or the basins of the Derwent and Tamar Rivers.

The igneous rocks of the island also offer a wide scope for prospecting. The clays and ochres which result from the weathering of the diabase (otherwise known as bluestone, greenstone, trap) all over the island should be examined. These occur on the flanks, or even on the summits, of hills of diabase rock. The great Central Plateau offers examples of residual clay deposits, and, in fact, these may be found wherever diabase-crowned mountains and ridges occur. Whether these are in any places bauxitic or not remains to be ascertained. The ordinary decomposed rock will still contain from 20 to 30 per cent. silica, and the desilication of clay takes place under some conditions not well understood. It is a characteristic phenomenon of tropical, subtropical, or warm temperate climates.

Judging from the analogy of the occurrences connected with the nepheline syenite of Arkansas, the clays in the Port Cygnet and Kettering and Woodbridge districts should not be neglected by prospectors. The mudstone clays of these districts, however, would be unlikely containers of bauxite. The favourable beds would be the clays directly derived from the decomposition of the alkali porphyries.

The extensive sheets of basalt in Tasmania are possible originators of bauxite deposits. The deep soil which is derived from the decay of this rock may well contain lenses of the mineral.

Finally, the kaolinic clays of the granite areas are worthy of examination. These are found in the tin districts throughout the island. Kaolin itself has a silica content of from 50 to 70 per cent., being among the most siliceous of clays, and though aluminous, cannot be used for the production of aluminium. Some less siliceous forms, however, may possibly be found, especially where the quartz-free modification of granite known as syenite exists as the parent rock.

If the prospector finds that his material is gritty with particles of quartz, he may reject it without further examination. On the other hand, pipe-clay, which is a fine-grained plastic clay, must not be confused with bauxite, which has an earthy feel. Pipe-clay is siliceous, despite its smoothness. The colours of bauxite are of little value as criteria, having a wide range from white through grey, yellow, buff, and brown to deep red.

If concretionary nodular and centric structure is present in the sample, the ore deserves careful examination. The texture may vary from a loose aggregate to that of a dense clay.

If present, bauxite will be found either at the surface or at shallow depths, horizontally bedded. Bauxite mining is generally carried on in open-cuts, and the ore won with pick and shovel. It is washed, when necessary, to eliminate clay, and then dried in rotary kilns. A selection is made of the least siliceous material for the aluminium furnace. Ores 40 per cent. and upwards are treated, the quality being controlled by daily assays.

From this circular it will be seen that the bauxite prospector has a wide field open to him. It is a mineral of which the deposits are associated with nearly every description of rock. They occur in connection with syenite, basalt lavas, beds of limestone, and lake sediments; and the substance exhibits many varieties of texture and structure. As said above, a reliable determination of the mineral can be made only by assay.

It may be mentioned here that specimens of bauxite are exhibited in the Geological Survey mineral collections in the Victoria Museum, Launceston.

If prospectors can discover deposits, there is in the State hydro-electric undertaking a means of treating the ore readily and cheaply.

---

## THE SEARCH FOR PETROLEUM IN TASMANIA.

---

### *Introduction.*

Stray lumps of bitumen on the Tasmanian coasts attracted attention a good many years ago, and sundry attempts were made to locate their source. Mr. Chas. Gould, Government Geologist, recorded their occurrence on Prime Seal Island (Hummock Island) in the Straits in 1871; and Mr. T. B. Moore discovered some of these petroleum residues on the West Coast, north and south of Sandy Cape, in 1876. He subsequently found pieces of the same material in Macquarie Harbour (near Farm Cove), near Point Hibbs, and at the mouth of the Mainwaring River. The Point Hibbs occurrences have been described by Mr. Loftus Hills in Geological Survey Bulletin No. 18, and all the known finds in Tasmania have been mentioned by the writer in Bulletin No. 24.

In the nineties a prolonged investigation was made in Macquarie Harbour and on Hummock Island by a visiting explorer from Sydney, who had been attracted to the search by a specimen from Macquarie Harbour which had come into his possession. The search for a place of origin was, however, a fruitless one.

In 1914 some interest was created by discoveries of this substance which had been made from time to time on the South Coast (New River, Rocky Boat Harbour, &c.), and a syndicate was formed to prospect the localities. A Geological Survey examination of the district was made, but the conclusion arrived at was that the pieces had been stranded by ocean currents on the beaches on which they were found, and that they furnished no evidence of local petroleum deposits. About that time some rather extensive discoveries were made of fragments of bitumen at the mouths of creeks in Port Davey harbour. There ensued an unsuccessful search for their source in that neighbourhood. There is a small development of Tertiary lignitic beds along the shores of the harbour, but the Pre-Cambrian schists and quartzites predominate overwhelmingly, and these are in the highest degree unfavourable for oil deposits. At the termination of the exploratory work at Port Davey a search was initiated in Permo-Carboniferous beds on Bruny

Island, where alleged exudations had been reported. The drilling trial there ceased this year without completing the proposed programme owing to an insufficiency of capital.

Thus, prospecting for native oil in Tasmania has not yet been successful. As far as the asphaltum occurrences are concerned, failure has been owing to a misinterpretation of the data. It not rarely happens that prospectors and other intelligent observers, either by accident or assiduous search, bring to light some signs or indications of oil, past or present, but fail to recognise the true inwardness and bearing of the facts. The geological structure of the ground, which should govern all tests, is unhappily only discovered after an expenditure unpleasant to all concerned. Although the elucidation of the stratigraphy is often difficult, and the geologist can more frequently announce where oil will not be found than say definitely where it exists, it must be remembered that in the early days of petroleum-winning the geologists established the intimate connection between oil reservoirs and crustal folds, and laid the foundations of all intelligent and successful modern drilling.

In Tasmania unequivocal indications of any native oil accumulations are so far not apparent, but it is safe to lay down as a postulate that any well-considered scheme for prospecting must be based upon, firstly, signs and evidences at surface; and, secondly, geologically correct drilling.

#### *Nature and Origin.*

Petroleum is a complex mixed series of numerous hydrocarbons, consisting of various proportions of hydrogen and carbon, with frequently associated nitrogen and sulphur. The crude oil as it flows from wells is of a dark-brown colour, occasionally, however, light-yellow. As is well known, its specific gravity is lower than that of water, ranging generally from .8 to .9 (water = 1).

On the subject of the origin of petroleum there has been considerable diversity of opinion. It is unnecessary here to discuss the arguments which have been advanced on one side or the other in the controversy of inorganic versus organic origin. The consensus of opinion is in favour of its derivation from organic sources, and attributes to it a dual origin, *i.e.*, from the remains of both animals and plants. Its intimate association with lignites and aquatic plants on the one hand and animal remains on the other makes it impossible to appeal to either as exclusive factors in its genesis.

#### *The Relationship of Oil-fields to Structural Geology.*

Structural geology plays a great rôle in the search for petroleum. It may be said without fear of contradiction that every oil-field is connected with some type or other of earth-folding. If oil lies distributed in a porous horizontal bed, it will not accumulate at any one point in sufficient quantity to make its exploitation remunerative. The arched structure, in which the beds are thrown into anticlinal and synclinal folds, is the one that is the most favourable for the rise of the oil and gas on the slopes of the anticlines.<sup>(1)</sup> The water, oil, and gas take up

(1)  = anticline;  = syncline.

their positions in accordance with their different densities; the gas, which is always present with petroleum, and which exercises such propulsive force in the oil-wells, occupies the crests of the folds, the oil a little below the crests, and the water usually in the troughs. This is the ideal sequence of positions, though there are some exceptions. Monoclines and terraces with a slope in one direction only also form oil-reservoirs.

This association of well-known geological features with accumulations of oil results in a good deal of attention being paid by oil-seekers to the folds of the stratified rocks when a start is made to test a field in which indications of oil are present.

The normal sequence of events in an oil region seems to be as follows:—

Primarily the animal or vegetable matter which passed through its usual stages of decomposition under pressure of overlying beds underwent under ill-understood conditions the process of distillation. The oil accumulated in porous rock, which henceforth constituted a supply reservoir. A higher impervious stratum prevented its escape. Subsequent folding allowed the gas and oil to rise along planes of bedding or folding, where they remained until released by boring.

The existence of an oil-field is dependent on three essential factors: the original oil-forming material, a porous reservoir rock, and an impervious cover-rock (usually clay or shale). The further connection between the supply reservoir and crustal curves has to be studied on the spot in each case. The ideal anticlinal fold is not always developed; its place is sometimes taken by monoclines or deformed anticlines and terraces and beds dipping gently in one direction. The great variety of structural features makes it difficult to generalise. In some instances the anticlinal folds are so sharp that wells have been sunk in almost vertical beds. Broad dome-shaped earth curves or gently-inclined strata are, however, the most commonly favourable. It is not out of place to remind the general reader that there are such things as deeply-buried anticlines impossible to detect without a drilling scheme, and not becoming apparent before a late period in the history of an oil-field.

#### *Indications of Oil.*

The most important hint of the existence of oil in depth is a seepage of the fluid or exudations of asphaltum at points on the surface. In many instances, however, no indications of petroleum have been seen until it was met with in the bore, and this has sometimes been appealed to as a warrant for blind stabbing with the drill on the off-chance of striking oil in country which has taken the prospector's or promoter's fancy. Competent authorities, however, remark that where this has been successful, the bores were in regions which in other parts yielded oil or showed indications of it. Dr. Wade, in his report on "The Prospects of Discovering Petroleum on North Bruny Island," quotes Prof. D. T. Day, United States Naval Inst. Proc., 1914:

"In nearly every case where oils have been discovered in the United States or other countries, the discovery has been directed by a seepage of oil or gas."

The natural gas associated with petroleum occurrences consists largely of inflammable marsh gas  $\text{CH}_4$  (methane), but as gas containing methane is an ordinary vegetable decomposition product characteristic of marshy areas, and is also given off by seams of coal, its occurrence is no infallible sign of the existence of petroleum. At the same time, petroleum is usually accompanied by this gas, and gas-shows in a bore, especially under increasing pressure, are indications which cause the driller to be on the alert. In some limestone fields the gas emitted is sulphuretted hydrogen. Indeed, this gas generally accompanies petroleum gas, and sometimes masks the distinctive odour of the oil. Gas-shows at surface in springs and pools should not be neglected in collecting information about possible oil areas. In some countries the evolution of gas from oil rocks just below the surface is responsible for the formation of conical hillocks called "mud volcanoes"; in these the impervious cover has been disrupted or has absorbed oil and gas. These, of course, are excellent indications.

The most usual places for exudations of oil are in stream beds, in ravines, and low ground generally, or at outcropping joints on the slopes of rock-folds. Frequently the surface soil will have to be removed before any actual signs of seepage can be seen. Outcrops may have a bituminous appearance, but if exhausted and much weathered they may not be recognisable at the first glance as oil rock. In such cases a faint odour and, with limestones, sometimes sulphur stains are all the indications available.

The solid bitumen passing under the names of asphaltum, albertite, grahamite, manjak, &c., is a residue of asphaltic oil, as ozokerite or mineral wax is the residue of the light paraffin oils. Veins of these substances are useful indications of original occurrences of petroleum.

Brine, rock-salt, and saline waters are frequently associated with petroleum, and the water in petroliferous strata is invariably impregnated with salt. Some authors consider this as more than a coincidence. The latest views, however, regard the occurrence of brine as unrelated to the facts of oil genesis beyond being possibly due to conditions which were favourable to the formation of both oil and salt.

Iridescent films seen on the surface of streams and pools are sometimes films of oil, but more frequently owe their bright colours to oxidation of ferrous salts, leaving an oil-like film of ferric hydrate on the surface of the water. When this is stirred with a stick it does not break up in the way characteristic of oil; and, besides, the distinctive odour of petroleum is absent. Oil seepages on the sea-floor give rise to wide films of oil on the surface of the water.

In arid countries the influence of petroleum on vegetation is marked, giving a barren appearance; but in countries with a heavy rainfall and with a climate like that of Tasmania tree and plant life would supply no useful clue to the existence of petroliferous beds.

*Geological Age of Limited Application as a Guide to  
Prospecting.*

Petroleum occurs in strata of all ages, but oil-fields of any importance are not likely to exist in areas so recent in age

as the Quaternary. A large output has been derived from Paleozoic rocks, while the most numerous fields obtain their production from strata of Tertiary age. In the Eastern Hemisphere the oil-fields are principally Tertiary. The Roumanian, Galician, Caucasian, the Burmah, and the Eastern Archipelago fields are Tertiary or Cretaceous, and none older than these exist in the East Indian and Australasian regions. One might be disposed, therefore, to argue that, given the necessary conditions, the balance of probability for Australasia lies with strata of Tertiary age. Strictly speaking, however, it cannot be affirmed that the question of age is involved in the problem. The intrinsic factors are the nature and conditions of sedimentation and structure; and the necessary conditions may exist in sediments of all ages.

#### *Prospecting in Tasmania.*

So far no undoubted surface seepages of petroleum in Tasmania are known to the Mines Department. It is true vague reports are current of occurrences in different parts of the island, but none of these have been verified and confirmed by a competent observer. Exudations have been reported on Bruny Island and near Launceston, supposed oil-films on the sea surface on the South Coast, off the mouth of the New River, and loose fragments of bitumen on the West and South Coast beaches and in the Straits, but such of these occurrences, real and alleged, as have been further examined have failed to yield satisfactory evidence of the existence of an available petroleum field. When any signs of native oil are noticed, observers would do well to communicate with the Secretary for Mines, in order that arrangements may be made for an officer of the Geological Survey to visit the spot.

Unquestionable petroleum residues are present as loose fragments of asphaltum on various beaches of the Tasmanian coasts, namely on King Island, north and south of Sandy Cape, in Macquarie Harbour, north of Point Hibbs, at the mouth of the Mainwaring River, north of Port Davey, in Port Davey, east of Cox Bight, at the mouth of the New River, in Rocky Boat Harbour, on Surprise River beach, on South Cape Bay beach, and on Hummock and Cape Barren Islands.<sup>(2)</sup> These fragments are usually found near high-water mark, between normal and storm tide levels. No pieces have been found up the streams. If they had been brought down by the creeks and rivers, they would have been more plentiful on the beaches, and it would not have been difficult to locate their sources up-stream in the same way as drift-coal is easily traced to its parent stream. They vary in weight from an ounce or two to nearly a hundredweight. They are of no particular shape, being mere fragments; they are often found in flattened, cake-like forms. The substance is sometimes plastic, and fresh-

<sup>(2)</sup> A collection of these asphaltum fragments may be seen in the Victoria Museum, Launceston (Case 26). A specimen of albertite (121) is exhibited in Case 11. In Case 7 are shown other bitumens, viz.:—Uintahite (Gilsonite) [2631]: asphaltum from Trinidad [2627]: Ozocerite from Galicia [2615]: elaterite or elastic bitumen from Cornwall [2629].

looking pieces frequently have an odour similar to that of naphtha. Fresh surfaces show the lustre of pitch. Mr. W. F. Ward, Government Analyst, reports that the average density of sea-water round Tasmania is 1.030. The specific gravity of this asphaltum has been determined in the Geological Survey laboratory by Mr. W. D. Reid, Government Assayer, as ranging from 1.0313 to 1.0459; consequently, though it might not float in stationary seawater, it would do so in moving water. It will be remembered that albertite, a kindred or practically identical mineral (that is to say, an inspissated petroleum), occurs in New Brunswick in vein-form. In the Albert Mine it was worked in a vertical vein up to 15 feet in width to a depth of 1300 feet, and after 230,000 tons of it had been extracted, the vein finally passed into a brecciated mass of shale fragments. Bores put down in search of free oil were unsuccessful.

It is possible that the fragments of bitumen met with on the Tasmanian beaches are also derivatives from veins; and it is very probable that they emanate from some submarine source or sources situate to the west or south-west of Tasmania. Similar fragments are found on the beaches along the southern and western coasts of Australia.

Unsubstantiated reports of discoveries of bitumen in undisclosed localities inland have been received by the Department from time to time.

In Petterd's "Catalogue of Tasmanian Minerals," an inland occurrence of this or a similar mineral is thus described:—

"Occurs about 4 miles from Chudleigh, on eastern bank of Mersey River. It is perfectly black, sectile, and burns with a dense smoke and strong odour. It occurs in drab-coloured aluminous shale."

An attempt should be made to locate the above and ascertain its mode of occurrence, and whether the mineral is identical with that found on the beaches. The drainage basin of the Arthur River has been spoken of as a district in which asphaltum has been found, but the reports are of a nebulous character. Several years ago an abortive attempt was made to locate some bituminous mineral alleged to exist as a seam on the sea-coast somewhere in the neighbourhood of Southport, which was said to be used by fishermen for their fire-pots, and was known as "kerosene stone." But so far all the asphaltum fragments have been found on beaches facing the south and west, and none on the east coast. An alleged discovery at Cockle Creek, in Recherche Bay, has been traced to South Cape Bay.

The hard Silurian limestones are unlikely to be oil-containers. As a rule they are very compact, and it is only occasionally that thin bands of a cavernous texture are met with in them.

Exudations of oil or some product or residuum of oil are said to have been observed on Bruny Island. The prospectus of the Bruny Island Petroleum Company issued in 1915 made the remarkable statement that liquid bitumen has been known to exude from the ground there at two distinct points for over 50 years. Dr. Arthur Wade was instructed by the Mines Department to examine the alleged petroliferous area on Bruny, but was unable to verify the existence of these exuda-

tions, and reported adversely on the chances of finding oil.<sup>(\*)</sup> The company, however, proceeded with its operations, and bored to a depth of 430 feet in Permo-Carboniferous marine beds, but unsuccessfully; and work finally ceased from lack of funds. The following particulars of the bore have been placed at the disposal of the Mines Department by Mr. Guy Andrew, the company's superintendent:—

	Ft.	In.
Top sand and clay ... ..	43	0
Quartz sand ... ..	8	0
Coarse sand ... ..	11	0
Running drift with no water ... ..	39	0
Sand and water ... ..	11	0
Limestone conglomerate ... ..	27	0
Brown shale ... ..	8	0
Quartz sand ... ..	5	0
Limestone conglomerate ... ..	4	0
Very fine sand with no water... ..	14	0
Brown clay ... ..	6	0
Limestone conglomerate ... ..	3	0
Limestone ... ..	12	0
Hard brown limestone ... ..	3	0
Grey limestone ... ..	54	0
Hard carboniferous grit ... ..	1	6
Hard blue siliceous shale ... ..	3	0
Hard limestone ... ..	3	0
Very hard grit... ..	3	0
Very hard limestone with alternate bands of shale ... ..	171	6
Total ... ..	430	0

In different parts of Tasmania the diamond-drill has prospected the beds of the Permo-Carboniferous system while exploring for coal-seams, without encountering gas or oil, and the chances of striking oil in such beds as they are developed here do not appear to be great.

A significant adverse indication is that, although the beds lying on the flanks and at the foot of the numerous mountains dip towards the hill, their outcrops have not been noticed to show any exudations or other signs of oil.

Faults are very common in the Permo-Carboniferous areas, and in connection with this circumstance it may be mentioned that fault-displacements do not always have an injurious effect on subterranean oil supplies; frequently they provide channels through which gas and oil force their way and increase the flow of a well.

The Permo-Carboniferous beds may be regarded as potential reservoir beds—they are both marine and terrestrial: some of them are charged plentifully with marine fossils, the organic remains from shallow seas, others with the carbonaceous residue of vegetation (coal-seams, &c.); they are generally tilted at a low angle, and they consist of alternating imper-

(\*) See "Petroleum Prospects on Bruny Island," by Arthur Wade, D.Sc., Parliamentary Paper No. 60, 1915.

vious and porous strata. Petroleum being a product (in greater or less quantity) normal to nearly all countries and to strata of every age, it would not be a geological surprise to meet with signs of it in these beds; but no definite evidence of its existence has been reported.

Oil is being extracted by destructive distillation from the Tasmanite shale of the Mersey district, and it can be distilled from the cannel coal or kerosene shale of Preolenna; but this has no bearing on the existence of rock oil.

The development of the Permo-Carboniferous in Tasmania is variable, but the maximum thickness of the strata is estimated between 2000 and 3000 feet.

The Trias-Jura comprises in Tasmania the continental sandstones and shales homotaxially comparable with the European Trias and Jura, and forming part of the old Gondwana continent which occupied the site of the present Indian Ocean, from Permo-Carboniferous onwards to Cretaceous times, separating the Southern Ocean from the greater Mediterranean or Eurasian Sea. It includes the Upper Coal Measures. The lowest beds of the series rest conformably on the Permo-Carboniferous, and the various members are conformable with each other. Their united thickness is probably between 1200 and 2000 feet.

The remarks on diamond-drill boring in the Permo-Carboniferous apply also to the Mesozoic. Numerous bores have been put down to locate or test coal-seams in these strata, but no record exists of oil having been struck in any of them. The series contains the plant-remains of coal-beds and fossil tree trunks, fish imprints, and bones of amphibians here and there in the sandstone beds, but generally the strata are poor in organic remains. There is an alternation of sandstones and shales in the system, and generally speaking the conditions are not unfavourable for accumulations of oil if the material for its formation had been present. Indications, however, are wanting. Bores have passed through the whole series of Mesozoic and Permo-Carboniferous sediments to the granite or Silurian slates without yielding any trace of oil or gas.

Some uncertainty attaches to the salt-pans of the lower Mesozoic as criteria in search of oil. These saline lagoons are on the estates of Lower Park, Ballochmyle, Ellenthorpe, and Mona Vale in the midlands, and are said to extend in a chain for 7 miles N.W.-S.E. Mr. Joseph Barwick reported to the Royal Society of Tasmania in 1889 that he knew at least ten of these lagoons in an area from 1 to 100 acres. At Ellenthorpe there is one large pan of 100 acres; but the most prolific are those at Ballochmyle and Mona Vale, from which hundreds of tons have been taken in dry seasons for domestic and farm use. It is stated that the salt lagoons were often the subject of much contention among the aboriginals, and were the scenes of fierce tribal warfare.<sup>(4)</sup>

It is well known that the American oil industry had its birth in the discovery of petroleum while drilling for brine, and the association of rock-salt, or brine and saline waters, is so general that it is difficult to persuade oneself that there is no genetic relationship. The association exists in the oil-fields of the United States, Canada, Roumania, Galicia, Russia,

(4) Proc. Roy. Soc. Tas., 1889, p. xxii.

Persia, Baluchistan, Burma, and New Zealand; and, in fact, in oil-fields generally. It is not easy to believe that this association is accidental. The commercially valuable oil-fields of Texas and Louisiana are characterised by salt domes with cores of salt and gypsum. These seem to be connected with fault systems, and have been of use in guiding the selection of sites for drilling in the inclined strata on and around them.<sup>(5)</sup> One of the Texas domes (Spindle Top oil-field) is stated to have led to drilling operations yielding over 5,000,000 tons of petroleum from an area of 200 acres. In Vera Cruz, in Mexico, the oil rock is dolomite lying below Tertiary fossiliferous marls and sandstones (diatomaceous and foraminiferal), and resting on gypsum and rock-salt.<sup>(6)</sup> In Roumania the oil-producing strata are saliferous. Rock-salt is also present in the oil areas of Galicia. There are salt lakes round the oil-fields of Baku, and the whole petroliferous Caspian area may be said to be saliferous.

A. Beeby Thompson remarks<sup>(7)</sup> that in most oil-fields the oil is raised mixed with salt-water. He says:

"In some petroleum districts salt plains or lakes are not uncommon. Wherever there are natural depressions without easy exit, and rain-water can collect at intervals, salt is dissolved from outcropping oil-beds, producing a solution of salt which in hot dry seasons suffers evaporation, leaving a white encrusting deposit on the ground. The gentle evaporation under the influence of the sun and wind often causes the salt to separate out in beautiful rose-tinted crystals which form the loveliest clusters. Dry salt lakes or salses formed in this manner are often the source of a large trade in salt, which, when required for crude uses, such as preservation, needs no purification or preparation."

Sir Boverton Redwood says:<sup>(8)</sup>

"The peculiar relations between salt and petroleum and natural gas were noticed at an early date. The petroleum industry of the United States originated in the drilling of wells for brine and the observation that gas and oil were usually found with it; and throughout the globe the association of gas and petroleum with salt, either in solution or in the solid state, is almost universal."

Expert opinion has wavered with respect to its value as an indication, but of late the view has been growing that salt and petroleum may have accumulated independently of one another under identical conditions favourable to each. Mr. Cunningham Craig, in his little book on "Oil-finding," suggests that dry and desert conditions in many fields involved the limited supply of water, which is supposed to be one of the factors in the formation of petroleum, and that these also favoured the concentration of salt, so that the two may have been influenced by a common condition, and still be quite unconnected with

(5) "The Relationship of Structure and Petrology to the Occurrence of Petroleum," by A. Beeby Thompson, *Trans. Inst. Min. and Metallurgy*, Vol. XX., 1910-11, pp. 225-6.

(6) *Trans. Inst. Min. and Metallurgy*, *supra*, p. 250.

(7) "Petroleum Mining," by A. Beeby Thompson, 1910, p. 112.

(8) "Petroleum," by Sir Boverton Redwood, 1906, p. 114.

each other. He points out that sometimes the salts are not sodium chloride, but sodium and calcium sulphates. Nevertheless the impression remains that the association has not yet been satisfactorily explained.

In applying this to the brine deposits of the Tasmanian midlands arid conditions probably prevailed when these sandstones were laid down, which would favour the concentration of salt and gypsum, but if what may be called the raw material were absent no oil would be formed. If no other indications can be discovered, it is unsafe to regard the salt-pans as such. The boring experience in the Gondwana rocks in other parts of Tasmania is rather against any association here. Still, if any purely speculative trials are to be made in Tasmania, boring in a structurally favourable part of this field would no doubt be considered. But all that can be said at present is that the brine is the only evidence available, and this must be accepted *quantum valet*.

Search should be made for surface signs of oil or gas, particularly in the creeks and along the edges of outcropping rock. The district is an extensive one, but it must be well-known to shepherds and others whose duties take them over the ground.

It remains to consider the Tertiary sediments which are widely distributed in Tasmania. These are, for the most part, fluviatile and lacustrine deposits, with a succession of alternating clays, sands, and carbonaceous beds. The Launceston Tertiary basin, with its ramifications, is estimated to cover an area of 600 square miles. The Derwent Tertiary basin is filled with an assemblage of similar sediments; and beds of the same age are developed in various parts of the island (North-West Coast, Macquarie Harbour, Swansea, &c.). The outcrops of Tertiary fossiliferous limestone in the vicinity of Cape Grim, Marawah, Temma, &c., should be examined by residents for any indications. The basin of the Arthur River, too, invites exploration. The development of Tertiary beds on the South Coast has been too slight to be attractive.

The greatest depth to which they have been proved was in the Belmont bores near Longford. Two bores there reached 690 and 894 feet, leaving off in lignitic sediments. The following are the registers of these bores:—<sup>(9)</sup>

<i>No. 1 Bore.</i>	Ft. In.
Surface shaft ... ..	13 6
Clay with veins of ironstone ... ..	41 11
Drift with quartz-stones ... ..	7 4
Sandy clay ... ..	28 7
Clay with lignite ... ..	98 1
Clay and sandy drift... ..	68 10
Concretionary drift with lignite ... ..	25 0
Sandy clay with lignite... ..	21 0
Drift ... ..	39 9
Drift with sandy clay and wood ... ..	57 9
Red clay... ..	55 0
Sandstone ... ..	20 2
Sandstone with seams of lignite and red clay ... ..	21 6

<sup>(9)</sup> "The Geology of Tasmania," by R. M. Johnston, 1888, pp. 275-276.

## No. 1 Bore.—continued.

	Ft.	In.
Hard mud-shale ... ..	31	10
Mud-shale and sandstone ... ..	10	1
Shale showing fossils... ..	11	10
Shale and sandstone ... ..	25	10
Hard brittle slate... ..	5	2
Shale ... ..	19	5
Shale with veins of carbonate of lime	7	9
Shale and sandstone ... ..	11	5
Shale with veins of concretionary sand and lignite ... ..	6	10
Mud-shale and sandstone ... ..	10	5
Concretionary sand and lignite ... ..	8	9
Layers of mud-shale and soft mul- locky sand and wood ... ..	42	3
Total ... ..	690	0

## No. 2 Bore.

	Ft.	In.
Surface shaft ... ..	16	6
Brown clay ... ..	23	6
Wash ... ..	3	0
Black clay ... ..	53	0
Stones and drift ... ..	34	0
Black clay and wood... ..	44	0
White clay and wood ... ..	70	0
White sandy clay and drift ... ..	257	4
Sandy clay and drift with decayed wood ... ..	150	2
Mottled clay ... ..	56	4
Red clay ... ..	7	0
Sand clays with wood (went through 4 feet of wood at 800 feet) ... ..	61	2
Light-blue clay and wood ... ..	102	0
Mottled clay and wood ... ..	16	3
Total ... ..	894	3

A bore for coal was put down on the Carr Villa estate near Launceston, in Tertiary beds, and reached a depth of 570 feet. It left off in the diabasic igneous rock. Prospecting-shafts have been sunk in these beds in various localities, but none of them have revealed any signs of petroleum. At the same time the few vague reports which have reached the Department suggesting the existence of oil scums or ooziings have invariably had reference to Tertiary beds. Such are reports of oil on the West Tamar, near Newstead, between Relbia and Evandale, and near Longford. None of these occurrences have been examined officially, and no samples of the exuding material have been received at the Survey laboratory. It cannot be said, therefore, whether the reported substances are derivatives from a petro-

leum reservoir or from any natural distillation of tar from beds of lignite, or merely films of iron oxide. The last of these is the phenomenon which is most common.

#### Field Tests.

Mr. Cunningham Craig, according to a compilation made by Dr. Wade,<sup>(10)</sup> gives characters by which genuine oil-scums may be distinguished from those of iron oxide, as follows:—

<i>Films of Iron Hydroxide.</i>	<i>Films of Petroleum.</i>
1. Iridescent reds, red-browns, and blues	Iridescent vivid greens, pinks, and purples
2. Acquire a semi-metallic lustre on drying	Never exhibit this character
3. Break when disturbed into sharp-edged and sharp-cornered fragments	Never break in this manner, but give rounded, curved, or convoluted figures
4. Small crystalline flakes may be seen to sink when a partially dried-up film is agitated	Film remains on surface under such conditions

In addition, suspected oil exudations may be tested by burning in a wick or by the characteristic odour.

Woodruff's test for oil in rocks is given by D. Hager in his work on "Practical Oil Geology" (1915, p. 59):—

"Crush the sample to a powder. Place a tablespoonful of it in a bottle and pour chloroform or carbon-tetrachloride over it till saturated and covered with the liquid. Cork and shake occasionally for a quarter of an hour. Filter. If the rock contains more than a trace of petroleum the filter-paper will show a dark ring. Allow the filtrate to evaporate slowly; examine the remaining substance. It is the petroleum which was in the rock."

#### General.

Prospectors should perseveringly search gullies and cliff faces for oil signs and gas shows. There is often a faint odour of petroleum in gullies where gas is escaping. The boundaries of the Tertiary strata along the foothills of the Western Tiers should be examined, and wherever contacts are exposed with outcrops of the Trias-Jura or Permo-Carboniferous sediments or with the Mesozoic diabase of the ranges. The Tertiaries of the Tamar, Longford, the Derwent, Macquarie Harbour, and of the extreme North-West of the island, should also receive the attention of the oil explorer. At Farm Cove, Macquarie Harbour, boring for coal has been carried on in the Tertiary beds to a depth of 300 feet. The lumps of fossil resin which are met with in these coal measures must not be mistaken for mineral wax.

<sup>(10)</sup> "The Supposed Oil-bearing Areas of South Australia," by Arthur Wade, D.Sc., Geol. Surv. S.A. Bulletin No. 4, 1915, p. 39.

Reviewing the whole subject, the two fields which offer the best off-chance of discovery of native oil in Tasmania are, as far as at present known :—

- (1) The Launceston Tertiary basin, in which rapidly alternating beds of sand, clay, and lignite recur to a proved depth of 900 feet, and probably persist for a few hundred feet deeper. The organic muds of these beds are potentially favourable for oil genesis.
- (2) The Gondwana land beds of the midlands, where salt-pans are known to exist in various localities.

A discovery of oil seepages and gas emanations in these areas would justify trial bores at structurally suitable spots. But until some indications of oil have been discovered, to initiate drilling savours somewhat of putting the cart before the horse. The rule should be, first obtain the indications, and then select the drilling site according to the information afforded by a study the structural geology of the district.

Up to the present, however, the Department has no definite knowledge of undoubted indications, but in view of the benefits derivable from the opening of a petroleum-field in Tasmania, and in view of the reasonable assumption that there is nothing exceptional in the physical characteristics and conditions of sedimentation, which would militate against the formation of oil, it recommends renewed search for surface evidences, and invites prompt communication of any discoveries made, in order that no time may be lost in visiting and examining the sites of alleged finds.

---

## PROSPECTING FOR MERCURY IN TASMANIA.

---

### *Uses of Mercury and Its Markets.*

The property which quicksilver possesses of combining with other metals and forming alloys with them makes it useful in extracting gold and silver from their ores. The same amalgamating property was formerly utilised in silvering mirrors with a tin-quicksilver alloy. The metal has a high specific gravity (13.59), and this, with its fluidity and its uniform expansion under heat, makes it suitable for the construction of certain instruments employed in physical science (thermometers, barometers, &c.). Quicksilver enters into the composition of various trade amalgams, and mercurial compounds have medicinal and other applications. A very important use is in the manufacture of fulminate for explosives.

Quicksilver is disposed of in the market in wrought iron flasks, which in England, America, and Austria contain 75 lbs. of metal, but in other countries about 76 lbs. The present price in London is quoted as between £20 and £25 per flask. Since the outbreak of war the price has mounted to double and triple what it was in pre-war time, when it was only £8 or £9 per flask.

The market is an irregular one, and has to be watched by mine-owners, who are often compelled to wait till a demand

stimulates prices. The metal, as Mr. C. G. Dennis remarks in "Mineral Industry for 1915" (page 617), "is not a commodity that can be produced and sold from day to day, or even from month to month. It is something that has to wait for a market, consequently it requires considerable capital to operate a quicksilver mine after the mine is equipped and producing."

The statistics of the world's output of quicksilver are not easily or precisely ascertainable, but from what can be gathered on the subject, it appears that the production is between 4000 and 5000 tons per annum.

Spain, Italy, Austria, and the United States are the chief producing countries, accounting for about three-fourths of the total output. Russia, Hungary, and Mexico put out limited quantities. The American production jumped from 21,033 flasks in 1915 to 29,932 flasks in 1916. The Commonwealth of Australia imported 1000 flasks (33 tons) during the fiscal year 1915-16, valued at £16 per flask.

#### *Ores of Mercury.*

**Cinnabar:** Sulphide of mercury ( $\text{HgS}$ ). (Composition: mercury, 86.2 per cent.; sulphur, 13.8 per cent. Hardness, 2-2.5. Specific gravity, 8.)

**Metacinnabarite:** Black sulphide of mercury; amorphous.

**Calomel:**  $\text{HgCl}_2$ . Chlorine, 15.10 per cent.; mercury, 84.90 per cent. White with adamantine lustre.

**Native Quicksilver:** Is present in most mercury-producing mines, generally in the form of globules. Remarkable for being fluid at ordinary temperatures. It is silver-white and is volatile at all temperatures above  $19^\circ \text{C}$ . It becomes solid at  $39-40^\circ \text{C}$ . It is generally a secondary occurrence due to oxidation processes connected with cinnabar and mercurial fahl ore. What may be considered primary quicksilver is rare.

**Native Amalgam:**  $\text{AgHg}$ . Silver and mercury. Brilliant silver-white.

**Montroydite** } Oxychlorides of mercury found in calcite veins  
**Terlinguaite** } and on stalactites in lower Cretaceous lime-  
**Eglestonite** } stone at Terlingua in Texas.

**Tiemannite:**  $\text{HgSe}$ . Selenide of mercury; blackish-grey.

**Onofrite:** Sulpho-selenide of mercury. At San Onofre in Mexico.

**Coloradoite:**  $\text{HgTe}$ . In gold-telluride veins in Western Australia. This and the two preceding minerals are primary and rare.

**Coralline Ore:** A variety of cinnabar of liver-brown colour. Hepatic cinnabar; inflammable.

**Idrialite:** Inflammable cinnabar.

**Coccinite:** Iodide of mercury.

**Ammiolite:** Antimonate of copper mixed with cinnabar.

**Lehrbachite:** Selenide of lead and mercury.

**Livingstonite:** Sulphantimonite of mercury. The mineral, when pure, contains as much as 53.1 per cent. mercury.

A few other varieties are met with, but are unimportant. Mercury is sometimes associated with native silver; with dyscrasite (silver antimonide); with tetrahedrite, and with lead and zinc ores. Cinnabar is practically the sole ore of commercial importance.

*Mode of Occurrence and Distribution.*

The most important productive quicksilver mines in the world are those of Almaden in Spain, Idria in Austria, and in Southern Russia. Other active mines are in the United States, Mexico, Peru, Italy, Transylvania, China, &c.

The Almaden mines are more than 2000 years old. The cinnabar here occupies the interspaces of the grains in beds of Silurian porous quartzite, and partly replaces the sandstone or quartzite itself. The important mines of Idria have been worked since the fifteenth century; the ores have impregnated Triassic beds of shale and dolomite. In Italy the Monte Amiata mines have been large producers; the cinnabar is in limestone (Jurassic to Tertiary). In the Russian Donetz region the mineral fills rock joints and occurs as impregnations in sandstones of Carboniferous age. Near Belgrade, in Servia, cinnabar and native quicksilver occur in hydro-thermally altered serpentine which has been reduced to a mixture of quartz, opal, and iron carbonate. The mineral occupies cavities in the cavernous siliceous rock. In the Carpathians cinnabar exists as an alteration product of mercurial fahl ore. In China deposits of quicksilver ores are in magnesian limestone, and in the form of nests and disseminations, besides being aligned along the bedding-planes of the strata. In New Zealand the ore is met with as a hot spring deposit; the same applies to Nevada and Venezuela. In California the occurrences are extremely varied—the ore occupies fissures with shattered fillings, or it forms pipes and shoots in opaline material at junctions of serpentine and basalt with sandstone, and is in many instances directly and obviously related to hot springs activity.

Cinnabar has been met with in several localities in New South Wales, and there has been a small production of quicksilver. Alluvial and vein cinnabar deposits exist in Queensland; and in Victoria native mercury and cinnabar occur in the Jamieson River basin. Native quicksilver has also been found in South Australia. The coloradoite of the gold-tellurium veins of Western Australia is an exceptional instance of a mercury compound formed under high temperature conditions. One of the most interesting features of mercury deposits is that the deposition of ore belongs essentially to a shallow zone, and the process is observable in operation at the present day in hot springs regions.

A recent identification of mercury in Tasmania was made by Mr. R. A. A. Johnston, mineralogist to the Geological Survey of Canada, when testing specimens of the zeolite laumontite, which is found in the tin-wolfram-bismuth lode of the S. and M. Mine at Moina. A metallic cloudiness was observed on the wall of the closed tube, and the deposit was concentrated and found to be mercury. The lodes in this mine are of Devonian age, and the zeolitic material appears to form an integral part of the lode, but the possibility has to be considered of it having been deposited under the influence of overlying basalt.

The association of hydro-carbons (petroleum and bitumen) with some cinnabar deposits is noteworthy. At the New Idria Mine, in California, petroleum has been met with in some quantity, and in some of the mines in Northern California it occurs to an extent which is inconvenient. At the New Almaden cinnabar mine bitumen is quite common. At Idria, in Austria, the ore yields idrialite or combustible cinnabar. The coralline

ore of Idria is a variety of cinnabar mixed with bituminous material. Inflammable marsh gas also occurs in the Californian quicksilver mines.

These hydro-carbons are regarded as having influenced the deposition of cinnabar. The association is, however, in all probability fortuitous, being dependent on the proximity of strata charged with hydro-carbons.

#### *Treatment of Ore.*

The Almaden ore is unusually rich, its metallic content being said to average 8 per cent. But the average investor is content if he has a mine which will yield  $\frac{1}{4}$  to 1 per cent., though ores as low as 0.30 to 0.40 are now regarded as payable. In California 1 per cent. ore is considered high grade, and 0.50 per cent. is a common working quality.

The low-grade ores which are being worked are encouraging numerous attempts in the direction of concentration previous to furnace treatment.

Concentration hitherto has proceeded along dry lines, as with wet dressing the ore slimes too much, and the losses are heavy. The crude ore is crushed in stone breakers and rolls, and classified by means of trommels and various screens. This applies especially to the poorer types of ore. Rich grade ores are crushed, dried, and charged direct into the furnace.

The dressed ore is roasted, and the mercury vapours condensed in cooling chambers and pipes. The types of furnaces and kilns and the details of treatment vary in different countries, and with different classes of ore.

Theoretically the treatment is simple, but in practice difficulties arise from the metal being so extremely volatile, and excessive losses occur. A good deal of the condensed metal sinks into the ground and foundations at quicksilver works, owing to its fluidity and weight.

Recent experiments at the University of California have shown that important improvements on present methods can be effected. The State Mining Bureau is conducting these investigations, and the following is an account of the preliminary results:—<sup>(1)</sup>

“It is doubtful if the Scott fine-ore furnaces in operation in California are averaging 75 per cent. extraction. In addition, they are notorious for the quicksilver absorbed by the furnace and condenser walls; also soot is formed which has to be retreated for contained mercury. The products of fuel combustion being mixed with the vaporised mercury cause condensing troubles.

“The Bureau's experiments have shown that high extraction (above 90 per cent.) can be obtained by water concentration on tables, with friable ores in which the cinnabar is distinctly crystalline. Crushing by rolls produces a minimum of slimes. If, however, the pulp contains a cinnabar slime, either from “paint” ores, or by reason of having to crush fine to release the sulphide, the extraction by tables will be low. In such cases, though, it can be improved by classification, and treating the different sizes on separate tables. The slimed cinnabar can be recovered

(1) “The Mining Journal,” August 11, 1917.

by flotation. A high extraction has been obtained by flotation test in finely-ground (80 mesh) fresh ores, utilising either pine oil derivatives or eucalyptus oils. We say "fresh" ores, because, contrary to common conception, cinnabar on exposure does oxidise sufficiently to affect flotation results, as some of our tests have indicated. Good results were obtained by table concentration on an ore carrying natural quicksilver.

"The concentrates being obtained have yet to be roasted. Retorts are of limited capacity; and the concentrates, because of their high specific gravity, require stirring to prevent packing. A small furnace of the Scott type could be used, with a narrower shaft and narrow shelf-slit; such as in use at the New Idria mine for treating soot. Here, again, we have the fuel combustion products mixed with the quicksilver vapour, and the attendant condensing difficulties. Some form of rotary roaster may be adapted, or a small-size unit of the McDougall or Wedge type of mechanically rabbled furnace muffle-fired.

"The ultimate decision between a straight furnace reduction or concentration and roasting of concentrates will be a matter of comparative costs, coupled with comparative extractions. The initial installation of a Scott fine-ore furnace unit is high (including condensers, &c., £1000 per ton—day capacity). In some instances the cost has been materially less than this figure, but this is now the exception rather than the rule. The extraction is low (in the majority of cases probably less than 75 per cent.); cost of operation is low (50 c. to 75 c. per ton for large units, economically managed, though this does not include high cost repairs, interest or depreciation on the high initial installation capital). A concentrating plant of equal capacity will require less than one-tenth the initial capital expenditure, and a correspondingly lower depreciation charge; it will give 25 per cent. to 30 per cent. higher extraction; but the operating cost, on account of finer crushing, will be 30 per cent. to 50 per cent. higher. These points will have to be determined upon for each individual property."

#### *Prospecting.*

The prospector who takes an intelligent interest in the mode of occurrence of the minerals which he seeks cannot fail to note that a very frequent feature of deposits of cinnabar is their association with hot springs, past or present. Consequently the silica which forms the gangue or matrix is not quartz, but opal or chalcedony. This is another way of stating that the deposits are in close connection with igneous eruptions, or (in the case of springs in sedimentary beds) their after-actions. The prepondering tendency for the mineral to occur in association with eruptive belts of Mesozoic, Tertiary, and even recent age, indicates the basaltic and diabasic rocks in Tasmania and their contiguous sedimentaries as more favourable than the rocks of higher antiquity. The point is to search in these for developments of opaline or chalcedonic silica. Opaline silica is an alteration and replacement product, the result of infiltration. It is a common deposit from thermal waters. It replaces the woody tissue of fossil trees; it is frequent in serpentine as

a magmatic residue. It is pseudomorphous after various minerals.

The hot springs in Nevada, California, and New Zealand afford evidences of the presence of cinnabar. In Tasmania very few still active warm springs exist. Examples are those at Kimberley, and near Southport; but these do not appear to have any connection with eruptive sources.

Evidence of former thermal activity is furnished by the chalcidisation and opalisation of pebbles in drifts below Tertiary basalt in numerous parts of the island. Fossil wood found in these gravels has frequently been opalised by the infiltration of heated waters from the overlying covering of lava. If tracts of the basalt can be found traversed by veins of opaline silica, such parts of the igneous rock are places which should be examined.

Fundamentally analogous conditions are illustrated by the well-known occurrences of common opal  $1\frac{1}{2}$  mile north and north-west of Bothwell. Outcrops of Gondwana sandstone (Triassic?) show patches and seams of jasperoid and common opal on the plain which is bounded on the south-west and north-east by ranges of intrusive diabase rock. The heated waters from the igneous rock have evidently produced the seams of opal and chalcidony, and in places have thoroughly opalised the sandstone. These conditions would favour the deposition of cinnabar should mercury be present in the igneous rock.

The above two instances typify the kind of conditions which prospectors should look for.

Among the older rocks in Tasmania opaline occurrences in serpentine should be examined. Examples of these are met with along the siliceous outcrop of Purcell's lode in the serpentine of the Bald Hill. The limonite gossan is mixed with chalcidonic and opaline silica which has probably been due to infiltration of terminal magmatic aqueo-siliceous solutions into the joint channels of the rock. This occurrence has not yet been tested for mercury.

Mercurial solutions appear quite specially to have saturated zones of porous and shattered country rock, and to have unloaded their burden along the joints of strata. Consequently such zones should not escape attention. Brecciated jasperoid quartz is a congenial gangue in which cinnabar may be disseminated.

The vermilion colour of cinnabar is so vivid that a very little mineral makes the rock appear much richer than it really is. Its high specific gravity will assist the prospector in determining the nature of his samples. The mineral, however, is frequently associated with bituminous matter, and the colour then becomes brown to black.

Sometimes (in Alaska) it weathers a rusty brown, and owing to being coated with oxide of iron cannot be determined with the naked eye. The ore is frequently earthy and friable.

The association of bitumen with some of the varieties of mercurial ore is peculiar, and apparently has some significance from a genetic point of view.

Cinnabar may be looked for in alluvial gold gravels where these have been derived from rocks containing deposits of the ore. The best field test for the prospector in this case is his dish; the grains of cinnabar, heavy and scarlet red, are recognised without difficulty.

Specimens of alleged cinnabar have been brought in from the Port Davey district, but on examination proved to be hematite.

Amalgam, which was thought to be native, has been met with on old Tasmanian goldfields, but the discoveries have been discredited owing to their circumstances and localities.

Mention may here be made of the characters of native quick-silver. It is a tin-white metallic liquid, found generally in the form of globules, occupying cavities in the rock. Cinnabar occurs in a massive-granular form or as minute flakes or crystals. It is soft and sectile. Pure cinnabar heated before the blow-pipe volatilises completely. It is insoluble in warm hydro-chloric acid, and this serves at once to distinguish it from hematite. If powdered cinnabar is moistened with hydro-chloric acid, and rubbed on bright copper, the latter becomes silver-white. The deep red streak of cinnabar is very characteristic. The powder is always red. In the closed tube with dry carbonate of soda it gives a sublimate of metallic mercury.

---

## DIAMONDS IN TASMANIA.

---

### *General Description of Diamond.*

The diamond is a stone which has an extremely simple composition, being pure crystallised carbon. Moreover, it is combustible, and can be reduced by burning in oxygen to carbon dioxide. Alluvial diamond in its rough state rarely attracts notice by reason of any special brilliancy; more often than not it bears some resemblance to a piece of dull, greasy-looking washing soda, and is frequently coated with a resin-like skin which conceals the intrinsic beauty of the stone. Limpid, flawless stones, which are rare, are classed in the trade as of "first water," but the gems found are as a rule flawed with minute cracks or spots. The term "Cape White" refers to South African white stones with an almost imperceptible tinge of yellow. Yellowish-greenish stones are technically known as "off-coloured" or "by-water," but in the diamond trade there is a complex classifying nomenclature which embraces many different shades of colour. The diamond is not uniformly white or yellow, but may shade into blue, pink, green, brown, and ruby-red, and under the name of carbonado or bort passes into black.

There are three varieties of diamond:—

1. The gem diamond.
2. Bort, composed of aggregates of very small crystals of diamond. Commercially the term is extended to mean any diamond stone which cannot be classed as a gem. Consequently, it may include carbonado.
3. Carbonado, the same dark-grey to black mineral as bort, but with a still more irregular crystallisation. It generally occurs in somewhat globular or rounded forms, with dull lustre and a somewhat porous texture, which gives it a coke-like appearance. It is less pure than the gem, but often exceeds it in hardness. Bort and carbonado are used in the bits of diamond-drills.

*Crystal Form.*

The diamond crystallises in the cubic system, and has normally the octahedral habit, though it is sometimes in the form of cubes and rhombic dodecahedra.\* The faces are frequently marked with triangular pittings, which have been supposed to be corrosion phenomena, but are now with greater probability regarded as being connected with crystal growth. The crystal faces are characteristically curved, which is of great assistance in identification.

*Hardness.*

The diamond is the hardest of all minerals (though metallic tantalum runs it extremely close), having the highest position on Mohs' scale (10). This is harder than sapphire or corundum (9) or topaz (8). Quartz is only 7, but crystals of quartz have been occasionally received by the Geological Survey from prospectors who inquired whether they could be diamond as they scratched glass. Although quartz will scratch glass, it will not cut it, and diamond can be cut only by diamond. It is said that the best hardness test is with carborundum, as this will not scratch a genuine diamond but will scratch any inferior stone. Diamonds of some countries are harder than those found in others. Thus the South African diamonds are said to be the softest, generally speaking; while Australian stones are harder than normal, and can be cut only with their own powder. The same applies to Borneo. Bort and carbonado are often harder than the gem diamond. A steel point, which has about the same hardness as quartz, is often used to detect imitations in glass.

When struck smartly, diamonds will split in the direction of the octahedral cleavage. It is a common fallacy that a diamond will not break on the anvil, and this silly test has been applied to many stones with disastrous results. Owing to its microscopic gas and fluid cavities, its substance is often in a state of high tension, and gems have been known to break into fragments on first being removed from their matrix or on being allowed to fall to the ground.

*Specific Gravity.*

The density of the diamond is constant within the narrow limits of 3.516 and 3.525, mostly in the neighbourhood of the figures 3.521. Bort is generally near 3.5, and carbonado from 3.1 to 3.4, but this inferior density is due to the porous structure, the specific gravity of the powdered stone being identical with that of the gem.

*Optical Features of the Diamond.*

It is singly refracting and remains therefore dark under crossed nicols. The lustre of a polished diamond is remarkably brilliant, and is described as adamantine. The brilliancy, however, varies a good deal, sometimes being quite splendid, and again very feeble. Alluvial stones which have been worn by

\* An octahedron is a solid bounded by eight equilateral triangles; the rhombic dodecahedron is one bounded by twelve equal rhomb-shaped faces.

attrition in the bed of a creek will be found to possess little or no lustre until fresh surfaces are exposed by cutting. Imperfectly translucent stones have a nearly metallic lustre.

The diamond will phosphoresce in darkness after being rubbed on wood, wool, and some other substances, and sometimes (but this is rare) is self-luminous after being exposed to sunlight.

Exposure to Röntgen rays or emanations from radium causes diamonds to glow with a pale-green fluorescent light, and this is a good test in cases of doubt. This characteristic was noticed by Sir William Crookes, and has since become well known. R. J. Strutt, in his work on "The Becquerel Rays and the Properties of Radium," says (p. 52):—

"This fluorescence of diamonds forms a very convenient test of their genuineness, quite within the reach of anyone who can obtain the use of a little radium. For imitation diamonds do not fluoresce, or at least so slightly, compared with real ones, that there is no possibility of mistaking them."

Levy and Williams, in their "Radium and Other Radio-active Elements," state (p. 54):—

"One of the most interesting of the luminous effects is that produced in diamonds. It affords a ready method of distinguishing real from artificial stones. The former fluoresce brightly with a pale-green light, whilst false stones or white sapphires (frequently used in their place) show little or no luminosity. . . . All diamonds of equal size and value do not glow with equal intensity, some appearing much more luminous than others. This may be due to slight differences in their composition or in the cutting."

Experiments were made by the writer and the late W. F. Petterd with diamonds found by Mr. L. Harvey in Harvey's Creek and Sunday Creek in 1894, and with one found by Mr. T. Batty near Mt. Donaldson.\* When placed on a sheet of mica over a preparation of radium bromide the gems fluoresced with a very pale-green light, even at a distance of two or three inches from the radium compound.

#### *Weights and Sizes of Diamonds.*

A diamond weighting 1 carat (3.168 grains or .205304 gramme) will measure about  $\frac{1}{8}$ -inch in diameter.

The unit of weight by which diamonds are bought and sold is the carat, divisible theoretically into 4 diamond grains, but in usual transactions divided into  $\frac{1}{4}$ ,  $\frac{1}{8}$ ,  $\frac{1}{12}$ ,  $\frac{1}{16}$ ,  $\frac{1}{24}$ ,  $\frac{1}{32}$ , and  $\frac{1}{48}$  carat. The carat weight had its origin in the weight of the seeds of some tree (supposed to be the carob tree), which when dried retained a constant weight. There are many confusing discrepancies in the international weight values of the diamond carat, and a fixed metric weight of 200 milligrammes has now been adopted or decided upon in several countries.

Brazilian diamonds weigh mostly between  $\frac{1}{4}$  and  $\frac{1}{2}$  carat; stones of 1 carat and upwards are infrequent. The few diamonds which have been found in Tasmania range from  $\frac{1}{4}$  to  $\frac{1}{2}$  carat.

\* In Harvey' Creek.

In South Africa it is estimated that diamonds under 1 carat represent from half to two-thirds of the entire output. Some famous diamonds are of exceptional size. The Great Mogul is supposed to have weighed in the rough 560 to 787½ carats. The Koh-i-noor weighed 186½ carats before being cut or cut up. The Orloff is now 195 carats. The South African fields are famous for large stones. The Jubilee (640 carats) and the Excelsior (971½ carats) were from the Jagersfontein Mine, Orange Free State. But the largest on record from any part of the world is the Cullinan, or Star of Africa, from the Premier Mine, near Pretoria, which weighed in its rough state 3024½ carats (1.37 lb. avoirdupois), a pure quality gem which is only part of a larger crystal.

#### *Artificial Diamonds.*

Various attempts have been made to produce diamonds in the laboratory, and with success. Moissan dissolved carbon in molten iron in a cylinder which, immersed in molten lead, yielded on cooling minute transparent crystals of diamond. Friedländer added carbon to molten olivine, and obtained on cooling a separation of diamond crystals. Ludwig obtained diamonds in the manipulation of carbon and iron; Hasslinger obtained diamond crystals from a solution of graphite in an artificial rock mixture of nearly the same composition as kimberlite (the rock matrix of the diamond at Kimberley). E. de Boismenu obtained diamonds of about 2½ mm. diameter by the electrolysis of fused calcium carbide.

All these experiments are purely of scientific interest, and do not seem likely to have any effect on the diamond trade.

#### *Use of Diamond.*

One important and familiar use is as an ornamental gem when cut and polished; the glazier uses it for cutting glass, the watchmaker for drilling holes for bearings, the lapidary as an abrasive; and the non-gem varieties, bort and carbonado, are employed for setting in bits for rock-drills. The diamond is said also to have some application in giving an edge to steel tools for boring heavy guns. Some idea of the extent to which this stone is used may be gathered from the figures of the British South African output, which to date must have reached a value of over £170,000,000. It is not often realised that Australia has produced diamonds to the value of £130,000.

#### *Market Prices.*

The old system of valuing the best cut stones by multiplying the rate per carat by the square of the weight in carats no longer obtains. One way was to square the weight and multiply by 8; the result would be in £ sterling. A more complicated rule was to halve the weight in carats and multiply the result by the weight plus 2 and by the value of a stone of 1 carat. The increase in the output of diamonds, the discovery of so many large stones, and the numerous classes of quality, have had their influence on the market quotations and made these rules inapplicable.

The De Beers and Kimberley mines yield stones ranging from 40s. a carat upwards. On the other hand, the general output

of the great Premier Mine shows a value of about 22s. per carat.

The present Australian quotations for diamonds suitable for boring are as follow:—

- South African bort, £2 15s. per carat.
- South African shot ballas, £2 17s. 6d. per carat.
- Brazilian bort, £16 per carat.
- Brazilian carbon, £16 to £22 10s. per carat.

The stones used range from 1 to 4 carats each, according to the size of bit. Supplies of Brazilian goods are very difficult to obtain.

Owing to the limitation of output and other war conditions, the prices of gems are at present not normal. The prices for cut diamonds of good average quality are approximately—for  $\frac{1}{2}$ -carat stones, £28 per carat; for 1-carat stones, £30 per carat; and for  $2\frac{1}{4}$ -carat stones, £50 per carat. This is an advance of 75 per cent. to 100 per cent. on pre-war values.

It may be mentioned that in cutting the gem there is generally a loss in weight of a little under to a little over half.

#### *Mode of Occurrence.*

For the most part the diamond output comes from alluvial or detrital or decomposed rock material, and the accompanying minerals and geological associations have generally to be studied carefully before the original source can be safely identified. In many cases a suspension of judgment is the wisest course.

At Kimberley diamonds are won in the so-called blue ground, which is a tuffaceous, brecciated, or decomposed product of kimberlite, a serpentinised porphyritic peridotite,\* into which the blue ground passes in depth. The deep-seated kimberlite is also diamondiferous, and can be considered as unmistakably a primary source of the gem. In South-West Africa diamonds occur in coastal sands and shingle, and it has been thought that they are derived from submarine beds in the neighbourhood.

The French mineralogist Lacroix has detected nepheline in the groundmass of kimberlite. The resemblance of the latter to certain melilite basalts in South Africa has led to comparisons between the two types, and they have been thought to be genetically related, the series running through nepheline-melilite basalt and melilite basalt to basaltic kimberlite, from which it is inferred that kimberlite may be a member of the alkali-peridotites. Nevertheless, the chemical composition of the two rocks does not lend much support to this suggestion.

In Brazil diamonds occur in Recent river sands and older terraces and conglomeratic sandstones, none of which are original sources. Great scientific interest attaches to the occurrence in Arkansas of a porphyritic diamond-bearing peridotite. In Russian Lapland the gem has been met with in sand assumed to have been derived from pegmatite rock, but this reference cannot be said to be established. In India the diamond is present in conglomerates and sandstones and their disintegra-

\* Peridotite is a deep-seated igneous rock with olivine as a dominant constituent and without felspar.

tion products, and in recent and older river sands. Here, too, a doubtful reference to pegmatite as a source has been made. Diamonds have been found in all the Australian States, but only at Oakey Creek, in New South Wales, has it been detected *in situ*. The rock is a hornblende-diabase in the form of a dyke intersecting granite. In the diamondiferous alluvial in Borneo, stones of pegmatite and granite from some unknown source have given rise to the hasty conclusion that the stones and the gems are derived from the same rock.

Diamond also occurs in meteorites, associated with olivine, nickel-iron, and amorphous carbon. As our olivine rocks are the nearest relatives of meteorites, it has been contended that such rocks (serpentines) are the likeliest home of terrestrial diamonds. On the other hand, it has been suggested that diamond in meteorites is to be regarded as a separation product from iron carbide, and that no necessary relationship exists between olivine-bearing rocks and diamonds.

#### *The Rocks of the Tasmanian Diamond Province.*

The Donaldson Range, north of Corinna, consists of Pre-Silurian slate, sandstone, and conglomerate, surrounded by and sinking below Tertiary and Recent terrace gravels of a more or less auriferous nature. These gravels are being dissected by the streams, in the beds of which intermittent prospecting has won gold, osmiridium in small quantities, and the diamonds. No serpentinitised rock is known in the immediate neighbourhood, though some veins of nickel-ore were met with in the Rocky River Mine, a few miles from Corinna, when that mine was being worked in 1900. Four miles from Corinna on the main road to Waratah is a patch of Tertiary basalt, but this is unrelated to the diamond occurrences. Serpentine is said to occur on Serpentine Hill between the Rio Tinto Mine and Specimen Reef, but the nearest great mass of serpentine rock is the Bald Hill Range. Unless some yet undiscovered serpentine exists on the Donaldson Range, it is most likely that the diamonds which have been found there are derived from the serpentine of the Upper Savage and Bald Hill.

No porphyritic peridotite, such as the South African kimberlite, has been found at Bald Hill; the rocks there are ordinary serpentinitised peridotite and pyroxenite, with here and there some gabbro, forming the outermost ultra-basic fringe of the great granite mass of the Meredith Range. Still, kimberlite belongs to this rock-group; and one may assume with a high degree of probability that the diamonds found have been liberated from these rocks. Diamond has been found in Africa embedded in the mineral olivine, and olivine is an important constituent of the Bald Hill serpentinitised rocks.

#### *Discoveries of Diamonds in Tasmania.*

An incorrect reference to diamonds in Tasmania is made in Max Bauer's work on "Precious Stones" (Spencer's translation, 1904, p. 225), as follows:—

"Tasmania has recently been added to the list of diamond-producing countries. According to newspaper reports, a large number of stones were found at the end of

the year 1894 in Corinna, one of the richest goldfields of the island. The reported occurrence caused a rush of diamond-seekers into Tasmania from the Australian mainland; many companies for the exploitation of the deposits sprang up, but apparently with no marked results."

The real facts are that 16, or at most 18, diamonds have been authenticated. They were mostly about  $\frac{1}{2}$ -carat in weight, one reaching  $\frac{3}{4}$ -carat.

These have all been found near Corinna, in the Donaldson Range district, between the Savage and Donaldson Rivers. In December, 1894, L. Harvey, prospector for the New Donaldson Sluicing Company, brought to Launceston two diamonds, one of which he stated that he had found in Sunday Creek, on the west side of Mt. Donaldson, which flows into the Savage, and the other in Harvey's Creek, which falls into the Badger, also a tributary of the Savage River. These were transparent octahedra, tinted straw-yellow at the apices.

In the same year the late Mr. Leslie Jolly brought a diamond back from the same district; this also had the characteristic tinge of yellow at the apices.

Another prospector (Lawson) found five specimens at the Donaldson Range; the exact locality has not been verified, but they are believed to have been discovered in either Middleton's Creek or the Badger. They also had the same tinge at the apices.

In 1906 Mr. T. Batty, of Long Plains, found a specimen in Harvey's Creek. It weighed .025 gramme or about  $\frac{1}{4}$ -carat. It was a brilliant octahedral crystal, tinted faint greenish-yellow at the apices. The crystal faces had the curves characteristic of diamonds. It contained numerous fluid cavities of microscopic size.

Another specimen has been recorded from Middleton's Creek, which flows into the Savage River north of Corinna.

A parcel of gem sand from near the Hellyer River, in the Waratah district, was sent to England by the Van Diemen's Land Company many years ago, and this was reported to contain a small diamond. It has not been possible to ascertain the locality of this sand.

It is quite a usual thing for diamonds from different fields and countries to be distinguished by certain differences and similarities, and one may record the constant yellow apices as characteristic of the Savage River or Donaldson district as a diamond province.

#### *Information for Prospectors.*

The few diamonds which have been found hitherto are sure and certain indications that more remain to be discovered. They were found at a time when unusual activity prevailed on the alluvial fields near Corinna. These fields are now idle, but it is a warrantable supposition that diamonds are still in the gravels waiting to be removed. They are in all probability present in the sands which the osmiridium workers are treating, but are escaping unnoticed in the waste. Being so small and so much like grains of quartz to a cursory glance, it is possible that they elude notice in considerable numbers. Even in the blue ground in South Africa diamonds are seldom seen

in the course of mining. G. F. Herbert Smith, in his "Gemstones" (1912, p. 147), says:—

"The diamonds are so sparsely, though regularly, scattered through the mass, that even of the actual workers in the mines but few have ever seen a stone in the blue ground."

Again, P. A. Wagner, in his "Diamond Fields of Southern Africa" (1914, p. 137), says:—

"So sparsely distributed, however, is the gem, that it is only by the merest chance ever observed *in situ*. It may be pointed out in substantiation of this statement that there are miners who have worked for over twenty years in the Kimberley pipes without having ever come across a diamond."

In confirmation of this, Mr. A. McIntosh Reid, Assistant Government Geologist, who has had personal experience at the De Beers Mine, informs the writer that he was told by an employee there that in the course of his 22 years' work underground he had never seen a diamond in the rock. The yield of the matrix in South African mines varies from 5 to 40 carats per 100 loads of 16 cubic feet ( $\frac{1}{3}$ -ton).

In Tasmania the district in which the diamonds were found while working the auriferous alluvial has long been abandoned by miners, and no discoveries have been announced for the last 12 years. The osmiridium workers higher up the Savage have been too much engrossed with their special mineral to pay much attention to anything else; nevertheless, wherever osmiridium is present in the alluvial there is a possibility of diamonds turning up, though they are likely to be sporadic, and it will hardly pay for a prospector to devote his time exclusively to the search for these stones. It would be well, however, for all who are washing sands in this district for gold or osmiridium to be on the look-out for diamonds. Unfortunately, the crystals are apt to escape with the quartz grains, and this renders detection difficult.

The only minerals which in the least resemble diamonds to the inexperienced eye are quartz, topaz, and white sapphire. Small water-clear crystals of quartz are often known locally as diamonds; the limpid stones of topaz from Killiecrankie Bay, on Flinders Island, are well known as "Killiecrankie diamonds," and the collector who first attempted to dispose of them in London as a kind of diamond got into trouble over the transaction. But quartz and sapphire crystallise in the hexagonal system and topaz in the orthorhombic system, while diamond belongs to the cubic system, and has most frequently a dodecahedral or octahedral habit. None of the minerals mentioned will scratch a diamond. It may be mentioned here that tin country minerals are not necessary companions of diamond, and are only present where certain conditions obtain. Thus, prior to the existing river systems, the sands of the plains between Bald Hill and Corinna received accessions of sediment from the tin-bearing Meredith Range, and this has mingled with the waste from the serpentines, so that in some places and to some extent a mixture of minerals has resulted which have no community of origin.

The curved convex crystal faces of diamond specimens are of great assistance in identification. The pitted surfaces furnish

an additional indication. When to crystal form and curvature, weight, hardness, pittings of surface, is added the yellow tint of the apices, the prospector has an aggregate of character upon which he may rely as regards stones from the Bald Hill, Savage, and Donaldson diamond province. In cases of doubt with regard to any particular specimens, they may be tested in the Geological Survey laboratory, Launceston, free of charge.

In looking round Tasmania for likely diamond fields, it is not sufficient to locate mere exposures of serpentine, for the solid rock will fail to reward the prospector. Beds of alluvial derived from the serpentine are what is required, and again these beds should be payable propositions for gold or osmiridium, as it is extremely improbable that any appreciable output of diamonds will result in any other way than in the course of gold (or osmiridium) winning. This is why the Savage and Donaldson districts are indicated as promising fields. Other serpentine districts are Dundas, Trial Harbour, Macquarie Harbour, Wilson and Huskisson Rivers, Denison Range, Styx River, Anderson's Creek, Salisbury, &c., but some of these outcrops are not accompanied by alluvial deposits of any importance, and therefore carry only bare possibilities.

It has been thought by some prospectors that the tin-fields of the north-east coast might carry deposits of the gem. Specimens of other gems and substances from that part of the island have been brought to the Geological Survey under the impression that they were diamonds, and in one instance the prospector was firmly convinced that he had struck the blue ground which is diamond-bearing in South Africa. Hence, it seems quite time to make available some definite information respecting diamond and its occurrence. An outstanding fact is that no peridotite rock has ever been recorded in association with the granites of the eastern and north-eastern tinfields; in the west of the island the massive tin-bearing granites are surrounded by fringes of gabbroid and ultra-basic rocks, some of which are most probably the matrices of diamonds. The question arises whether diamonds could be looked for in the debris or alluvial shed from granitic rocks.

It cannot be denied that in some other parts of the world there are occurrences of diamonds which have been considered as suggestive of a pegmatitic source.\*

It must be added, however, that the literature of these occurrences is not absolutely convincing. In Russian Lapland, a district characterised by gneissose rocks intersected by pegmatites, some sands carry sparsely diamonds associated with garnet, zircon, tourmaline, &c., and it has been assumed that the diamonds have been derived from the gneiss and pegmatites. Too little is known of the geology for the source to be looked upon as established. References to pegmatities in India and Borneo as being sources of diamonds are also lacking in precision. The occurrence of diamonds in Rhodesia, associated with tourmaline, sapphire, &c., in gravel lying on decomposed granite may also be cited, but a diamondiferous pipe of kimberlite rock in granite exists in the same region, and similar pipes

\* Pegmatites are those coarsely grained aggregates of quartz and felspar which were formed in or traversed granite during a late phase in the cooling of the magma, in the super-heated water of which a large number of unusual and characteristic minerals separated out.

may have furnished the diamonds now found in the gravels and conglomerate.

It would not be correct to say that pegmatites are absolutely impossible sources of diamonds, for it is known that these rocks contain certain quantities of carbon gases, but it is also true that basic and especially ultra-basic rocks contain these in far greater proportions. It would seem that the acid rocks of the tin districts are not promising for diamonds, and the total absence of any record of a discovery in such localities, though a negative feature, is in harmony with an *a priori* anticipation that a search would not meet with success.

As indicated above, discoveries of diamonds in Tasmania are most likely to be made by individuals on the look-out for them while working gold-bearing or osmiridium alluvial derived from the weathering of serpentinised rocks; and the Donaldson and Savage River districts seem at present the most promising in this respect, though alluvial country anywhere round the serpentine fringes of the Meredith Range has possibilities which should be borne in mind.

## A REVIEW OF THE OSMIRIDIUM MINING INDUSTRY OF TASMANIA.

By CAMPBELL BROWN, M.A., B.Sc. (Edin.), Ph.D.

### 1.—*Retrospect.*

As far back as the year 1804, a British scientist first announced the existence of the two metallic substances known as Iridium and Osmium; and exactly one year later, another discovered that the two substances were habitually found combined together in a rare metal usually associated with Platinum, and he named the new metal Iridosmine. By this latter name the metal in question is universally known in scientific circles to-day; though its somewhat uncouth and misleading synonym "osmiridium" persists in mining communities everywhere. The Tasmanian miner calls Iridosmine "osie," in his familiar way of expressing himself, and "osie" it is likely to remain.

The Russians at first looked on it as a hard variety of Platinum, which it resembles somewhat closely, and it was only after a considerable amount of investigation that the new metal betrayed distinctive features of its own that Platinum itself did not have. Some of these very features attracted commercial attention in the process of time, and gradually the metal obtained an independent market apart altogether from platinum.

In the early days Tasmanian prospectors operating in the North-West struck a rich belt of country yielding a variety of mineral substances of more or less commercial importance. The prospector after gold, in penetrating the bush, found in "panning off" an unknown metal with a tin-white colour, which annoyed him very much, and which obviously had a greater specific gravity than gold itself. In certain localities this metal was so abundant and persistent that steps were taken finally to have it scientifically identified, and to ascertain its commercial importance. It was soon recognised as Osmiridium, and the problem then arose to secure a market for it.

There is living to-day on the osmiridium fields in Tasmania one of these old pioneers, by name James McGinty, who found the metal as described, and whose first efforts to sell it were quite abortive. Latterly he started off by obtaining 25s. an ounce Troy for it, while many a gold miner associated with him threw the useless, irritating metal away, altogether oblivious of what the future had in store for him.

Once a market was discovered, the miners systematically preserved the metal, and as soon as Tasmania became a recognised locality, buyers entered into competition to secure it in a small way. In consequence, output went up, and an encouraging price was obtained, and the industry then took firm root.

It was not till 1910 that the State of Tasmania officially took notice of osmiridium among its Mineral Resources, and

then efforts were made to ascertain output and values by the Department of Mines. These have been carefully placed on record ever since, thus enabling the State to enter the world's market, and attract attention to its new and promising source of mineral wealth. Prior to 1910 detailed information about the rare metal was lacking, and no particular interest was therefore taken in it. It was known that small parcels went somehow to London or New York or somewhere else, but what it was used for, or what became of it, very few knew and less cared.

### 2.—*Tasmania's Output.*

The Department of Mines in 1910 ascertained that 120 ozs. had been produced, and by its encouragement and assistance the output in 1911 was more than doubled, viz., 271 ozs. The next year showed even a more striking increase, the figure rising to 778 ozs., paving the way to the phenomenal year of 1913, when the figure reached was 1261 ozs. This figure would have been far surpassed in 1914 if the war had not broken out, and actually stood at 1018 ozs. in spite of the check the industry received. Under the influence of war conditions, for the next three years the figures dropped right down to 247, 222, and 332 ozs. respectively.

As osmiridium was a precious metal requisite for munitions of war, manufacturers who used the metal found some of their usual sources of supply cut off, and then turned their attention to Tasmania. This resulted in keen buying in 1918, which sent up the output to its maximum figure of 1606 ozs. With the close of the war the rush collapsed, and the figures for the first quarter of this year show only 209 ozs. Right up to the outbreak of war the development of the industry had been most gratifying, but received a severe set-back for three years thereafter on account of diminished markets. The prolongation of the war made buyers nervous, and produced a rush such as is unlikely ever to occur again. Stability is, however, now setting in, and production will doubtless soon settle down to its normal limit, by the force of circumstances.

### 3.—*Location of Mines.*

The precious metal is found in various districts in the West, all of them more or less remote, and somewhat distant from each other, yet bound together by a common invariable feature, viz., the occurrence in the neighbourhood of great masses of a rock named by petrologists serpentine—a name acquired on account of its mottled appearance. It is in the creeks and river beds, and on the hillsides and even on the plateau itself, of such serpentine country, that the miner gets his osmiridium.

The best known locality is perhaps the Savage River, which has been sporadically worked for about 16 miles below its confluence with its tributary, called the Nineteen-Mile Creek, which drains part of the Bald Hill area.

This latter creek has numerous little tributaries, all famous for metal, and taking off the drainage from the western side of the Bald Hill, and are, or have been, busy scenes of alluvial

mining activity. Right on the brow of the Bald Hill itself, facing the Nineteen-Mile Creek, there occurs an osmiridium mine which is quite unique. Here a well-known miner has been quarrying solid serpentine rock for over six years, and by crushing it obtaining a very high-grade class of metal. He is the first and only miner in the world to find the precious metal actually occurring in the solid rock.

The above-mentioned Nineteen-Mile Creek, with its tributaries, is undoubtedly the best and most abundant locality for the metal in Tasmania. It has yielded far more, and a far higher grade metal, than any place yet discovered in the State, and even at its top end many a rich nugget has been unearthed.

Just a few miles distant from here, over a saddle and situated in another watershed, lies Jones Creek, a locality recently opened up and not yet fully developed. First-class metal is being found here, and this field is rapidly coming into importance, though yet small, but promising.

Leaving this area altogether, one naturally proceeds to Mt. Stewart, which lies some distance away in a region none too easy to get at. A little over one year ago, when the metal was discovered here in attractive quantities, a great "rush" took place. The result was that all the clear ground soon became worked out, and alluvial miners are only to be found at the present moment either right at the top or further down in the Castra Valley below. Interesting developments are, however, expected in the near future in this area.

Practically within sight of Mt. Stewart, yet in the inaccessible distance, lie the Wilson River osmiridium fields. The miner's theory, both at Mt. Stewart and Wilson River, is that the same mass of serpentine persists as a belt from point to point, uniting both fields; but impenetrable bush at present separates the two, and no man can say what the future may disclose. Meantime the visitor to Mt. Stewart has to go many a long mile before he can get at the Wilson River fields from here. At the latter the miners are mostly working for the metal in small creeks or in very shallow ground or in loam or in mud itself, while further down some are obtaining the metal from cemented bottoms. The origin of some of the alluvial deposits in this neighbourhood is distinctly puzzling, and some would seem to be accounted for by transportation from a distance, probably by glacial agency.

#### 4.—*Seasonal Nature of Mining.*

In the valley of the Savage River alluvial mining, in the bed itself, can only be done to any extent in summer time, when the water is low. As the river rises in winter with each rainfall, work becomes very trying and dangerous, and in many places quite impossible, which causes the miners to suspend operations entirely, and usually to go somewhere else. On the Wilson River the position is practically reversed, the fields being situated in an elevated position, and the very small streamlets, rivulets, and creeks where the workings are mostly situated dry up in summer, when work ceases. The top of Mt. Stewart, and Jones, and the top of the Nineteen-Mile Creek, are very much in the same position with regard to water-supply, as well as the workings on the edge of the plateau and

the slopes of the Bald Hill. Plenty of water is necessary for successful mining, and work is often held up by the prolonged absence of rain. In the valley of the Nineteen-Mile Creek the work goes on all the year round, and here the most of the permanent camps are to be found, in a long stretch of country reaching practically to the creek's confluence with the Savage River. The seasonal nature of the mining has a distinct influence on output, which makes the supplies coming from Tasmania somewhat erratic and uncertain.

#### 5.—*Mode of Occurrence of Metal.*

For the most part osmiridium is found in a capricious, erratic fashion, distributed in the beds of creeks and rivers in the serpentine country. Here and there a miner may be seen working at a higher level on an old flood-plane, or he may be seen pursuing an old bottom, representing a former course taken by the stream, and quite different from the present day. Although the bulk of the metal has been won in this way, the up-to-date miner is now becoming more and more resourceful, and searching for and finding metal in quite unexpected places. As already cited, high-grade metal has been successfully mined for a number of years out of the rock itself. This occurrence is the keystone to the whole situation. All the metal found in the river beds and creeks was derived from the solid rock originally, and has been weathered out by the natural agencies which cause denudation. On account of the phenomenal rainfall and climatic conditions of the western region, erosion has taken place relatively quickly, and the amount of osmiridium found in the creeks at the present day must represent the metallic content of a prodigious amount of serpentine no longer existing.

When found in the rock the metal is not abundant, and may either be bright in appearance or coated with a black incrustation of iron ore; in which latter case it is not easily detected. It occurs in a curious fitful way, vanishing for a little, then reappearing, but never in excessive, though payable, quantities. In hand specimens the bright crystals are quite conspicuous, but when coated recognised with difficulty. Its distribution in the rockmass may take a definite trend or direction, which was determined before the solidification of the parent rock itself took place, and at a time when the crystals of osmiridium and its associates were floating free in the molten magma. In nearly all rocks of deep-seated origin the same phenomenon is quite familiar, the lenticular distribution of certain substances being brought about by the forces acting during magmatic movement before solidification.

Once the miner turns his serious attention to the solid rock itself, new localities will doubtless turn up in Tasmania. He will also probably abandon the use of the word "lode," as applied to such an occurrence, and no one will regret it. Several of these so-called "lodes" have come into unfortunate prominence in the past, and some are talked of now.

A few quite exceptional occurrences of the metal may be cited before we finish consideration of this point. At one place a group of industrious miners, securing plenty of metal, may be found working 20 feet underground, following a subterranean

drainage area which Nature made in the master-joints of the serpentine rock. It is a weird place to look at, and a safe-looking place for Nature to store her treasures. In another locality men may be seen removing forbidding-looking grey mud in barrows, and sluicing it readily, thereby securing a plentiful reward in precious metal. This mud is but a few inches in thickness, and overlies in places rocks of sedimentary origin. Many miles away another group of men may be found working the loam, right on the edge of a plateau. The loam is full of organic vegetable matter, but uncommonly rich in osmiridium as well, which is all the digger cares about. Another quite unexpected locality, where the loam contains payable metal, is right on the plateau itself of the Bald Hill, where some activity is likely to take place shortly. Other anomalies could be quoted, but enough has been said to show that osmiridium can be looked for and found in places altogether out of variance with commonly accepted ideas, theories, and traditions—which fact augurs well for the future development of the industry.

It might be noticed, in passing, that osmiridium is found usually alone or in association with gold, but never with platinum. Creek and river men look for water-worn nodules of iron ore, which are regarded by them as the invariable "index" of the presence of precious metal.

#### 6.—Quality of Metal.

Osmiridium is known to occur in two distinct varieties, both of which are found in Tasmania. The variety known as Nevyanskite is the familiar tin-white substance with a bright metallic lustre, and is found in the Savage River, Nineteen-Mile Creek, Jones Creek, the Castra River, Wilson River, and the Bald Hill. The variety known as Siserskite has a much duller lustre, is steel-grey with a bluish tint in colour, and occurs in fair quantities at the top of Mt. Stewart. From a commercial standpoint Nevyanskite is much more valuable than Siserskite, and is eagerly sought after by manufacturers who use the precious metal. Both varieties occur in Russia, while Nevyanskite alone occurs in Japan. In the platinum fields of New South Wales, near Fifield, Nevyanskite alone occurs, and the same applies to Papua (British New Guinea). Tasmanian miners recognise and appreciate the difference between the two varieties, and the creek digger does not like his parcel mixed with any of the Mt. Stewart metal.

From a commercial point of view the best osmiridium yet yielded in Tasmania is derived from the Nineteen-Mile Creek, with its tributaries, as well as the Bald Hill. Here the metal is found well rounded or "shotty." This granular habit, combined with absence of well-marked cleavage planes, being the characteristics desired by manufacturers. On the Savage River much of it is very scaly or flaky, with the basal cleavage plane well pronounced. This is due, in all probability, to the severe pounding the metal has been submitted to by erosive agencies. The same applies generally to much of the Wilson River metal, though some of the new localities now being developed there are yielding prime granular metal.

### 7.—*Constitution of Metal.*

The feature that attracts the user most to osmiridium, commercially, is its percentage of iridium. Unfortunately, there has been very little research work done, as yet, with regard to Tasmanian metal, and very little information is available. The only two records of detailed analyses which the writer has access to, show a percentage of 58 and 33 respectively of iridium. The former was from a sample of the tin-white variety, above referred to as Nevyanskite, and the latter from a sample of the variety known as Siserskite. Russian metal from the Ural Mountains shows at times as high a percentage of iridium as 77, and anything lower than 43 is exceptional. The Japanese metal is always round about 70 per cent., and that from Borneo about 60. From all other known localities a fair average is about 58 per cent., the metal corresponding in its features very closely with the Tasmanian metal.

### 8.—*Grading of Metal.*

The man who controls the situation is the man who uses lots of crude metal, just as it stands, for the purposes of manufacture. The smelter, chemist, and others count but little, as their requirements are easily met from residues derived mainly from the people who handle crude platinum. The best friend that the "osie" miner has is the man who tips his gold nibs for fountain-pens with crude granular metal. But with the latter the size of the grain is the only thing that matters, and anything too small or too large is unsuitable. These facts are well known throughout the osmiridium world, except in Tasmania. Everywhere else special sieves are used for grading the metal. Anything that goes through an aperture of '031 is sold only for smelting or other metallurgical purposes. Anything up to '042 from '031 is suitable for manufacturing purposes. The shrewd miner could reduce his large metal to "point" size in a mortar, the small metal which fails to respond to the sieve test being set aside for the smelter. The importance of this procedure is made manifest by the fact that the writer has received, while preparing this review, cabled advice from New York stating that £20 per ounce is being paid for "point" metal, while only £15 per ounce is being paid for the ungraded supplies.

If the metal from Tasmania continues to be sold just as it is found the result of competition will inevitably drive the price right down to smelting price only, thus placing the Tasmanian digger in an unfavourable and false position with regard to other localities. Another matter which is likely to prejudice the future development of the industry is the habit of some of the miners of selling their metal "unclean." Nothing can bias the mind of a consumer against a locality so much as receiving parcels of metal containing obvious impurities.

The procuring and handling of corrosive acids in the bush is no simple matter, it must be admitted, yet most of the conscientious men would scorn to sell a parcel unless satisfied that it is actually clean, and this standard ought to be maintained by every right-thinking miner. It certainly

involves a little trouble and care, but the result will have an important effect in the future when competition sets in. It must be frankly stated that Tasmanian parcels, up to the present, have been often characterised by the unnecessary percentage of impurity, and in this respect compare unfavourably with those from other parts.

#### 9.—*The Tasmanian Miner.*

The average type of man earning his living out of "osie" is, without doubt, one of the highest type of alluvial miners in the world. He is clean, hospitable, industrious, and skilful at his work, though perhaps a little conservative, and lives a secluded life in the most forsaken spots that ever a human being got to. He realises that he is not undergoing his hardships for nothing, and wants his "pound of flesh" all the time, but is fair and straight in a business deal. He is free from the common vices so prevalent amongst precious metal miners, and when he has "made a bit" he keeps it. His home in the bush is never one of architectural beauty, but serviceable though temporary. He gets his letters and food brought to him from a long distance by carrier or pack-horse, and his contact with the outside world is slight. It may be a fascinating life to the man with "bushy" habits, who is fond of the wild; but he pays the price for it. His attention is concentrated on one thing only, viz., the desire to get the metal, get it quickly, and get it in plenty. Unlike some miners he makes no revenue from fur-bearing animals, though wild cats, ringtails, black and grey opossums are around him; while the black, tiger, and whip snakes are his sworn enemies. He gets anywhere from one-half to one pennyweight of metal from his daily digging, on an overhead average. When the price goes up he simply works less, because money becomes more plentiful, and the stimulus on output is not proportionate. It is true it attracts more miners, but the individual overhead average does not increase, but actually falls. From an industrial standpoint an inflated price is a check on the individual output of the metal.

#### 10.—*Welfare of Miners.*

The sum of £44,833 was paid in Tasmania to miners during the last twelve months in the purchase of osmiridium, and the figure may warrant the assumption that the industry is now becoming important enough to draw increased attention to it from the State. An observer notices a general concensus of opinion among the miners that, for example, the mining laws as applicable to osmiridium might here and there be advantageously amended or amplified. They were obviously framed with gold in view, and on account of the peculiar differences and circumstances under which osmiridium is mined some modifications would doubtless be most helpful. Financial help from the State, in any shape or form, is altogether unnecessary and undesirable; but something could and should be done for the men by opening up and developing new serpentine country, making new tracks, improving old ones, repairing dangerous bridges, and other things which are obvious to the

visitor touring the fields. The country lying around the top of Mt. Stewart has so far baffled penetration, but is likely to yield most interesting results when developed. It ought to be linked up with the Wilson River by dealing effectively with the intervening bush. The conditions on the Savage are indescribably bad, and one cannot help admiring the indomitable pluck and grit of the men enduring them. Track-cutting and systematic bush-burning, under skilled direction, would go a long way to help the fuller development of the fields, and enable the digger to reap a richer and surer harvest than at present.

### 11.—*Some of Their Fallacies.*

A visitor, in chatting with the diggers, soon gets impressed with the constant repetition of curious erroneous ideas with regard to the metal. Its reputed fabulous hardness is one of the things about which they like to talk, and about which there would appear to be widespread misconception. In the estimation of some the diamond itself pales into insignificance in hardness to osmiridium. As a matter of fact, the metal's hardness is nothing out of the ordinary, and many mineral substances occurring quite commonly in Nature are much harder. Another common misconception, arising perhaps out of the latter, is that the metal cannot be broken. The fact that it has one cleavage plane too well developed is one of the very features of the substance that manufacturers heartily dislike it for. To realise how easily it is broken, one requires only to put it in a mortar and pound it for a moment. Another mistaken idea is, that it will not respond to metallurgical treatment, and cannot be smelted, which is quite on a par with the other misconception that Tasmania is the only country in the world where the metal is found. It would seem to have escaped notice altogether that the main and sole commercially important feature of osmiridium is its entire and absolute resistance to all acids.

One of war's results has been a considerable amount of metallurgical research work in the quest of a metallic substance yielding features identical with the metal under review. It has now been achieved, and a satisfactory substitute found, and markets are bound to be affected shortly to a profound degree. For, as soon as the manufacturer has his requirements fully met by the synthetic substitute, he will cease to interest himself in the purchase of metal at prohibitive prices in remote parts of the world. He will shift his worries on to the shoulders of the metallurgist, who can have no difficulty in procuring the strictly limited quantities of crude metal necessary for his purposes.

### 12.—*Outlook for the Future.*

After Peace is signed and Reconstruction takes place in earnest, every metal of commercial importance will be under better control than in the past, and its destination closely observed. Of recent years Tasmania has already secured a place, and firmly established herself, as a producer of osmiridium. The miner may at present be inclined to be pessimistic, but he really has a bright future in store for him.

Let him be more enterprising and less conservative, let him shut his eyes to abandoned ground, adopt new ideas and seek new fields, let him "get up and get" and decline to be dependant; let him have all the help and moral support of the State, and things will go apace. The resources of Tasmania have only begun to be tapped, for no man can say even the exact location of, far less the full extent of, all the serpentine country in the Island, and a great deal of hard, patient, and profitable work still remains to be done. The miner must, however, bear in mind that the inevitable will happen, and competition will force down the price till a condition of stability is attained.

He will doubtless recall that in 1910 his average price was £4 8s. per ounce; in 1911 it was £4 7s.; in 1912 it rose to £7 7s.; while in 1913 it reached £9 10s.; followed in 1914 by £9 17s. per ounce. After war broke out it was impossible to sell the metal at all, until recovery took place, and the price fell in 1915 to £6 8s. In 1916 it again rose, the figure being £8 11s., eclipsed again by 1917, which reached £14 15s. per ounce. The climax, however, was reached in 1918, when the average rose to the astounding figure of £27 18s. Some parcels were actually sold as high as £37 10s. The cessation of hostilities caused a considerable drop in price, and the figures for the first quarter of the current year show an average of £16 5s. per ounce.

These figures are taken from official records of the Mines Department, Hobart, and are sufficient to show that the Tasmanian miner has been singularly fortunate in his earnings of recent date. During the whole war the price of platinum, about which the price of osmiridium normally gyrates, never rose above £20 per ounce, and was commandeered for munitions. Osmiridium never was, though at one time it was proposed to commandeer it, and fix its price. The enormous inflation of the Tasmanian price was due to the anomalous circumstances under which metal is bought and sold in this country. The outlook, as far as price is concerned, is fairly well defined. It is bound to fall sooner or later, in view of competition, until equilibrium is established. If it did not, foreign dealers would soon import metal into Tasmania; or, far more likely, seek a direct contact with the buyers who keep Tasmania going, and secure their business by under-selling.

### 13.—*Comparison with Other Fields.*

Within the Commonwealth of Australia osmiridium occurs in several places. On the coast of Victoria, at no great distance from Melbourne, it has been found along with gold, in a black beach sand, but so far only the crudest methods of cradling have been employed to recover it. At Byron Bay vicinity the metal occurs in a highly comminuted condition, which has baffled efforts to handle it commercially. In New South Wales the platinum miners find it both in the shallow ground and deep leads, and their parcels contain as a rule 5 to 10 per cent. of the metal mixed up with platinum. In Papua some splendid parcels have been produced, resembling those of the Nineteen-Mile Creek metal. So far very little mining development has taken place in Papua, largely on

account of native difficulties and official indifference, but the metal is reputed to occur abundantly, and there is a possibility of Papua in the near future out-rivalling Tasmania as a source of the precious metal. It is stated that German New Guinea is another locality for the metal, but reliable information on the subject is still lacking. In Borneo the natives, while working platinum, are finding first-class metal, which finds its way into the hands of dealers in Batavia. The output of Japan is more than three times that of the Tasmanian, while the metal has a brighter lustre, being richer in iridium, and slightly larger in grain and less fissile. The miner there pays 4s. a day for his permit, and has to be content to sell his parcels at a low figure. The dealer, broker, and exporter secure the profits. Ever since Russia's collapse in the war the main supply was cut off from the world. In normal times she can produce ten times more than Tasmania, and, on account of cheapness of labour, sell the metal at a price which determines the dead-level. In North America we find it occurring with platinum in North California and South-West Oregon, and in Albany County, Wyoming, and in the Yellow Pine District, and Moapa, in Clark County, Nevada. In Colorado it turns up at Como, and Clear Creek, and Villa Grove. Turning now to South America, we find an area of 5000 square miles where alluvial mining takes place, on the western side of the Andes, in Colombia. Gold, platinum, and osmiridium are found here together, and many dredges are kept busy. The control is under American and British hands, and it may be noted that after Russia's collapse in the war this field saved the situation, as far as platinoid metals were concerned, for the purposes of war.

#### 14.—Where the Metal Goes To.

At this juncture it might be well to clear up some points with regard to the final destination of the metal. Taken altogether, there are comparatively few people throughout the world that have any commercial interest in osmiridium. Of these few some want it for iridium, others for osmium, or other rare substance combined in its constitution. The big buyer is the manufacturer who uses it in crude form. He needs it as an essential and important item in the manufacture of the pen-nibs used in fountain-pens. This latter industry has already assumed enormous proportions, especially in the United States of America. One firm alone has five factories, each of which is a marvel of organisation, and equipped with cunningly-devised machines. There one can see osmiridium being handled by highly skilled labour; each individual grain being sifted out and arranged in its proper place, according to its suitability; while the delicate operation of attaching it on to the gold nib is one calling for infinite patience and deftness. Platinum could almost be used in place of it, but it is too soft, and has other features which render it less desirable.

The great bulk of the metal, which has lain for millions of years in the rivers and creeks of Tasmania, and about which all the "osie" digger's hopes and aspirations are centred, finds an ultimate fate in being lodged finally in the breast-

in pocket of every business man up-to-date enough to arm himself with a fountain-pen.

#### 15.—*How it is Bought and Sold.*

Each miner has always some metal held in reserve. He keeps it carefully tied up, somewhere about his person, in a piece of chamois leather firmly bound together. When his "tucker bill" comes along, he has to realise on part of it, and receives either cash or an open cheque from the visiting field buyer. It may be mentioned here that many of the miners have grievances at the hands of the buyers. Quite commonly a buyer in going his rounds, in the same day will tactlessly buy parcels for different prices in different localities, or even in the same locality. Ultimately the miners who carried out the deal find out what has happened, and dissatisfaction and bitter feeling arises. Again, several buyers may be on the field at the same time, and each one offering a different price. The miners will subsequently compare notes, air their grievances, and be at a loss to know what to do next. It seems also desirable here to observe that the delicate operation of weighing small quantities of osmiridium should be under better control, and the weights and scales used by the buyers for the purpose should come under official periodic inspection. It must be admitted that the miner has justification in being discontented with the present system, which certainly does not exist on any other precious metal field in the world.

To do the miner full justice the field buyer should have no power whatever to lower, raise, or otherwise manipulate the price of the digger's metal, and the field buyer should himself be debited with all the obvious impurities in the parcels he buys and sends off. Consumers would insist on both points if they were only familiar enough with the full facts of the situation. Most movements in price in the immediate past have been of trivial origin, and it is credibly related of one field buyer that he raised the price £2 per ounce for a wager! While this might be an exaggerated piece of pleasantry, the situation is undoubtedly wrong at present and needs to be remedied. It is particularly aggravated by the various mining localities being so far apart, and out of touch with each other. Furthermore, in the same locality the individual workings and camps are either far apart or inaccessible to each other, and the men come little in contact with one another. There is no unity of purpose, cohesion, or organisation among the miners on account of the lives they lead, but something might now be done officially to get things on a better business footing for them.

The writer has had the privilege of visiting all the mining fields, and coming in personal contact individually and collectively with nearly all the miners, and, with one exception, every single man thinks that his welfare might be better cared for and the industry fostered by more official assistance. They are most appreciative for what the Mines Department has already done on their behalf, and on account of the very remoteness and obscurity, and one might almost say mystery, of the industry, as well as lack of proper organisation, they realise that

nothing more could possibly have been done in the past for them by the Government.

Let us look at the other side of it. New York and London are the two controlling centres for metal buyers. The business men sitting at their desks there are more to blame perhaps than anyone else for existing irregularities. They have never been to Tasmania. They instruct a local broker, who instructs an Australian broker, who in turn instructs a field buyer, giving him *carte blanche* instructions to procure the metal.

The field buyer is usually a working miner, actually digging for and selling metal as well as buying it, which is of course unfortunate from a business standpoint. With one or two exceptions the Australian brokers know nothing whatever about the Tasmanian fields from personal experience, and the man in New York or London keeps on wondering why the Tasmanian price for metal is so abnormal. No one can blame the hard-working, industrious "osie" miner for taking the fullest advantage of the peculiar situation and getting every hard-earned penny he can out of it as long as it lasts. But the moment is coming when the man in New York and London will wake up.

Russian parcels are already filtering their way through Vladivostock, Harbin, and Shanghai, *en route* to America and England. While in the Far East, of very recent date, the writer had an opportunity of inspecting quite a large number of parcels of precious metal so derived. Colombia is exceedingly busy, and Japan is out to capture the market. Tasmania must therefore take steps to retain her place, and find out what the rest of the world is doing. By posting the miner up with information, derived officially, as to what current prices are in controlling centres, by regularly publishing same in the press in Tasmania and Melbourne, and by sending out periodic official circulars by packers and carriers from the nearest resident Registrar, steps could be effectively taken to ensure the fullest development of the industry, and make the osmiridium miners perfectly satisfied and contented with their lot.